AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:21-cv-00579-ADA	6/7/2021	Western District of Texas

PLAINTIFF	DEFENDANT
SCRAMOGE TECHNOLOGY LIMITED	APPLE INC.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 10,622,842	4/14/2020	Scramoge Technology Limited
2 9,806,565	10/31/2017	Scramoge Technology Limited
3 10,804,740	10/13/2020	Scramoge Technology Limited
4 9,843,215	12/12/2017	Scramoge Technology Limited
5 10,424,941	9/24/2019	Scramoge Technology Limited

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY
6/18/2021	☑ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,997,962	6/12/2018	Scramoge Technology Limited
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

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6:21-cv-00579	6/7/2021	Western District of Texas

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Print Save As... Reset

AO 120 (Rev. 08/10)

TO: **Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:21-cv-00579	6/7/2021	Western District of Texas

PLAINTIFF	DEFENDANT
SCRAMOGE TECHNOLOGY LIMITED	APPLE INC.

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3 10,804,740	10/13/2020	Scramoge Technology Limited
4 9,843,215	12/12/2017	Scramoge Technology Limited
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DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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2		
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4		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

Print Save As... Reset

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420

CONFIRMATION NO. 3575

POWER OF ATTORNEY NOTICE

OC000000124890151

23557
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
P.O. BOX 142950
GAINESVILLE, FL 32614

Date Mailed: 04/15/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/13/2021.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/zretta/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/663,012	10/29/2012	Jeong Wook AN	0106.001POA1

CONFIRMATION NO. 3575

POA ACCEPTANCE LETTER

151145
Shami Messinger PLLC
1000 Wisconsin Ave. NW
Suite 200
Washington, DC 20007

OC000000124890261

Date Mailed: 04/15/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/13/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/zretta/

PTO/AIA/123 (08-12)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

CHANGE OF CORRESPONDENCE ADDRESS
Patent

Address to:
Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patent Number	9,806,565
Issue Date	10-31-2017
Application Number	13/663,012
Filing Date	10-29-2012
First Named Inventor	Jeong Wook AN
Attorney Docket Number	0106.001POA1

Please change the Correspondence Address for the above-identified patent to:

☑ The address associated with Customer Number: 151145

OR

☐ **Firm *or* Individual Name**

Address

City	**State**	**ZIP**

Country

Telephone	**Email**

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:

☐ Patentee.

☐ If the Patentee was not the applicant for patent (37 CFR 1.42), then a Statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is enclosed or was filed on __________. See 37 CFR 3.71.

☑ Attorney or agent of record. Registration Number 37,575.

☐ Patent practitioner acting in a representative capacity whose correspondence address is the correspondence address of record. Notice has been given to the patentee or owner. Registration Number 37,575.

Signature /Michael Messinger/

Typed or Printed Name MICHAEL MESSINGER

Date April 13, 2021	Telephone 202-516-6900

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of __________ forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/96 (08-12)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: SCRAMOGE TECHNOLOGY LIMITED

Application No./Patent No.: 9,806,565 Filed/Issue Date: 10-31-2017

Titled: WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

SCRAMOGE TECHNOLOGY LIMITED, a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is ____________%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel ____________, Frame ____________, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: AN, JEONG WOOK, LEE, JUNG OH, LEEM, SUNG HYUN, KIM, YANG HYUN To: LG INNOTEK CO., LTD.

   The document was recorded in the United States Patent and Trademark Office at Reel 029219, Frame 0323, or for which a copy thereof is attached.

2. From: LG INNOTEK CO., LTD. To: SCRAMOGE TECHNOLOGY LIMITED

   The document was recorded in the United States Patent and Trademark Office at Reel 055335, Frame 0652, or for which a copy thereof is attached.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

4. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

5. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

6. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Michael Messinger/	April 13, 2021
Signature	Date
Michael Messinger	37,575
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	42436970
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Michael V. Messinger/Susanh Perez
Filer Authorized By:	Michael V. Messinger
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	13-APR-2021
Filing Date:	29-OCT-2012
Time Stamp:	12:06:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	01060000000_POASigned.pdf	1055768 a163da1e2fda2ffb59b2385b929b44750ed33a63	no	1

Warnings:

Information:					
2	Transmittal Letter	Pat_9806565_POA_Transmittal.pdf	185381 004cd986591f8e28bd3f74d55f73462c320fe03a	no	1
Warnings:					
Information:					
3	Change of Address	Pat_9806565_aia0123.pdf	284672 9c8114da7e93e1165b28bc2ebdee56fd7e52fba9	no	2
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73	Pat_9806565_373_aia0096.pdf	130846 71e318f025390939dde82f1af92396a4bbf4f47f	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	1656667		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 151145

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Scramoge Technology Limited

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	Ciaran O'Gara	Date (Optional)	FEB 19 2021
Name	Ciaran O'GARA		
Title	Director		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted

PTO/AIA/82A (07-13)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	13/663,012
Filing Date	10-29-2012
First Named Inventor	Jeong Wook AN
Title	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
Art Unit	2836
Examiner Name	EVANS, JAMES P
Attorney Docket Number	0106.001POA1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Michael Messinger/	Date (Optional)	
Name	Michael Messinger	Registration Number	37,575
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ___________ forms are submitted.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/31/2017	9806565	SUN.LGI.420	3575

23557 7590 10/11/2017

SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 487 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Jeong Wook AN, Seoul, KOREA, REPUBLIC OF;
Jung Oh LEE, Seoul, KOREA, REPUBLIC OF;
Sung Hyun LEEM, Seoul, KOREA, REPUBLIC OF;
Yang Hyun KIM, Seoul, KOREA, REPUBLIC OF;
LG INNOTEK CO., LTD., Seoul, KOREA, REPUBLIC OF

IR103 (Rev. 10/09)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 09/27/2017
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	
ART UNIT	**PAPER NUMBER**
2836	
NOTIFICATION DATE	**DELIVERY MODE**
09/27/2017	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

euspto@slepatents.com

PTOL-90A (Rev. 04/07)

Corrected Notice of Allowability	**Application No.** 13/663,012	**Applicant(s)** AN ET AL.	
	Examiner JAMES EVANS	**Art Unit** 2836	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *IDS of 9/14/2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,3,7,9,11-13,19,21,23,25,30 and 32-39*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:

   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/JAMES EVANS/ Examiner, Art Unit 2836	/JARED FUREMAN/ Supervisory Patent Examiner, Art Unit 2836

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	James P. Evans
Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	KR-10-2014-0113205-A (with English Abstract)	09-24-2014	LG INNOTEK CO., LTD	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	European Search Report dated August 8, 2017 in European Application No. 16206292.1.	
	R2	European Search Report dated August 29, 2017 in European Application No. 17157643.2.	

Examiner Signature	/JAMES P EVANS/	Date Considered	09/19/2017

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

J:\SUN\LGI\420\IDS-Refs\9-14-17\PTO-SB-08(11).doc/mrk

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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P.O. Box 1450
Alexandria, Virginia 22313-1450
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23557 7590 06/26/2017

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Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Miranda Price	(Depositor's name)
[signature]	(Signature)
September 25, 2017	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

TITLE OF INVENTION: WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$960	~~$960~~ $0	09/26/2017

Issue Fee previously paid 08/16/2016 to be applied

EXAMINER	ART UNIT	CLASS-SUBCLASS
EVANS, JAMES P	2836	307-104000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 Saliwanchik, Lloyd & Eisenschenk
   2 ____
   3 ____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: LG INNOTEK CO., LTD.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): SEOUL, KOREA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
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- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 190065 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature [signature] Date September 25, 2017

Typed or printed name Jeff Lloyd Registration No. 35,589

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Acknowledgement Receipt

EFS ID:	30463317
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Miranda Price
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	25-SEP-2017
Filing Date:	29-OCT-2012
Time Stamp:	15:24:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IFP2-AF.pdf	147894 a942589a1875f32674ecfff2c7276ca54ecfec1b	no	1

Warnings:

Information:	
Total Files Size (in bytes):	147894

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

OPAP SEP 2 5 2017

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23557 7590 06/26/2017
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A PROFESSIONAL ASSOCIATION
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Miranda Price	(Depositor's name)
	(Signature)
September 25, 2017	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

TITLE OF INVENTION: WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

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Issue Fee previously paid 08/16/2016 to be applied

09/26/2017 HVUONG2 13663012

EXAMINER	ART UNIT	CLASS-SUBCLASS
EVANS, JAMES P	2836	307-104000

960.00 OP

01 FC:1501

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   1 Saliwanchik, Lloyd & Eisenschenk
   2 ____
   3 ____

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(B) RESIDENCE: (CITY and STATE OR COUNTRY): SEOUL, KOREA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
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- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
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Authorized Signature ____ Date September 25, 2017

Typed or printed name Jeff Lloyd Registration No. 35,589

Adjustment date: 09/26/2017 HVUONG2

08/16/2016 INTEFSW 00008450 13663012

-960.00 OP

01 FC:1501

Page 2 of 3

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet	1	of	2

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	James P. Evans
Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	KR-10-2014-0113205-A (with English Abstract)	09-24-2014	LG INNOTEK CO., LTD	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	European Search Report dated August 8, 2017 in European Application No. 16206292.1.	
	R2	European Search Report dated August 29, 2017 in European Application No. 17157643.2.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
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Espacenet

Bibliographic data: KR20140113205 (A) — 2014-09-24

ANTENNA ASSEMBLY AND MANUFACTURING METHOD THEREOF

Inventor(s):	LEE HYE MIN [KR]; LEEM SUNG HYUN [KR] + (LEE, HYE MIN, ; LEEM, SUNG HYUN)
Applicant(s):	LG INNOTEK CO LTD [KR] + (LG INNOTEK CO., LTD)
Classification:	**- international:** ***H01Q1/24; H01Q7/00; H01Q7/06; H02J17/00*** **- cooperative:** H01Q1/243; H01Q1/38; H01Q7/06; H02J50/20 more
Application number:	KR20130028301 20130315 Global Dossier
Priority number (s):	KR20130028301 20130315
Also published as:	KR101449254 (B1)

Abstract of KR20140113205 (A)

An antenna assembly comprises: a substrate; a first antenna pattern formed on the upper part of the substrate; a magnetic substrate disposed on the upper part of the substrate and the first antenna pattern; and an adhesive layer disposed on the upper part of the substrate and the first antenna pattern and disposed on the lower part of the magnetic substrate for bonding the magnetic substrate and the substrate, wherein the first antenna pattern is spaced apart from the magnetic substrate at first predetermined distance by the adhesive layer.

(19) 대한민국특허청(KR)
(12) 공개특허공보(A)
(11) 공개번호 10-2014-0113205
(43) 공개일자 2014년09월24일
(51) 국제특허분류(Int. Cl.)
H01Q 7/06 (2006.01) *H01Q 7/00* (2006.01)
H01Q 1/24 (2006.01) *H02J 17/00* (2006.01)
(21) 출원번호 10-2013-0028301
(22) 출원일자 2013년03월15일
심사청구일자 2013년03월15일

(71) 출원인
엘지이노텍 주식회사
서울특별시 중구 한강대로 416 (남대문로5가, 서울스퀘어)
(72) 발명자
이혜민
서울 중구 한강대로 416, (남대문로5가, 서울스퀘어)
임성현
서울 중구 한강대로 416, (남대문로5가, 서울스퀘어)
(74) 대리인
서교준

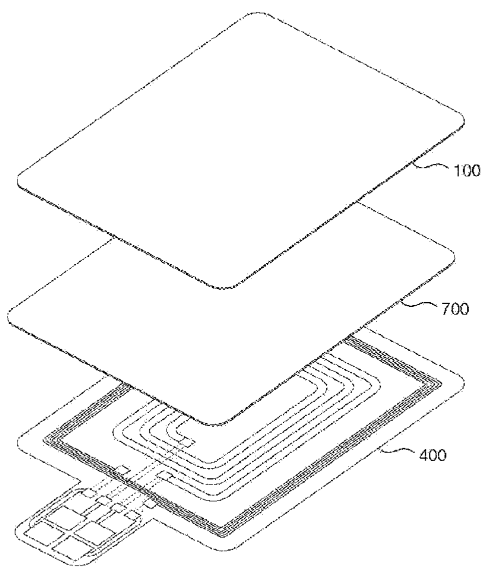
전체 청구항 수 : 총 8 항

(54) 발명의 명칭 **안테나 어셈블리 및 그의 제조 방법**

(57) 요 약

안테나 어셈블리는 기판; 상기 기판의 상부에 형성되는 제1 안테나 패턴; 상기 기판과 상기 제1 안테나 패턴의 상부에 배치되는 자성 기판; 및 상기 기판 및 상기 제1 안테나 패턴의 상부에 배치되고 상기 자성 기판의 하부에 배치되어 상기 기판과 상기 자성 기판을 접착하는 접착층을 더 포함하고, 상기 접착층에 의해 상기 제1 안테나 패턴은 상기 자성 기판과 제1 소정 거리만큼 이격된다.

대 표 도 - 도1



특허청구의 범위

청구항 1

기판;

상기 기판의 상부에 형성되는 제1 안테나 패턴;

상기 기판과 상기 제1 안테나 패턴의 상부에 배치되는 자성 기판; 및

상기 기판 및 상기 제1 안테나 패턴의 상부에 배치되고 상기 자성 기판의 하부에 배치되어 상기 기판과 상기 자성 기판을 접착하는 접착층을 더 포함하고,

상기 접착층에 의해 상기 제1 안테나 패턴은 상기 자성 기판과 제1 소정 거리만큼 이격되는

안테나 어셈블리.

청구항 2

제1항에 있어서,

상기 기판의 상부에 형성되고, 상기 제1 안테나 패턴의 내부에 위치하는 제2 안테나 패턴을 더 포함하고,

상기 접착층에 의해 상기 제2 안테나 패턴은 상기 자성 기판과 제2 소정 거리만큼 이격되고,

상기 제1 소정 거리와 상기 제2 소정 거리는 동일한

안테나 어셈블리.

청구항 3

제2항에 있어서,

상기 제1 안테나 패턴은 무선 통신 안테나에 해당하고,

상기 제2 안테나 패턴은 무선 충전 안테나에 해당하는

안테나 어셈블리.

청구항 4

제3항에 있어서,

상기 제2 안테나 패턴의 두께는 상기 제1 안테나 패턴의 두께와 동일하고,

상기 기판의 상면으로부터 상기 제2 안테나 패턴의 상면까지의 높이는 상기 기판의 상면으로부터 상기 제1 안테나 패턴의 상면까지의 높이와 동일한

안테나 어셈블리.

청구항 5

제1항 내지 제4항 중 어느 한 항에 있어서,

상기 제1 소정 거리는 10um보다 큰

안테나 어셈블리.

청구항 6

제5항에 있어서,

상기 제1 소정 거리는 35um보다 큰

안테나 어셈블리.

청구항 7

제6항에 있어서,

상기 제1 안테나 패턴의 선폭은 400um보다 작은

안테나 어셈블리.

청구항 8

제7항에 있어서,

상기 제1 안테나 패턴의 선간 간격은 200um보다 작은

안테나 어셈블리.

명 세 서

기 술 분 야

[0001] 본 발명은 안테나 어셈블리 및 그의 제조 방법에 관한 것이다. 보다 상세하게는, 무선 충전 안테나를 포함하는 안테나 어셈블리 및 그의 제조 방법에 관한 것이다.

배 경 기 술

[0002] 무선으로 전기 에너지를 원하는 기기로 전달하는 무선전력전송 기술(wireless power transmission 또는 wireless energy transfer)은 이미 1800년대에 전자기유도 원리를 이용한 전기 모터나 변압기가 사용되기 시작했고, 그 후로는 라디오파나 레이저와 같은 전자파를 방사해서 전기에너지를 전송하는 방법도 시도 되었다. 우리가 흔히 사용하는 전동칫솔이나 일부 무선면도기도 실상은 전자기유도 원리로 충전된다. 전자기 유도는 도체의 주변에서 자기장을 변화시켰을 때 전압이 유도되어 전류가 흐르는 현상을 말한다. 전자기 유도 방식은 소형 기기를 중심으로 상용화가 빠르게 진행되고 있으나, 전력의 전송 거리가 짧은 문제가 있다.

[0003] 현재까지 무선 방식에 의한 에너지 전달 방식은 전자기 유도 이외에 공진 및 단파장 무선 주파수를 이용한 원거리 송신 기술 등이 있다.

[0004] 그러나, 일반적으로 단말기에 내장되는 안테나 어셈블리는 그 두께가 두껍고, 제조 공정이 복잡한 문제가 있다.

발명의 내용

해결하려는 과제

[0005] 본 발명이 이루고자 하는 기술적 과제는 무선 충전 안테나를 포함하되 두께가 감소되고 제조 공정이 단순화될 수 있는 안테나 어셈블리와 그 제조 방법을 제공하는 것이다.

과제의 해결 수단

[0006] 일 실시예에서, 안테나 어셈블리는 기판; 상기 기판의 상부에 형성되는 제1 안테나 패턴; 상기 기판과 상기 제1 안테나 패턴의 상부에 배치되는 자성 기판; 및 상기 기판 및 상기 제1 안테나 패턴의 상부에 배치되고 상기 자성 기판의 하부에 배치되어 상기 기판과 상기 자성 기판을 접착하는 접착층을 더 포함하고, 상기 접착층에 의해 상기 제1 안테나 패턴은 상기 자성 기판과 제1 소정 거리만큼 이격된다.

발명의 효과

[0007] 실시 예에 따르면, 자성 기판과 코일부를 접착층을 통해 이격시켜 안테나 성능을 향상시킬 수 있다.

[0008] 실시 예에 따르면, 라미네이팅 및 에칭 과정만을 통해 비자성 절연 기판 상면에 코일부를 직접 배치시켜 안테나 어셈블리의 제조 공정을 단순화 시킬 수 있다.

[0009] 실시 예에 따르면, 나선형의 안테나 패턴의 내부 단자와 그 안테나 패턴의 외부에 배치되는 연결 단자를 전도성 브릿지로 연결하여 안테나 어셈블리의 제조 공정을 단순화 시킬 수 있다.

[0010] 실시 예에 따르면, 안테나 패턴의 확장 패턴을 기판과 함께 절취하고 절취된 기판을 접어서 나선형의 안테나 패턴의 내부 단자와 그 안테나 패턴의 외부에 배치되는 연결 단자를 전기적으로 연결하여 안테나 어셈블리의 제조 공정을 단순화 시킬 수 있다.

[0011] 실시 예에 따르면, 에칭을 통해 비교적 두꺼운 무선 충전 안테나 패턴과 무선 통신 안테나 패턴을 동시에 형성하여 안테나 어셈블리의 제조 공정을 단순화 시킬 수 있다.

[0012] 실시 예에 따르면, 자성 기판 상면에 코일부 및 근거리 통신 안테나를 직접 배치시켜 높은 전력전송 효율을 유지시키며 동시에 외부 장치와 통신도 가능케 한다.

[0013] 실시 예에 따르면, 자성 기판의 내부에 도전 패턴을 형성하여 안테나 어셈블리의 두께를 크게 감소시킬 수 있다.

[0014] 실시 예에 따르면, 자성 기판의 내부에 도전 패턴을 형성하여 높은 전력전송 효율을 갖을 수 있으며, 동시에 근거리 통신 안테나를 이용하여 외부 장치와 통신도 가능케 한다.

[0015] 실시 예에 따르면, 연결부가 자성기판의 수용공간에 배치됨에 따라 연결부의 두께만큼 안테나 어셈블리의 전체두께가 크게 감소될 수 있다.

[0016] 실시 예에 따르면, 연결부로 테입 부재를 사용하여, 안테나 어셈블리의 전체 사이즈를 줄일 수 있다.

[0017] 실시 예에 따르면, 연결부로 리드 프레임을 사용하여 발열, 외부의 습기, 충격 등으로부터, 연결부에 포함된 배선층이 보호될 수 있고, 대량 생산이 가능한 효과를 얻을 수 있다.

[0018] 실시 예에 따르면, 자성 기판의 내부에 형성된 도전 패턴으로 인해, 외부로 향하는 자기장의 방향을 코일부 측으로 변경시켜, 전력 전송 효율을 높일 수 있고, 동시에 외부로 누출되는 자기장의 양을 감소시켜, 인체 유해성을 갖는 자기장의 영향을 최소화할 수 있다.

[0019] 본 발명의 일 실시 예에 따르면, 패턴 홈을 형성하는 과정 및 코일부를 삽입하는 과정 만을 통해 안테나 어셈블리를 제조할 수 있어, 제조 공정이 단순화되는 효과가 있다.

[0020] 한편 그 외의 다양한 효과는 후술될 본 발명의 실시 예에 따른 상세한 설명에서 직접적 또는 암시적으로 개시될 것이다.

도면의 간단한 설명

[0021] 도 1은 본 발명의 실시예에 따른 안테나 어셈블리의 분해 사시도이다.

도 2는 본 발명의 실시예에 따른 안테나 어셈블리의 평면도이다.

도 3은 본 발명의 실시예에 따른 안테나 어셈블리의 단면도이다.

도 4는 본 발명의 실시예에 따른 안테나 어셈블리의 평면도이다.

도 5은 본 발명의 실시예에 따른 안테나 어셈블리의 단면도이다.

도 6은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 7은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 저면도이다.

도 8은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다.

도 9은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 10은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 저면도이다.

도 11은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다.

도 12은 본 발명의 또 다른 실시예또 다른 실시예에 따른 안테나 어셈블리의 사시도이다.

도 13는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 14은 도 13의 접촉부에 도시된 점선을 따라 A에서 A'로 자른 경우, 안테나 어셈블리의 단면도이다.

도 15 내지 도 19는 본 발명의 일 실시 예에 따른 안테나 어셈블리의 제조 방법에 설명하기 위한 도면이다.

도 20는 도 13의 접촉부에 도시된 점선을 따라 A에서 A'로 자른 경우, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다.

도 21은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 22은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 사시도이다.

도 23는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 24은 도 23의 접촉부에 도시된 점을 따라 B에서 B'로 자른 경우, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다.

도 25는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 사시도이다.

도 26는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이다.

도 27은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리를 C에서 C'로 자른 단면도이다.

도 28 내지 도 32은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 제조 방법을 설명하기 위한 도면이다.

도 33는 본 발명의 또 다른 실시예에 따라 자성 기판 상면에 코일부를 배치한 경우, 사용 주파수에 따른 내측 안테나의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

도 34은 본 발명의 또 다른 실시예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 사용 주파수에 따른 내측 안테나의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

도 35는 본 발명의 또 다른 실시예에 따라 자성 기판 상면에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

도 36는 본 발명의 또 다른 실시예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

도 37은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리의 분해 사시도이다.

도 38은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리의 사시도이다.

도 39은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리의 단면도이다.

도 40 내지 도 48은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리의 제조 방법을 설명하기 위한 도면이다.

도 49는 본 발명의 실시예에 따른 안테나 어셈블리의 제조 방법의 흐름도이다.

도 50과 도 51은 본 발명의 실시예에 따른 식각에 의해 형성되는 도전 패턴의 단면을 보여준다.

도 52은 본 발명의 일 실시예에 따른 안테나 어셈블리의 연결부(500)의 제조 방법의 흐름도이다.

도 53은 본 발명의 실시예에 따른 전도성 페이스트의 인쇄 횟수에 따른 전도성 브릿지의 성능을 보여주는 그래프이다.

도 54는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 연결부의 제조 방법의 흐름도이다.

도 55는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 연결부의 제조 방법의 흐름도이다.

발명을 실시하기 위한 구체적인 내용

[0022] 명세서 전체에서, 어떤 부분이 다른 부분과 "전기적으로 연결"되어 있다고 할 때, 이는 "직접적으로 전기적으로 연결"되어 있는 경우뿐 아니라, 그 중간에 다른 소자를 사이에 두고 "전기적으로 연결"되어 있는 경우도 포함한다.

[0023] 도 1은 본 발명의 실시예에 따른 안테나 어셈블리의 분해 사시도이다.

[0024] 도 2는 본 발명의 실시예에 따른 안테나 어셈블리의 평면도이다.

[0025] 도 3은 본 발명의 실시예에 따른 안테나 어셈블리의 단면도이다. 특히, 도 3은 도 1에 도시된 안테나 어셈블

리를 A에서 A'로 자른 경우의 단면도이다.

[0026] 도 1 내지 도 3을 참고하면, 본 발명의 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300), 기판(400), 연결부(500), 외측 안테나(600), 접착층(700)을 포함한다.

[0027] 안테나 어셈블리(1000)는 무선 충전의 대상인 배터리와 무선 통신 모듈을 가지는 단말 장치와 전기적으로 연결될 수 있다.

[0028] 안테나 어셈블리(1000)는 단말 장치와 같은 전자기기에 내장될 수 있다. 단말 장치는 셀룰러 폰, PCS(Personal Communication Servie) 폰, GSM 폰, CDMA-2000 폰, WCDMA 폰과 같은 통상적인 이동 전화기, PMP(Portable Multimedia Player), PDA(Personal Digital Assistants), 스마트폰, MBS(Mobile Broadcast System) 폰 일 수 있으나, 이에 한정될 필요는 없다. 특히, 안테나 어셈블리(1000)는 단말 장치의 백 커버 내에 매립될 수 있다. 단말 장치의 백 커버가 단말 장치와 결합되는 경우에, 안테나 어셈블리(1000)의 접촉부(300)를 통해 안테나 어셈블리(1000)는 단말 장치와 전기적으로 연결될 수 있다.

[0029] 안테나 어셈블리(1000)가 단말 장치와 결합되는 경우에, 자성 기판(100)은 단말 장치의 금속 부분과 안테나 어셈블리(1000) 내의 안테나 사이에 위치하며, 안테나 어셈블리(1000) 내의 안테나에 유도되는 자기장이 단말 장치의 금속 부분에 의해 손실되는 것을 막고, 자속의 경로를 만들어준다. 특히, 단말 장치의 금속 부분은 단말 장치의 배터리의 금속 케이스일 수 있다. 자성 기판(100)은 송신기로부터 전달받는 자기장의 방향을 변경시킬 수 있다. 자성 기판(100)은 송신기로부터 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과가 생길 수 있다. 자성 기판(100)은 송신기로부터 전달받는 자기장의 방향을 측방으로 변경시켜 내측 안테나(200)와 외측 안테나(600)에 자기장이 더 집중적으로 전달될 수 있도록 한다. 자성 기판(100)은 송신기로부터 전달받는 자기장 중 외부로 누출되는 자기장을 흡수하여 열로 방출시킬 수도 있다. 외부에 누출되는 자기장의 양이 감소되면, 인체에 유해한 영향을 미칠 수 있는 상황이 방지될 수 있다. 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다. 자성체(110)는 입자 형태를 가질 수 있으며, 그 재질은 세라믹일 수 있다. 지지체(120)의 재질은 열경화성 수지 또는 열가소성 수지를 포함할 수 있다. 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

[0030] 기판(400)은 인쇄 회로 기판(printed circuit board, PCB), 연성 회로 기판(flexible printed circuit board, FPCB)일 수 있다. 기판(400)은 비자성 절연 기판일 수 있다. 특히, 기판(400)의 재질은 폴리이미드(polyimide, PI) 필름일 수 있다. 폴리이미드 필름은 통상 영상 400도 이상의 고온이나 영하 269도의 저온을 견디고, 초내열성과 초내한성을 지니고 있으며, 얇고 굴곡성이 뛰어나다. 폴리이미드 필름은 내화학성, 내마모성도 강해 열악한 환경에서 안정적인 성능을 유지할 수 있다.

[0031] 내측 안테나(200)는 기판(400) 상에 배치될 수 있다. 후술하겠지만, 내측 안테나(200)는 안테나 패턴일 수 있다. 이때, 안테나 패턴의 단면은 일반적인 코일의 형상인 원형이 아니라, 소정의 각을 가지는 다각형일 수 있다. 특히, 안테나 패턴의 단면은 사각형의 형상일 수 있으며, 더욱 상세하게는 사다리꼴의 형상, 더욱 좁게는 직사각형 형상일 수 있다. 안테나 패턴은 라미네이팅 공정과 에칭 공정에 의해 기판(400) 상에 형성될 수 있다. 내측 안테나(200)는 평면 나선형의 형상을 가질 수 있다. 내측 안테나(200)는 무선 충전을 위한 무선 충전 안테나일 수 있다. 내측 안테나(200)는 평면 나선형의 외측에 위치하는 외측 단자(outer terminal)(210), 평면 나선형의 내측에 위치하는 내측 단자(inner terminal)(220) 및 평면 나선형의 내측 코일(230)을 포함할 수 있다. 이때, 코일은 코일 패턴일 수 있다.

[0032] 외측 안테나(600)는 기판(400) 상에 배치될 수 있다. 후술하겠지만, 외측 안테나(600)는 안테나 패턴일 수 있다. 이때, 안테나 패턴의 단면은 일반적인 코일의 형상인 원형이 아니라, 소정의 각을 가지는 다각형일 수 있다. 특히, 안테나 패턴의 단면은 사각형의 형상일 수 있으며, 더욱 상세하게는 사다리꼴의 형상, 더욱 좁게는 직사각형 형상일 수 있다. 안테나 패턴은 라미네이팅 공정과 에칭 공정에 의해 기판(400) 상에 형성될 수 있다. 외측 안테나(600)는 평면 나선형의 형상을 가질 수 있다. 외측 안테나(600)는 무선 통신 위한 무선 통신 안테나일 수 있다. 특히, 외측 안테나(600)는 근거리 통신(near field communication, NFC) 안테나일 수 있다. 외측 안테나(600)는 평면 나선형의 내측에 위치하는 내측 단자(inner terminal)(610), 평면 나선형의 외측에 위치하는 외측 단자(outer terminal)(620) 및 평면 나선형의 외측 코일(630)을 포함할 수 있다. 이때, 코일은 코일 패턴일 수 있다.

[0033] 내측 안테나(200)가 형성된 레이어는 외측 안테나(600)가 형성된 레이어와 동일할 수 있다. 내측 안테나(200)의 코일 패턴의 선폭은 외측 안테나(600)의 코일 패턴의 선폭보다 클 수 있다. 내측 안테나(200)의 코일 패

턴의 선간 간격은 외측 안테나(600)의 코일 패턴의 선간 간격보다 클 수 있다.

[0034] 자성 기판(100)의 두께는 0.3 내지 0.6㎜이고, 내측 안테나(200)와 외측 안테나(600)의 두께는 0.8 내지 1.4㎜일 수 있다. 특히, 자성 기판(100)의 두께는 0.43㎜이고, 내측 안테나(200) 와 외측 안테나(600)의 두께는 0.1㎜이고, 이를 합한 두께는 0.53㎜일 수 있다. 그러나, 이 수치는 예시에 불과하다.

[0035] 접착층(700)은 자성 기판(100)의 일면과 기판(400)의 일면을 접착한다. 이때, 접착층(700)과 맞닿는 기판(400)의 일면은 기판(400)의 두 면 중에서 내측 안테나(200)와 외측 안테나(600)가 형성된 면일 수 있다.

[0036] 접촉부(300)는 단말 장치와 전기적으로 접촉하며, 복수의 연결 단자(310), 복수의 연결 도선(320), 기판(330), 복수의 접촉 단자(340)를 포함한다. 복수의 연결 단자(310)는 제1 연결 단자(311), 제2 연결 단자(312), 제3 연결 단자(313), 제4 연결 단자(314)를 포함한다. 복수의 연결 도선(320)은 제1 연결 도선(321), 제2 연결 도선(322), 제3 연결 도선(323), 제4 연결 도선(324)를 포함한다. 복수의 접촉 단자(340)는 제1 접촉 단자(341), 제2 접촉 단자(342), 제3 접촉 단자(343), 제4 접촉 단자(344)를 포함한다.

[0037] 복수의 연결 단자(310)는 내측 안테나(200)의 외측에 배치될 수 있다. 또한, 복수의 연결 단자(310)는 외측 안테나(600)의 외측에 배치될 수 있다.

[0038] 복수의 연결 도선(320)는 내측 안테나(200)의 외측에 배치될 수 있다. 또한, 복수의 연결 도선(320)는 외측 안테나(600)의 외측에 배치될 수 있다.

[0039] 복수의 접촉 단자(340)는 내측 안테나(200)의 외측에 배치될 수 있다. 또한, 복수의 접촉 단자(340)는 외측 안테나(600)의 외측에 배치될 수 있다.

[0040] 복수의 연결 단자(310)는 내측 안테나(200)의 외측 단자(210), 내측 안테나(200)의 내측 단자(220), 외측 안테나(600)의 내측 단자(610), 외측 안테나(600)의 외측 단자(620)에 각각 대응할 수 있다. 복수의 연결 도선(320)은 복수의 연결 단자(310)에 각각 대응한다. 복수의 접촉 단자(340)는 복수의 연결 도선(320)에 각각 대응한다. 복수의 접촉 단자(340)는 대응하는 연결 도선(320)을 통해 대응하는 연결 단자(310)와 전기적으로 연결된다.

[0041] 구체적으로, 제1 접촉 단자(341)는 제1 연결 도선(321)을 통해 대응하는 제1 연결 단자(311)와 전기적으로 연결된다. 제2 접촉 단자(342)는 제2 연결 도선(322)을 통해 대응하는 제2 연결 단자(312)와 전기적으로 연결된다. 제3 접촉 단자(343)는 제3 연결 도선(323)을 통해 대응하는 제3 연결 단자(313)와 전기적으로 연결된다. 제4 접촉 단자(344)는 제4 연결 도선(324)을 통해 대응하는 제4 연결 단자(314)와 전기적으로 연결된다.

[0042] 복수의 연결 단자(310), 복수의 연결 도선(320), 및 복수의 접촉 단자(340)는 도선 패턴일 수 있다. 도선 패턴은 라미네이팅 공정과 에칭 공정에 의해 기판(330) 상에 형성될 수 있다. 특히, 복수의 연결 단자(310), 복수의 연결 도선(320), 및 복수의 접촉 단자(340)는 동일 레이어에 형성될 수 있다.

[0043] 기판(330)은 인쇄 회로 기판, 연성 회로 기판일 수 있다. 또, 기판(330)은 비자성 절연 기판일 수 있다. 특히, 기판(330)의 재질은 폴리이미드 필름일 수 있다.

[0044] 후술하겠지만, 일 실시예에서, 기판(330)은 기판(400)과는 분리된 별도의 기판일 수 있다.

[0045] 또 다른 실시예에서 기판(330)과 기판(400)은 일체로 형성될 수 있다. 이 경우, 복수의 연결 단자(310), 복수의 연결 도선(320), 복수의 접촉 단자(340), 내측 안테나(200), 외측 안테나(600)는 동일 레이어에 형성될 수 있다.

[0046] 내측 안테나(200)가 무선 충전 안테나이고, 외측 안테나(600)가 무선 통신 안테나인 경우에, 단말 장치의 백 커버가 단말 장치와 결합되면, 내측 안테나(200)에 전기적으로 연결된 복수의 접촉 단자(340)를 통해 내측 안테나(200)는 단말 장치의 배터리와 전기적으로 연결되고, 외측 안테나(600)에 전기적으로 연결된 복수의 접촉 단자(340)를 통해 외측 안테나(600)는 단말 장치의 무선 통신 모듈과 전기적으로 연결될 수 있다. 구체적으로, 내측 안테나(200)에 전기적으로 연결된 제1 접촉 단자(341)와 제2 접촉 단자(342)를 통해 내측 안테나(200)는 단말 장치의 배터리와 전기적으로 연결되고, 외측 안테나(600)에 전기적으로 연결된 접촉 단자(343)와 접촉 단자(344)를 통해 외측 안테나(600)는 단말 장치의 무선 통신 모듈과 전기적으로 연결될 수 있다.

[0047] 연결부(500)는 내측 안테나(200)를 접촉부(300)에 전기적으로 연결시킨다. 또, 연결부(500)는 외측 안테나(600)를 접촉부(300)에 전기적으로 연결시킨다. 구체적으로 연결부(500)는 제1 서브 연결부(501), 제2 서브

연결부(502), 제3 서브 연결부(503), 제4 서브 연결부(504)를 포함한다. 제1 서브 연결부(501)는 내측 안테나(200)의 외측 단자(210)를 제1 연결 단자(311)에 전기적으로 연결시킨다. 제2 서브 연결부(502)는 내측 안테나(200)의 내측 단자(220)를 제2 연결 단자(312)에 전기적으로 연결시킨다. 제3 서브 연결부(503)는 외측 안테나(600)의 내측 단자(610)를 제3 연결 단자(313)에 전기적으로 연결시킨다. 제4 서브 연결부(504)는 외측 안테나(600)의 외측 단자(620)를 제4 연결 단자(314)에 전기적으로 연결시킨다. 연결부(500)의 다양한 실시예에 대해서는 후술한다.

[0048] 도 4는 본 발명의 실시예에 따른 안테나 어셈블리의 평면도이다.

[0049] 도 5은 본 발명의 실시예에 따른 안테나 어셈블리의 단면도이다. 특히, 도 5은 도 4에 도시된 안테나 어셈블리를 A에서 A'로 자른 경우의 단면도이다.

[0050] 특히, 도 4와 도 5의 실시예는 도 1 내지 도 3의 안테나 어셈블리에서 연결부(500)를 구체화한 것이다.

[0051] 도 4와 도 5를 참고하면, 기판(330)과 기판(400)은 일체로 형성된다.

[0052] 일 실시예에서, 제1 서브 연결부(501), 제2 서브 연결부(502), 제3 서브 연결부(503), 및 제4 서브 연결부(504)는 전도성 브릿지(520)이다.

[0053] 또 다른 실시예에서, 제1 서브 연결부(501), 제2 서브 연결부(502), 제3 서브 연결부(503)는 전도성 브릿지(520)이고, 제4 서브 연결부(504)는 기판(330) 상에 형성된 도선 패턴일 수 있다. 이는 외측 안테나(600)의 외측 단자(620) 및 제4 연결 단자(314) 사이에는 도선 패턴의 형성을 가로막는 또 다른 도선 패턴이 존재하지 않을 수 있기 때문이다. 이하에서는 제4 서브 연결부(504)는 기판(330) 상에 형성된 도선 패턴임을 가정한다.

[0054] 연결부(500)는 절연층(531)을 더 포함한다. 절연층(531)은 전도성 브릿지(520)가 안테나 패턴과 전기적으로 연결되지 않도록 하는 범위 내에서 안테나 패턴의 일부와 기판(400)의 일부를 덮고 있다. 일 실시예에서, 절연층(531)은 도포 후 건조된 절연 잉크일 수 있다. 즉, 절연층(531)은 절연 잉크의 도포 후 건조에 의해 형성될 수 있다. 또 다른 실시예에서, 절연층(531)은 절연 시트일 수 있다. 즉, 절연층(531)은 절연 시트를 가지고 라미네이팅 공정에 의해 형성될 수 있다.

[0055] 전도성 브릿지(520)는 절연층(531)의 상부에 형성된다.

[0056] 전도성 브릿지(520)는 전도성 페이스트에 의해 형성되는 제1 서브 브릿지(521)와 도금에 의해 형성되는 제2 서브 브릿지(522)를 포함할 수 있다. 제1 서브 브릿지(521)의 재질은 휘발된 전도성 페이스트일 수 있다. 여기서, 전도성 페이스트는 실버 페이스트(silver paste)일 수 있다. 하부 브릿지의 형성에는 구리 도금이 이용될 수 있다.

[0057] 제1 서브 브릿지(521)는 절연층(531)의 상부에 형성되고, 제2 서브 브릿지(522)는 제1 서브 브릿지(521)의 상부에 형성될 수 있다.

[0058] 도 6은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이고, 도 7은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 저면도이며, 도 8은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다. 특히, 도 8은 도 7에 도시된 안테나 어셈블리를 A에서 A'로 자른 경우의 단면도이다.

[0059] 도 6에서 점선은 도 6이 보여주는 면의 반대면의 도전 패턴을 보여주고, 도 7에서 점선은 도 7이 보여주는 면의 반대면의 일부의 도전 패턴을 보여준다.

[0060] 특히, 도 6 내지 도 8의 실시예는 도 1 내지 도 3의 안테나 어셈블리에서 연결부(500)를 구체화한 것이다.

[0061] 도 6 내지 도 8을 참고하면, 기판(330)과 기판(400)은 일체로 형성된다.

[0062] 일 실시예에서, 제1 서브 연결부(501), 제2 서브 연결부(502), 제3 서브 연결부(503), 및 제4 서브 연결부(504)는 전도성 브릿지(520)이다.

[0063] 또 다른 실시예에서, 제1 서브 연결부(501), 제2 서브 연결부(502), 제3 서브 연결부(503)는 전도성 브릿지(520)이고, 제4 서브 연결부(504)는 기판(330)의 상부에 형성된 도선 패턴일 수 있다. 이는 외측 안테나(600)의 외측 단자(620) 및 제4 연결 단자(314) 사이에는 도선 패턴의 형성을 가로막는 또 다른 도선 패턴이 존재하지 않을 수 있기 때문이다. 이하에서는 제4 서브 연결부(504)는 기판(330) 상에 형성된 도선 패턴임을 가정한다.

[0064] 전도성 브릿지(520)는 기판(400)의 하부에 형성된다. 이 경우, 기판(400)이 절연성이므로, 별도의 절연층을

형성할 필요가 없는 장점이 있다.

[0065] 대신에, 기판(400)에서 내측 안테나(200)의 외측 단자(210)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 내측 안테나(200)의 외측 단자(210)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 일단과 전기적으로 연결된다.

[0066] 또, 기판(400)에서 제1 연결 단자(311)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 제1 연결 단자(311)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 타단과 전기적으로 연결된다.

[0067] 기판(400)에서 내측 안테나(200)의 내측 단자(220)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 내측 안테나(200)의 내측 단자(220)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 일단과 전기적으로 연결된다.

[0068] 기판(400)에서 제2 연결 단자(312)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 제2 연결 단자(312)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 타단과 전기적으로 연결된다.

[0069] 기판(400)에서 외측 안테나(600)의 외측 단자(610)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 외측 안테나(600)의 외측 단자(610) 는 제1 서브 연결부(501)의 전도성 브릿지(520)의 일단과 전기적으로 연결된다.

[0070] 기판(400)에서 제3 연결 단자(313)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 제3 연결 단자(313)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 타단과 전기적으로 연결된다.

[0071] 기판(400)에서 외측 안테나(600)의 내측 단자(610)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 외측 안테나(600)의 내측 단자(610) 는 제1 서브 연결부(501)의 전도성 브릿지(520)의 일단과 전기적으로 연결된다.

[0072] 기판(400)에서 제4 연결 단자(314)의 하부에 형성된 비아홀(533)에서 제공되는 전도성 비아를 통해 제4 연결 단자(314)는 제1 서브 연결부(501)의 전도성 브릿지(520)의 타단과 전기적으로 연결된다.

[0073] 전도성 브릿지(520)는 실버 페이스트(silver paste)에 의해 형성되는 제1 브릿지(521)와 도금에 의해 형성되는 제2 브릿지(522)를 포함할 수 있다. 특히, 하부 브릿지의 형성에는 구리 도금이 이용될 수 있다.

[0074] 제1 서브 브릿지(521)는 기판(400)의 하부에 형성되고, 제2 서브 브릿지(522)는 제1 서브 브릿지(521)의 하부에 형성될 수 있다.

[0075] 도 9은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 평면도이고, 도 10은 본 발명의 또 다른 실시에에 따른 안테나 어셈블리의 저면도이며, 도 11은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 단면도이다. 특히, 도 11은 도 10에 도시된 안테나 어셈블리를 A에서 A'로 자른 경우의 단면도이다.

[0076] 도 9에서 점선은 도 6이 보여주는 면의 반대편의 도전 패턴을 보여주고, 도 7에서 점선은 도 7이 보여주는 면의 반대면의 일부의 도전 패턴을 보여준다.

[0077] 특히, 도 6 내지 도 8의 실시예는 도 1 내지 도 3의 안테나 어셈블리에서 연결부(500)를 구체화한 것이다.

[0078] 도 9 내지 도 11을 참고하면, 기판(330)과 기판(400)은 일체로 형성된다.

[0079] 기판(400)은 제1 절취선(411), 제1 접는 선(folding line)(421), 제1 절취부(431), 제2 절취선(412), 제2 접는 선(422), 제2 절취부(432), 제3 절취선(413), 제3 접는 선(423), 제3 절취부(433)을 포함한다.

[0080] 제1 서브 연결부(501)는 제1 확장 패턴(541), 제1 서브 기판(551)을 포함한다. 제1 확장 패턴(541)은 내측 안테나(200)의 외측 단자(210)에서 확장되는 확장 패턴이다.

[0081] 제1 서브 기판(551)과 기판(400)은 제1 접는 선(421)에서 일체로 형성된다.

[0082] 제1 절취선(411)은 열린 도형(open figure)을 형성하고, 제1 절취선(411) 및 제1 접는 선(421)의 결합은 닫힌 도형(closed figure)을 형성한다.

[0083] 제1 절취선(411) 및 제1 접는 선(421)의 결합이 형성하는 닫힌 도형의 크기 및 모양은 제1 절취부(431)의 크기 및 모양에 대응하고, 제1 절취부(431)의 크기 및 모양은 제1 서브 기판(551)의 크기 및 모양에 대응한다.

[0084] 제1 접는 선(421)은 제1 절취선(411)에 의해 절취되어 형성되는 제1 서브 기판(551)을 접기 위한 선이다.

[0085] 제1 서브 기판(551)은 제1 확장 패턴(541)을 수용할 수 있는 크기와 모양을 가진다.

[0086] 제1 절취부(431)는 제1 절취선(411)에 따른 기판(400)의 절취와 제1 접는 선(421)에 따른 제1 서브 기판(551)의 접음(folding)에 의해 형성된다.

[0087] 제2 서브 연결부(502)는 제2 확장 패턴(542), 제2 서브 기판(552)을 포함한다. 제2 확장 패턴(542)은 내측 안테나(200)의 내측 단자(220)에서 확장되는 확장 패턴이다.

[0088] 제2 서브 기판(552)과 기판(400)은 제2 접는 선(422)에서 일체로 형성된다.

[0089] 제2 절취선(412)은 열린 도형(open figure)을 형성하고, 제2 절취선(412) 및 제2 접는 선(422)의 결합은 닫힌 도형(closed figure)을 형성한다.

[0090] 제2 절취선(412) 및 제2 접는 선(422)의 결합이 형성하는 닫힌 도형의 크기 및 모양은 제2 절취부(432)의 크기 및 모양에 대응하고, 제2 절취부(432)의 크기 및 모양은 제2 서브 기판(552)의 크기 및 모양에 대응한다.

[0091] 제2 접는 선(422)은 제2 절취선(412)에 의해 절취되어 형성되는 제2 서브 기판(552)을 접기 위한 선이다.

[0092] 제2 서브 기판(552)은 제2 확장 패턴(542)을 수용할 수 있는 크기와 모양을 가진다.

[0093] 제2 절취부(432)는 제2 절취선(412)에 따른 기판(400)의 절취와 제2 접는 선(422)에 따른 제2 서브 기판(552)의 접음(folding)에 의해 형성된다.

[0094] 제3 서브 연결부(503)는 제3 확장 패턴(543), 제3 서브 기판(553)을 포함한다. 제3 확장 패턴(543)은 외측 안테나(600)의 내측 단자(610)에서 확장되는 확장 패턴이다.

[0095] 제3 서브 기판(553)과 기판(400)은 제3 접는 선(423)에서 일체로 형성된다.

[0096] 제3 절취선(413)은 열린 도형(open figure)을 형성하고, 제3 절취선(413) 및 제3 접는 선(423)의 결합은 닫힌 도형(closed figure)을 형성한다.

[0097] 제3 절취선(413) 및 제3 접는 선(423)의 결합이 형성하는 닫힌 도형의 크기 및 모양은 제3 절취부(433)의 크기 및 모양에 대응하고, 제3 절취부(433)의 크기 및 모양은 제3 서브 기판(553)의 크기 및 모양에 대응한다.

[0098] 제3 접는 선(423)은 제3 절취선(413)에 의해 절취되어 형성되는 제3 서브 기판(553)을 접기 위한 선이다.

[0099] 제3 서브 기판(553)은 제3 확장 패턴(543)을 수용할 수 있는 크기와 모양을 가진다.

[0100] 제3 절취부(433)는 제3 절취선(413)에 따른 기판(400)의 절취와 제3 접는 선(423)에 따른 제3 서브 기판(553)의 접음(folding)에 의해 형성된다.

[0101] 일 실시예에서, 제4 서브 연결부(504)는 기판(330)의 상부에 형성된 도선 패턴일 수 있다. 이 경우, 제 4 서브 연결부(504)에 해당하는 도선 패턴의 둘레에는 절취선과 접는 선이 구비되지 않고, 대신에 제 4 서브 연결부(504)에 해당하는 도선 패턴은 제4 접촉 단자(344)에 전기적으로 연결된다.

[0102] 또 다른 실시예에서, 기판(400)은 제4 절취선(도시하지 않음), 제4 접는 선(도시하지 않음), 제4 절취부(도시하지 않음)을 포함할 수 있다.

[0103] 제4 서브 연결부(504)는 제4 확장 패턴(도시하지 않음), 제4 서브 기판(도시하지 않음)을 포함할 수 있다. 제4 확장 패턴은 외측 안테나(600)의 내측 단자(610)에서 확장되는 확장 패턴이다.

[0104] 제4 서브 기판과 기판(400)은 제4 접는 선에서 일체로 형성된다.

[0105] 제4 절취선은 열린 도형(open figure)을 형성하고, 제4 절취선 및 제4 접는 선의 결합은 닫힌 도형(closed figure)을 형성한다.

[0106] 제4 접는 선은 제4 절취선에 의해 절취되어 형성되는 제4 서브 기판을 접기 위한 선이다.

[0107] 제4 절취선 및 제4 접는 선의 결합이 형성하는 닫힌 도형의 크기 및 모양은 제4 절취부의 크기 및 모양에 대응하고, 제4 절취부의 크기 및 모양은 제4 서브 기판의 크기 및 모양에 대응한다.

[0108] 제4 서브 기판은 제4 확장 패턴(도시하지 않음)을 수용할 수 있는 크기와 모양을 가진다.

[0109] 제4 절취부는 제4 절취선에 따른 기판(400)의 절취와 제4 접는 선에 따른 제4 서브 기판의 접음(folding)에 의해 형성된다.

[0110] 도 9 내지 도 11을 참고하면, 제1 접는 선(421)에 따른 제1 서브 기판(551)이 접히면, 기판(400)의 하부에 제1 서브 기판(551)이 형성된다. 그리고, 제1 서브 기판(551)의 하부에 제1 확장 패턴(541)가 마련된다. 제1 연결 단자(311)와 제1 확장 패턴(541)의 단자는 기판(400) 내에서 제1 연결 단자(311)의 하부에 형성되는 비아홀(533)과 제1 서브 기판(551) 내에서 제1 확장 패턴(541)의 단자의 상부에 형성되는 비아홀(533)에 의해 전기적으로 연결될 수 있다. 특히, 제1 연결 단자(311)와 제1 확장 패턴(541)의 단자는 비아홀(533)에서 제공되는 전도성 비아의 열압착, 그 전도성 비아 주변에 제공되는 전도성 물질에 의해 전기적으로 연결될 수 있다. 여기서 전도성 물질은 전도성 페이스트, 솔더일 수 있다.

[0111] 또, 제2 접는 선(422)에 따른 제2 서브 기판(552)이 접히면, 기판(400)의 하부에 제2 서브 기판(552)이 형성된다. 그리고, 제2 서브 기판(552)의 하부에 제2 확장 패턴(542)가 마련된다. 제2 연결 단자(312)와 제2 확장 패턴(542)의 단자는 기판(400) 내에서 제2 연결 단자(312)의 하부에 형성되는 비아홀(533)과 제2 서브 기판(552) 내에서 제2 확장 패턴(542)의 단자의 상부에 형성되는 비아홀(533)에 의해 전기적으로 연결될 수 있다. 특히, 제2 연결 단자(312)와 제2 확장 패턴(542)의 단자는 비아홀(533)에서 제공되는 전도성 비아의 열압착, 그 전도성 비아 주변에 제공되는 전도성 물질에 의해 전기적으로 연결될 수 있다. 여기서 전도성 물질은 전도성 페이스트, 솔더일 수 있다.

[0112] 또, 제3 접는 선(423)에 따른 제3 서브 기판(553)이 접히면, 기판(400)의 하부에 제3 서브 기판(553)이 형성된다. 그리고, 제3 서브 기판(553)의 하부에 제3 확장 패턴(543)가 마련된다. 제3 연결 단자(313)와 제3 확장 패턴(543)의 단자는 기판(400) 내에서 제3 연결 단자(313)의 하부에 형성되는 비아홀(533)과 제3 서브 기판(553) 내에서 제3 확장 패턴(543)의 단자의 상부에 형성되는 비아홀(533)에 의해 전기적으로 연결될 수 있다. 특히, 제3 연결 단자(313)와 제3 확장 패턴(543)의 단자는 비아홀(533)에서 제공되는 전도성 비아의 열압착, 그 전도성 비아 주변에 제공되는 전도성 물질에 의해 전기적으로 연결될 수 있다. 여기서 전도성 물질은 전도성 페이스트, 솔더일 수 있다.

[0113] 도 12은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 사시도이고, 도 13는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 평면도이고, 도 14은 도 13의 접촉부(300)에 도시된 점선을 따라 A에서 A'로 자른 경우, 안테나 어셈블리(1000)의 단면도이다.

[0114] 도 12 내지 도 14을 참고하면, 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300)를 포함할 수 있다. 접촉부(300)는 제1 접촉 단자(341), 제2 접촉 단자(342), 제1 연결 도선(321), 제2 연결 도선(322), 기판(330)을 포함할 수 있다. 도 13과 도 14에서는 제1 접촉 단자(341), 제2 접촉 단자(342), 제1 연결 도선(321), 제2 연결 도선(322), 기판(330)의 도시는 생략되었다.

[0115] 안테나 어셈블리(1000)는 송신 측으로부터 무선으로 전력을 수신할 수 있다. 일 실시 예에서 안테나 어셈블리(1000)는 전자기 유도를 이용해 무선으로 전력을 수신 할 수 있다. 일 실시 예에서 안테나 어셈블리(1000)는 공진을 이용해 무선으로 전력을 수신할 수 있다.

[0116] 다시 도 12을 설명하면, 내측 안테나(200)는 외측 단자(210), 내측 단자(220)내측 단자(220) 및 내측 코일(230)을 포함할 수 있다. 내측 코일(230)은 도전층 또는 도전 패턴을 형성할 수 있다.

[0117] 외측 단자(210)는 내측 코일(230)의 일단에 내측 단자(220)는 내측 코일(230)의 타단에 위치한다.

[0118] 외측 단자(210) 및 내측 단자(220)는 접촉부(300)와의 전기적 연결을 위해 필요한 단자이다.

[0119] 내측 코일(230)은 하나의 도선이 복수 번 권선된 코일 패턴을 형성할 수 있다. 일 실시 예에서 코일 패턴은 평면 나선 구조일 수 있으나, 이에 한정될 필요는 없고, 다양한 패턴을 형성할 수 있다.

[0120] 내측 안테나(200)는 자성 기판(100)의 상면에 직접 배치될 수 있다. 일 실시 예에서 내측 안테나(200)와 자성 기판(100) 사이에는 접착층(미도시)이 더 배치될 수 있다.

[0121] 내측 안테나(200)는 도전체를 포함할 수 있다. 도전체는 금속 또는 합금이 이용될 수 있다. 일 실시 예에서 금속은 은 또는 구리가 사용될 수 있으나, 이에 한정될 필요는 없다.

[0122] 내측 안테나(200)는 송신 측으로부터 무선으로 수신한 전력을 접촉부(300)에 전달할 수 있다. 내측 안테나(200)는 송신 측으로부터 전자기 유도 또는 공진을 이용하여 전력을 수신할 수 있다.

[0123] 접촉부(300)의 제1 연결 단자(311)는 내측 안테나(200)의 외측 단자(210)와 전기적으로 연결될 수 있고, 접촉부(300)의 제2 연결 단자(312)는 내측 안테나(200)의 내측 단자(220)와 전기적으로 연결될 수 있다.

[0124] 기판(330)은 배선층을 포함할 수 있고, 배선층은 후술하는 수신회로 등이 배치될 수 있다.

[0125] 접촉부(300)는 수신회로(미도시)와 내측 안테나(200) 사이를 연결하여 내측 안테나(200)로부터 전달받은 전력을 수신회로(미도시)를 통해 부하(미도시)로 전달할 수 있다. 수신회로는 교류전력을 직류전력으로 변환하는 정류회로 및 변환된 직류전력에서 리플 성분을 제거하여 부하에 전달하는 평활회로를 포함할 수 있다.

[0126] 도 13 내지 도 14은 내측 안테나(200)와 접촉부(300)가 연결된 상태인 경우, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 상세한 구성을 설명하기 위한 도면이다.

[0127] 도 13는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 평면도이다.

[0128] 도 13는 내측 안테나(200)와 접촉부(300)가 서로 접속되어 있는 상태를 보여준다.

[0129] 일 실시 예에서 내측 안테나(200)와 접촉부(300) 간의 전기적 연결은 솔더에 의해 이루어질 수 있다. 구체적으로 제1 서브 연결부(501)는 솔더(10)에 해당하고, 제2 서브 연결부(502)는 솔더(20)에 해당할 수 있다. 즉, 내측 안테나(200)의 외측 단자(210)와 접촉부(300)의 제1 연결 단자(311)는 제1 솔더(10)에 의해 전기적으로 연결될 수 있고, 내측 안테나(200)의 내측 단자(220)와 접촉부(300)의 제2 연결 단자(312)는 제2 솔더(20)에 의해 전기적으로 연결될 수 있다. 구체적으로, 내측 안테나(200)의 외측 단자(210)는 제1 솔더(10)의 비아홀을 통해 접촉부(300)의 제1 연결 단자(311)와 전기적으로 연결될 수 있고, 내측 안테나(200)의 내측 단자(220)는 제2 솔더(20)의 비아홀을 통해 접촉부(300)의 제2 연결 단자(312)와 전기적으로 연결될 수 있다.

[0130] 도 13에서 접촉부(300)에 도시된 점선을 따라 A에서 A'로 자른 단면에 대한 설명은 도 14에서 한다.

[0131] 도 14은 도 13의 접촉부(300)에 도시된 점선을 따라 A에서 A'로 자른 경우, 안테나 어셈블리(1000)의 단면도이다.

[0132] 도 14을 참고하면, 자성 기판(100) 상면에는 내측 안테나(200)의 구성요소인 외측 단자(210), 내측 단자(220) 및 내측 코일(230)이 배치되어 있다.

[0133] 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100)의 상면에 내측 안테나(200)가 직접 배치되어 있어, 기존의 FPCB 상에 코일 패턴을 형성한 경우와 달리 전체적인 두께를 크게 감소시킬 수 있다.

[0134] 앞서 설명한 바와 같이, 자성 기판(100)의 두께는 0.3 내지 0.6mm이고, 내측 안테나(200)의 두께는 0.8 내지 1.4mm일 수 있다. 특히, 자성 기판(100)의 두께는 0.43mm이고, 내측 안테나(200)의 두께는 0.1mm이고, 이를 합한 두께는 0.53mm일 수 있다. 그러나, 이 수치는 예시에 불과하다.

[0135] 즉, 내측 안테나(200)를 도전체, 도전 패턴, 박막과 같은 형태로 구성함으로써 안테나 어셈블리(1000)의 두께를 감소시킬 수 있다. 이는, 요즘 휴대용 단말기와 같이 슬림화를 요구하고 있는 전자기기에 적용한다면 휴대용 단말기의 전체 두께를 감소시키면서 송신 측으로부터 전력을 수신하는데 유용한 효과를 가져올 수 있다.

[0136] 내측 안테나(200)의 상 측에는 접촉부(300)가 직접 배치되어 있다. 내측 안테나(200)의 상 측에 접촉부(300)가 직접 배치됨에 따라 내측 안테나(200)와 접촉부(300)가 쉽게 접속될 수 있다.

[0137] 내측 안테나(200)의 외측 단자(210)는 솔더(10)에 의해 접촉부(300)의 제1 연결 단자(311)와 접속된다.

[0138] 내측 안테나(200)의 내측 단자(220)는 솔더(20)에 의해 접촉부(300)의 제2 연결 단자(312)와 접속된다.

[0139] 내측 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 내측 코일(230)과 내측 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

[0140] 도 15 내지 도 19는 본 발명의 일 실시 예에 따른 안테나 어셈블리(1000)의 제조 방법에 설명하기 위한 도면이다.

[0141] 안테나 어셈블리(1000)의 구성은 도 12 내지 도 14에서 설명한 것과 본질적으로 결합될 수 있다.

[0142] 먼저, 도 15를 참고하면, 자성 기판(100)이 형성된다.

[0143] 다음으로 도 16를 참고하면, 자성 기판(100)의 상면에 직접 도전체(201)를 적층시킨다. 일 실시 예에서는 자성 기판(100)의 상면에 접착층이 적층된 후, 도전체(201)가 적층될 수도 있다.

[0144] 일 실시 예에서 자성 기판(100)의 상면에 도전체(201)를 적층시키는 방법은 도전체(201)를 소정의 온도에서 가열하고, 그 후, 소정의 압력을 가하는 라미네이팅(laminating) 공정이 사용될 수 있다. 라미네이팅(laminating) 공정이란, 열과 압력을 이용하여 서로 다른 종류의 금속박, 종이 등을 접착시키는 공정을 의미한다.

[0145] 다음으로 도 17을 참고하면, 도전체(201)의 상 면에 마스크(50)가 적층된다. 마스크(50)는 내측 안테나(200)의 외측 단자(210), 내측 단자(220), 내측 코일(230)이 형성될 위치의 상 면에만 적층될 수 있다.

[0146] 다음으로, 도 18을 참고하면, 도 17의 상태에서 에칭액에 담구면 마스크(50)가 위치하지 않은 홈 부분이 식각된다. 그러면, 도전체(201)는 일정한 도전 패턴을 형성하게 된다.

[0147] 그 후, 마스크(50)를 제거하면, 안테나 어셈블리(1000)의 내측 안테나(200)가 형성된다.

[0148] 다음으로 도 19을 참고하면, 내측 안테나(200)와 접촉부(300)가 접속되도록 솔더링 작업을 거친다.

[0149] 즉, 내측 안테나(200)의 외측 단자(210)와 접촉부(300)의 제3 연결단자(310)를 솔더(10)에 의해 접속시키고, 내측 안테나(200)의 제2 연결단자(200)와 접촉부(300)의 제4 연결단자(320)를 솔더(20)에 의해 접속시킨다.

[0150] 상기와 같이 자성 기판(100) 상 면에 직접 내측 안테나(200)를 배치시킴으로써, 안테나 어셈블리(1000)의 전체 두께를 크게 감소시킬 수 있고, 라미네이팅과 에칭 과정만을 통해 안테나 어셈블리(1000)를 제조할 수 있어 공정이 단순화되는 효과가 있다.

[0151] 도 20는 도 13의 접촉부(300)에 도시된 점선을 따라 A에서 A'로 자른 경우, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 단면도이다.

[0152] 도 20를 참고하면, 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300), 접착층(700)을 포함할 수 있다.

[0153] 자성 기판(100), 내측 안테나(200), 접촉부(300)는 도 12에서 설명한 것과 같다.

[0154] 접착층(700)은 자성 기판(100)과 내측 안테나(200) 사이에 배치되어 자성 기판(100)과 내측 안테나(200)를 접착시킨다.

[0155] 도 21은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 평면도이다.

[0156] 도 21을 참고하면, 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300), 외측 안테나(600)를 포함할 수 있다. 접촉부(300)는 제1 연결 단자(311), 제2 연결 단자(312), 제3 연결 단자(313), 제4 연결 단자(314), 제1 연결 도선(321), 제2 연결 도선(322), 제3 연결 도선(323), 제4 연결 도선(324), 제1 접촉 단자(341), 제2 접촉 단자(342), 제3 접촉 단자(343), 제4 접촉 단자(344)를 포함할 수 있지만, 그 도시는 생략되었다.

[0157] 자성 기판(100), 내측 안테나(200), 접촉부(300)에 대한 설명은 도 12 내지 도 14에서 설명한 것과 같다.

[0158] 외측 안테나(600)는 내측 단자(610), 외측 단자(620), 외측 코일(630)을 포함한다.

[0159] 외측 안테나(600)의 내측 단자(610) 및 외측 단자(620)는 접촉부(300)에 접속된다.

[0160] 외측 안테나(600)는 근거리 무선통신이 가능한 리더기와 통신을 수행할 수 있다. 외측 안테나(600)는 상기 리더기와 정보를 송수신하는 안테나의 역할을 수행한다.

[0161] 일 실시 예에서 외측 안테나(600)는 내측 안테나(200)의 외곽에 배치될 수 있다. 일 실시 예에서 내측 안테나(200)가 자성 기판(100)의 중앙에 배치된 경우, 외측 안테나(600)는 내측 안테나(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 외측 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

[0162] 외측 안테나(600)는 내측 안테나(200)처럼 도전 패턴, 도전층을 형성할 수 있다.

[0163] 외측 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다. NFC(Near Field Communication)는 13.56MHz의 대역을 가지며, 가까운 거리의 무선통신을 하기 위한 기술이다.

[0164] 외측 안테나(600)는 자성 기판(100)의 상면에 직접 배치될 수 있다.

[0165] 외측 안테나(600)가 자성 기판(100)에 배치되는 방법은 상기 도 15에서 설명한 제조 방법과 동일할 수 있다.

[0166] 다음으로 도 22 내지 도 24에서 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 상세한 구성을 설명한다.

[0167] 도 22은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 사시도이다.

[0168] 도 22을 참고하면, 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300)를 포함한다. 접촉부(300)는 제1 접촉 단자(341), 제2 접촉 단자(342), 제1 연결 도선(321), 제2 연결 도선(322), 기판(330)을 포함할 수 있다. 도 23과 도 24에서는 제1 접촉 단자(341), 제2 접촉 단자(342), 제1 연결 도선(321), 제2 연결 도선(322), 기판(330)의 도시는 생략되었다.

[0169] 내측 안테나(200), 접촉부(300)에 대한 설명은 도 12에서 설명한 것과 같다. 다만, 자성 기판(100)의 경우, 일부 구조가 다르므로 이를 중심으로 설명한다.

[0170] 도 22을 참고하면, 자성 기판(100)은 접촉부(300)의 구조와 동일한 구조를 갖는 수용영역(130)을 형성하고 있다. 즉, 도 12의 경우, 자성 기판(100) 상면에 내측 안테나(200)가 배치되고, 내측 안테나(200) 위에 접촉부(300)가 연결되는 구조이나, 도 22의 경우, 자성 기판(100) 자체에 접촉부(300)의 구조와 동일한 구조에 해당하는 부분만큼 수용영역(130)이 형성되어, 내측 안테나(200)의 하측에 접촉부(300)가 배치될 수 있다.

[0171] 도 23는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 평면도이다.

[0172] 도 23는 내측 안테나(200)와 접촉부(300)가 서로 접속되어 있는 상태를 보여준다.

[0173] 접촉부(300)의 두께는 자성 기판(100)의 두께와 같거나 작을 수 있다. 접촉부(300)는 플렉서블한 인쇄회로기판(FPCB: Flexible PCB)로 구현될 수 있다.

[0174] 접촉부(300)는 자성 기판(100)의 수용영역(130)에 배치될 수 있다.

[0175] 접촉부(300)의 두께가 자성 기판(100)의 두께와 같거나 작다면, 도 14의 실시 예와 달리, 접촉부(300)의 두께만큼 안테나 어셈블리(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

[0176] 도 24은 도 23의 접촉부(300)에 도시된 점을 따라 B에서 B'로 자른 경우, 안테나 어셈블리(1000)의 단면도이다.

[0177] 접촉부(300)의 두께는 자성 기판(100)의 두께보다 작은 경우를 가정하여 설명한다.

[0178] 도 24을 참고하면, 접촉부(300) 상면에는 내측 안테나(200)의 구성요소인 외측 단자(210), 내측 단자(220), 내측 코일(230)이 배치되어 있다.

[0179] 내측 안테나(200)의 하 측에는 접촉부(300)가 배치되어 있다.

[0180] 내측 안테나(200)의 외측 단자(210)는 제1 서브 연결부(501)에 해당하는 솔더(10)에 의해 접촉부(300)의 제1 연결 단자(311)와 접속된다.

[0181] 내측 안테나(200)의 내측 단자(220)는 제1 서브 연결부(501)에 해당하는 솔더(20)에 의해 접촉부(300)의 제2 연결 단자(312)와 접속된다.

[0182] 내측 코일(230)의 폭(W)과 두께(T)는 소정의 값을 갖도록 설계될 수 있다. 내측 코일(230)과 내측 코일(230) 사이의 간격 또한, 소정의 거리 값을 갖도록 설계될 수 있다.

[0183] 도 24을 참고하면, 접촉부(300)의 두께가 자성 기판(100)의 두께보다 작으므로, 도 14의 실시 예와 달리, 접촉부(300)의 두께만큼 안테나 어셈블리(1000)의 전체 두께가 감소할 수 있다. 또한, 자성 기판(100)이 도 21에서 도시한 수용영역(130)만큼 자성체(110) 및 지지체(120)가 덜 필요하게 되므로, 비용상 이점이 있다.

[0184] 다음으로, 도 25 내지 도 31에서 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)에 대해 상세히 설

명한다.

[0185] 도 25는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 사시도이고, 도 26는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 평면도이고, 도 27은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)를 C에서 C'로 자른 단면도이고, 도 28 내지 도 32은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 제조 방법을 설명하기 위한 도면이다.

[0186] 먼저, 도 25를 참조하면, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100), 내측 안테나(200), 접촉부(300)를 포함할 수 있다.

[0187] 일 실시 예에서 안테나 어셈블리(1000)는 송신 측으로부터 전자기 유도에 의해 전력을 수신할 수 있다. 이 경우, 내측 안테나(200)의 코일(210)은 송신 측의 코일과 전자기 유도에 의해 무선으로 전력을 수신할 수 있다.

[0188] 일 실시 예에서 안테나 어셈블리(1000)는 송신 측으로부터 공진에 의해 전력을 수신할 수 있다. 이 경우, 내측 안테나(200)의 내측 코일(230)은 송신 측의 송신 공진 코일과 공진 주파수에서 동작하여 전력을 수신하는 수신 공진 코일 및 수신 공진 코일과 커플링되어 전달받은 전력을 수신회로로 전달하는 수신 유도 코일을 포함할 수 있다.

[0189] 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시킬 수 있다.

[0190] 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과를 가질 수 있다.

[0191] 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 측방으로 변경시켜 내측 안테나(200)에 자기장이 더 집중적으로 전달될 수 있도록 한다.

[0192] 자성 기판(100)은 송신 측으로부터 전달받는 자기장 중 외부로 누출되는 자기장을 흡수하여 열로 방출시킬 수도 있다. 외부에 누출되는 자기장의 양이 감소되면, 인체에 유해한 영향을 미칠 수 있는 상황이 방지될 수 있다.

[0193] 도 27을 참고하면, 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다.

[0194] 자성체(110)는 입자 또는 세라믹의 형태를 포함할 수 있다. 일 실시 예에서 자성체(110)는 스피넬 타입, 헥사 타입, 센다스트 타입, 퍼멀로이 타입의 자성체 중 어느 하나일 수 있다.

[0195] 지지체(120)는 열경화성 수지 또는 열가소성 수지를 포함할 수 있으며, 자성 기판(100)을 지지하는 역할을 수행한다.

[0196] 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

[0197] 다시 도 25를 설명하면, 내측 안테나(200)는 외측 단자(210), 내측 단자(220), 내측 코일(230)을 포함할 수 있다. 내측 코일(230)은 도전층 또는 도전 패턴을 형성할 수 있다.

[0198] 내측 안테나(200)는 자성 기판(100)의 내부에 배치될 수 있다. 구체적으로, 내측 안테나(200)는 자성 기판(100)의 내부에 함몰되어 배치될 수 있다. 더 구체적으로, 자성 기판(100)은 패턴 홈을 포함할 수 있고, 상기 패턴 홈에는 상기 내측 안테나(200)가 배치될 수 있다. 상기 패턴 홈은 상기 내측 안테나(200)가 형성하는 도전 패턴 또는 도전층의 형태와 동일한 형태를 가질 수 있다.

[0199] 내측 안테나(200)의 두께는 자성 기판(100)의 두께보다 더 작고, 내측 안테나(200)의 상 측은 자성 기판(100)의 외부로 노출될 수 있다.

[0200] 자성 기판(100)에 내측 안테나(200) 및 접촉부(300)가 배치되어 안테나 어셈블리(1000)가 제조되는 공정은 도 28 내지 도 32에서 후술한다.

[0201] 내측 안테나(200)의 외측 단자(210)는 내측 코일(230)의 일단에 내측 단자(220)는 내측 코일(230)의 타단에 위치한다.

[0202] 내측 안테나(200)의 외측 단자(210) 및 내측 단자(220)는 접촉부(300)와의 접속을 위해 필요한 단자이다.

[0203] 내측 코일(230)은 하나의 도선이 복수 번 권선된 패턴을 형성할 수 있다. 일 실시 예에서 패턴은 평면 나선 구조일 수 있으나, 이에 한정될 필요는 없고, 다양한 패턴을 형성할 수 있다.

[0204] 내측 안테나(200)는 송신 측으로부터 무선으로 수신한 전력을 접촉부(300)에 전달할 수 있다. 내측 안테나

(200)는 송신 측으로부터 전자기 유도 또는 공진을 이용하여 수신한 전력을 접촉부(300)에 전달할 수 있다.

[0205] 접촉부(300)는 제1 연결 단자(311), 제2 연결 단자(312), 기판(330)을 포함할 수 있다.

[0206] 접촉부(300)의 제1 연결 단자(311)는 내측 안테나(200)의 외측 단자(210)와 접속될 수 있고, 접촉부(300)의 제2 연결 단자(312)는 내측 안테나(200)의 내측 단자(220)와 접속될 수 있다.

[0207] 기판(330)은 배선층을 포함할 수 있고, 배선층은 후술하는 수신회로 등을 포함할 수 있다.

[0208] 접촉부(300)는 수신회로(미도시)와 내측 안테나(200) 사이를 연결하여 내측 안테나(200)로부터 전달받은 전력을 수신회로를 통해 부하(미도시)로 전달할 수 있다. 수신회로는 교류전력을 직류전력으로 변환하는 정류회로(미도시) 및 변환된 직류전력에서 리플 성분을 제거하여 부하에 전달하는 평활회로(미도시)를 포함할 수 있다.

[0209] 도 26 내지 도 27은 내측 안테나(200)와 접촉부(300)가 연결된 상태인 경우, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 상세한 구성을 설명하기 위한 도면이다.

[0210] 도 26는 내측 안테나(200)와 접촉부(300)가 서로 접속되어 있는 상태를 보여준다.

[0211] 내측 안테나(200)와 접촉부(300) 간의 접속은 솔더에 의해 이루어질 수 있다.

[0212] 도 27을 참조하면, 내측 안테나(200)의 외측 단자(210)와 접촉부(300)의 제1 연결 단자(311)는 제1 솔더(10)에 의해 연결될 수 있고, 내측 안테나(200)의 내측 단자(220)와 접촉부(300)의 제2 연결 단자(312)는 제2 솔더(20)에 의해 연결될 수 있다. 구체적으로, 내측 안테나(200)의 외측 단자(210)는 제1 솔더(10)의 비아홀을 통해 접촉부(300)의 제1 연결 단자(311)와 연결될 수 있고, 내측 안테나(200)의 내측 단자(220)는 제2 솔더(20)의 비아홀을 통해 접촉부(300)의 제2 연결 단자(312)와 연결될 수 있다.

[0213] 일 실시 예에서 상기 비아홀은 레이저를 이용하여 형성될 수 있다. 이 때, 레이저는 UV 레이저, CO2 레이저 등이 이용될 수 있다.

[0214] 도 27을 참조하면, 자성 기판(100) 및 내측 안테나(200)가 접촉부(300)와 접속되어 있는 안테나 어셈블리(1000)의 단면도가 도시되어 있다.

[0215] 즉, 자성 기판(100)의 패턴 홈(140)에는 내측 안테나(200)의 구성요소인 외측 단자(210), 내측 단자(220), 내측 코일(230)이 배치될 수 있다.

[0216] 또한, 자성 기판(100) 및 내측 안테나(200)가 접촉부(300)와 접속되어 있는 상태가 도시되어 있다.

[0217] 내측 코일(230)의 폭(W)과 두께(T), 자성 기판(100)의 두께(T1)은 소정의 값을 갖도록 설계될 수 있다. 일 실시 예에서 내측 코일(230)의 두께는 0.1mm, 자성 기판(100)의 두께는 0.43mm일 수 있으나, 이는 예시에 불과하다. 일 실시 예에서 내측 코일(230)의 두께(T)는 자성 기판(100)의 두께(T1)보다 작을 수 있다.

[0218] 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100)의 패턴 홈(140)에 내측 안테나(200)가 직접 배치되어 있어, 내측 안테나(200)의 두께만큼 안테나 어셈블리(1000)가 장착된 전자기기의 전체 두께가 감소될 수 있다. 본 발명의 또 다른 실시예를 휴대용 단말기와 같은 안테나 어셈블리(1000)를 장착하고 있는 전자기기에 적용한다면, 슬림화가 요구되고 있는 휴대용 단말기의 전체 두께를 감소시키는 효과를 얻을 수 있다.

[0219] 또한, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100)의 패턴 홈(140)에 내측 안테나(200)가 배치되어 있어, 기존의 FPCB 상에 코일 패턴을 형성한 경우와 달리, 안테나 어셈블리(1000)가 장착된 전자기기의 전체 사이즈가 감소될 수 있다.

[0220] 도 28 내지 도 32은 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 제조 방법을 설명하기 위한 도면이다.

[0221] 이하에서는 도 25 내지 도 27의 내용과 결부시켜, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 제조 방법을 설명한다.

[0222] 먼저, 도 28을 참조하면, 자성 기판(100)이 배치된다. 일 실시 예에서 자성 기판(100)은 폴리에틸렌계 고무 위에 센더스트(sendust) 합금계(Al, Fe, SiO2) 금속 분말을 도포하고, 표면에 산화 피막을 형성하여 제조될 수 있다.

[0223] 다음으로, 도 29을 참조하면, 자성 기판(100)에 내측 안테나(200)를 수용할 수 있는 패턴 홈을 형성하기 위해 금형(1)을 이용하여, 열과 압력을 동시에 가한다. 금형(1)은 내측 안테나(200)의 형상과 같도록 제작될 수 있다. 일 실시 예에서 금형(1)의 재료로는 알루미늄 합금, 구리합금, 주철 등이 사용될 수 있다.

[0224] 금형(1)에는 무선으로 전력을 수신하기 위한 내측 안테나(200)가 배치될 위치에 대응한 돌출부가 형성될 수 있다.

[0225] 금형(1)을 이용하여, 열을 가할 시, 자성 기판(100)의 구성요소인 센더스트 합금계 금속 분말의 특성을 고려하여 특정 온도를 갖는 열을 가한다. 일 실시 예에서 자성 기판(100)이 상기 폴리에틸렌계 고무 위에 센더스트(sendust) 합금계 금속 분말을 도포하여 제조된 경우, 금형(1)을 이용하여 열과 압력을 가할 시, 100도 이상 180도 이하의 온도에서 고압으로 압력을 가한 후, 100도 이하의 온도로 냉각시킨 다음, 자성 기판(100)으로부터 금형(1)을 분리한다. 금형(1)을 이용하여, 자성 기판(100)에 압력을 가한 후, 금형(1)을 바로 분리하게 되면, 패턴 홈(140)에 남아있는 열로 인해, 원하고자 하는 패턴 홈(140)이 형성되지 않을 수 있기 때문에, 100도 이하로 냉각 시킨 후, 자성 기판(100)으로부터 금형(1)을 분리시킬 필요가 있다.

[0226] 만약, 자성 기판(100)으로 센더스트 합금계 금속 분말을 사용하는 경우, 분말의 배열, 밀도 등에 따라 가하는 온도와 압력이 달라질 수 있다. 즉, 분말의 배열이 균일하지 못한 경우에는 더 높은 온도와 압력을 가해야 하며, 분말의 배열이 균일한 경우에는 분말의 배열이 균일하지 못한 경우에 비해 더 낮은 온도 및 압력을 가해도 된다. 또한, 분말의 밀도가 낮은 경우에는 높은 경우에 비해 더 낮은 온도 및 압력을 가해도 된다. 또한, 분말의 성분 즉, 분말을 구성하는 합금에 따라 가해지는 온도 및 압력이 달라질 수도 있다.

[0227] 이와 같이, 분말의 배열, 밀도, 성분에 따라 가해지는 온도는 달라질 수 있다.

[0228] 일 실시 예에서 금형(1)을 이용하여, 열과 압력을 가하는 대신, 자성 기판(100)에 내측 안테나(200)를 수용할 수 있는 패턴 홈을 형성하기 위해 레이저를 조사할 수 있다. 패턴 홈은 자외선 영역의 파장을 갖는 레이저 빔을 발사하는 엑시머 레이저(excimer laser)를 사용하여 형성될 수 있다. 상기 엑시머 레이저는 KrF 엑시머 레이저(크립톤 불소, 중심파장 248nm) 또는 ArF 엑시머 레이저(아르곤 불소, 중심파장 193nm) 등이 사용될 수 있다.

[0229] 다음으로, 도 30를 참조하면, 도 30는 금형(1)을 자성 기판(100)으로부터 분리 시 패턴 홈(140)이 형성된 자성 기판(100)의 상태를 보여준다.

[0230] 다음으로, 도 31을 참조하면, 도 30의 상태에서 자성 기판(100)에 형성된 패턴 홈(140)에 내측 안테나(200)를 삽입한다. 내측 안테나(200)가 삽입되면, 자성 기판(100)의 패턴 홈(140)는 일정한 도전 패턴이 형성된다.

[0231] 일 실시 예에서 자성 기판(100)의 패턴 홈(140)에 내측 안테나(200)가 삽입되는 과정은 도금 또는 내측 안테나(200)가 형성하는 도전 패턴을 갖도록 에칭과정을 거친 금속을 삽입하는 방법이 사용될 수 있다.

[0232] 구체적으로, 도금은 패턴 홈(140)을 금속 물질로 충진하는 공정을 통해 내측 안테나(200)가 형성될 수 있다. 이때, 상기 금속 물질은 Cu, Ag, Sn, Au, Ni 및 Pd 중 선택되는 어느 하나의 물질일 수 있으며, 상기 금속 물질 충진은 무전해 도금, 전해 도금, 스크린 인쇄(Screen Printing), 스퍼터링(Sputtering), 증발법(Ecaporation), 잉크젯팅 및 디스펜싱 중 어느 하나 또는 이들의 조합된 방식을 이용할 수 있다.

[0233] 다음으로, 도 32을 참조하면, 내측 안테나(200)와 접촉부(300)가 접속되도록 솔더링 작업을 거친다.

[0234] 즉, 내측 안테나(200)의 외측 단자(210)와 접촉부(300)의 제1 연결 단자(311)를 솔더(10)에 의해 접속시키고, 내측 안테나(200)의 제2 연결단자(200)와 접촉부(300)의 제2 연결 단자(312)를 솔더(20)에 의해 접속시킨다.

[0235] 이와 같이, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)의 제조 방법은 자성 기판(100)에 패턴 홈을 형성하고, 형성된 패턴 홈에 내측 안테나(200)를 배치시킴으로써, 안테나 어셈블리(1000)의 전체 두께를 감소시킬 수 있고, 패턴 홈을 형성하는 과정 및 코일부를 삽입하는 과정 만을 통해 안테나 어셈블리(1000)를 제조할 수 있어, 제조 공정이 단순화되는 효과가 있다.

[0236] 도 33는 본 발명의 또 다른 실시예에 따라 자성 기판 상면에 코일부를 배치한 경우, 사용 주파수에 따른 코일부의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이고, 도 34은 본 발명의 또 다른 실시예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 사용 주파수에 따른 내측 안테나(200)의 인덕턴스, 저항, Q값의 변화를 설명하기 위한 도면이다.

[0237] 내측 안테나(200)의 인덕턴스, 저항 및 Q 값의 관계식은 다음의 [수학식 1]을 통해 표현될 수 있다.

[0238] [수학식 1]

[0239] Q=w*L/R

[0240] [수학식 1]에서 w는 전력 전송 시 사용되는 주파수이고, L은 내측 안테나(200)의 인덕턴스, R은 내측 안테나(200)의 저항을 나타낸다.

[0241] [수학식 1]에서 확인할 수 있듯이, 내측 안테나(200)의 인덕턴스는 그 값이 증가할수록 Q값이 높아진다. Q값이 증가하면, 전력 전송 효율이 좋아질 수 있다. 내측 안테나(200)의 저항은 내측 안테나(200) 자체에서 발생하는 전력 손실량을 수치화한 것이며, 그 값이 작을수록 Q 값이 증가한다.

[0242] 도 33 및 도 34을 참조하면, 사용 주파수가 150kHz 일때를 비교하면, 본 발명의 또 다른 실시예에 따라 자성 기판(100) 상면에 내측 안테나(200)를 배치한 경우에 비해, 도 34은 본 발명의 또 다른 실시예에 따라 자성 기판(100) 내부의 패턴 홈(140)에 내측 안테나(200)를 배치한 경우, 내측 안테나(200)의 인덕턴스는 약 9986.92um에서 약 10339.34um로 352.42um만큼 증가하였고, 내측 안테나(200)의 저항은 약 0.910옴에서 약 0.853옴으로 0.057옴만큼 감소한 것을 확인할 수 있다. 결국, 인덕턴스의 증가 및 저항의 감소양만큼 Q값이 증가한다.

[0243] 따라서, 본 발명의 또 다른 실시예에 따른 안테나 어셈블리(1000)는 자성 기판(100) 내부의 패턴 홈에 내측 안테나(200)를 배치하여, Q값을 높일 수 있다.

[0244] 도 35는 본 발명의 또 다른 실시예에 따라 자성 기판 상면에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이고, 도 36는 본 발명의 또 다른 실시예에 따라 자성 기판 내부의 패턴 홈에 코일부를 배치한 경우, 자기장의 방사 패턴을 보여주기 위한 H-Field이다.

[0245] 도 35 및 도 36를 참조하면, 자성 기판(100) 내부의 패턴 홈에 내측 안테나(200)를 배치한 경우가 자성 기판(100) 상면에 코일부를 배치한 경우에 비해, 내측 안테나(200)의 외측에서 자기장이 더 많이 방사됨을 확인할 수 있다. 이는, 자성 기판(100) 내부에 내측 안테나(200)가 함몰된 구조에 의해 외부로 향하는 자기장의 방향을 내측 안테나(200)의 측방으로 변경시키기 때문이다.

[0246] 또한, 자성 기판(100) 내부의 패턴 홈에 내측 안테나(200)를 배치한 경우가 자성 기판(100) 상면에 내측 안테나(200)를 배치한 경우에 비해, 내측 안테나(200)의 내측에서 자기장이 더 많이 방사됨을 확인할 수 있다. 이 또한, 자성 기판(100) 내부에 내측 안테나(200)가 함몰된 구조에 의해 외부로 향하는 자기장의 방향을 내측 안테나(200)의 측방으로 변경시키기 때문이다.

[0247] 도 35 및 도 36를 참조하면, 안테나 어셈블리(1000)는 외측 안태나(600)를 더 포함할 수 있다.

[0248] 외측 안테나(600)는 근거리 무선통신이 가능한 리더기와 통신을 수행할 수 있다. 외측 안테나(600)는 상기 리더기와 정보를 송수신하는 안테나의 역할을 수행한다.

[0249] 일 실시 예에서 외측 안테나(600)는 내측 안테나(200)의 외곽에 배치될 수 있다. 일 실시 예에서 내측 안테나(200)가 자성 기판(100)의 중앙에 배치된 경우, 외측 안태나(600)는 내측 안테나(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 외측 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

[0250] 외측 안테나(600)는 내측 안테나(200)처럼 도전 패턴, 도전층을 형성할 수 있다.

[0251] 외측 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다.

[0252] 다음으로, 도 37 내지 도 48을 참조하여 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리에 대해 설명한다.

[0253] 도 37은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리(1000)의 분해 사시도이고, 도 38은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리(1000)의 사시도이고, 도 39은 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리(1000)의 단면도이다.

[0254] 한편, 도 38은 도 37에 도시된 안테나 어셈블리(1000)의 구성요소를 결합해 놓은 사시도이고, 일부 구성요소가 생략되어 결합한 형태를 갖는다.

[0255] 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리(1000)는 휴대용 단말기와 같은 전자기기에 장착될 수 있

다.

[0256] 도 37내지 도 39을 참조하면, 안테나 어셈블리(1000)는 자성기판(100), 내측 안테나(200), 접촉부(300), 외측 안테나(600), 접착층(700), 제1 양면 접착층(710), 제2 양면 접착층(720), 보호 필름(800) 및 박리지층(730)을 포함할 수 있다.

[0257] 먼저, 도 37을 참조하면, 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 변경시킬 수 있다.

[0258] 자성 기판(100)은 송신 측으로부터 내측 안테나(200)가 전달받는 자기장의 방향을 변경시켜 외부에 누출될 수 있는 자기장의 양을 감소시킬 수 있다. 이로 인해, 차폐 효과를 가질 수 있다.

[0259] 자성 기판(100)은 송신 측으로부터 전달받는 자기장의 방향을 측방으로 변경시켜 내측 안테나(200)에 자기장이 더 집중적으로 전달될 수 있도록 한다.

[0260] 자성 기판(100)은 송신 측으로부터 내측 안테나(200)가 전달받는 자기장 중 외부로 누출되는 자기장을 흡수하여 열로 방출시킬 수도 있다. 외부에 누출되는 자기장의 양이 감소되면, 인체에 유해한 영향을 미칠 수 있는 상황이 방지될 수 있다.

[0261] 도 39을 참고하면, 자성 기판(100)은 자성체(110) 및 지지체(120)를 포함할 수 있다.

[0262] 자성체(110)는 입자 또는 세라믹의 형태를 포함할 수 있다. 일 실시 예에서 자성체(110)는 스피넬 타입, 헥사 타입, 센다스트 타입, 퍼멀로이 타입의 자성체 중 어느 하나일 수 있다.

[0263] 지지체(120)는 열경화성 수지 또는 열가소성 수지를 포함할 수 있으며, 자성 기판(100)을 지지하는 역할을 수행한다.

[0264] 다시 도 37을 설명하면, 자성 기판(100)은 시트(Sheet) 형태로 구성될 수 있으며, 플렉서블(flexible)한 성질을 가질 수 있다.

[0265] 자성 기판(100)은 일정영역에 수용공간(130)을 가질 수 있다. 수용공간(130)은 접촉부(300)의 형태와 동일한 형태를 가질 수 있고, 접촉부(300)는 상기 수용공간(130)에 배치되어 내측 안테나(200)와 접속될 수 있다.

[0266] 내측 안테나(200)는 송신 측으로부터 전자기 유도 또는 공진을 이용해 무선으로 전력을 수신할 수 있다. 내측 안테나(200)는 도 12에서 설명한 바와 마찬가지로, 외측 단자(210), 내측 단자(220) 및 내측 코일(230)을 포함할 수 있다. 내측 코일(230)은 도전층 또는 도전패턴으로 형성될 수 있다.

[0267] 접촉부(300)는 내측 안테나(200)와 수신회로(미도시) 사이를 연결하여 내측 안테나(200)로부터 전달받은 전력을 수신회로를 통해 부하(미도시)로 전달할 수 있다.

[0268] 접촉부(300)는 배선층을 포함할 수 있고, 배선층은 상기 수신회로를 포함할 수 있다. 상기 수신회로는 내측 안테나(200)로부터 전달받은 전력을 정류하는 정류회로, 노이즈 신호를 제거하는 평활회로 및 무선으로 전력을 수신하기 위한 전반적인 동작을 수행하는 메인 IC칩을 포함할 수 있다.

[0269] 또한, 상기 수신회로는 외측 안테나(600)로부터 수신한 신호를 근거리 통신 신호 처리부(미도시)에 전달할 수 있다.

[0270] 접촉부(300)는 자성 기판(100)의 수용공간(130)에 배치되어 내측 안테나(200)와 접속 가능하다. 도 38을 함께 참조하면, 자성 기판(100)의 수용공간(130)에 접촉부(300)가 배치된 것을 확인할 수 있다.

[0271] 접촉부(300)는 제1 연결 단자(311), 제2 연결 단자(312), 제3 연결 단자(313) 및 제4 연결 단자(314)를 포함할 수 있고, 접촉부(300)의 제1 연결 단자(311)는 내측 안테나(200)의 제1 연결 단자(311)와 접속될 수 있고, 접촉부(300)의 제2 연결 단자(312)는 내측 안테나(200)의 내측 단자(220)와 접속될 수 있고, 접촉부(300)의 제3 연결 단자(313)는 외측 안테나(600)의 내측 단자(610)와 접속될 수 있고, 접촉부(300)의 제4 연결 단자(314)는 외측 안테나(600)의 외측 단자(620)와 접속될 수 있다.

[0272] 접촉부(300)는 수용공간(130)의 형태와 동일한 형태를 가지고, 수용공간(130)에 배치될 수 있다. 접촉부(300)가 자성기판(100)의 수용공간(130)에 배치됨에 따라 접촉부(300)의 두께만큼 안테나 어셈블리(1000)의 전체 두께가 크게 감소될 수 있다. 이로 인해, 안테나 어셈블리(1000)가 장착된 휴대용 단말기와 같은 전자기기의 두께도 크게 감소될 수 있다.

[0273] 일 실시 예에서 접촉부(300)는 플렉서블한 인쇄회로기판(FPCB: Flexible Printed Circuit) 또는 테잎 부재(TS: Tape Substrate) 또는 리드 프레임(LF: Lead Frame)이 사용될 수 있다. 접촉부(300)로 테잎 부재를 사용

하는 경우, 접촉부(300)의 두께가 감소되어 안테나 어셈블리(1000)의 전체 사이즈를 줄일 수 있다.

[0274] 접촉부(300)로 리드 프레임을 사용하는 경우, 발열, 외부의 습기, 충격 등으로부터, 접촉부(300)에 포함된 배선층이 보호될 수 있고, 대량 생산이 가능한 장점이 있다.

[0275] 다시 도 37을 설명하면, 외측 안테나(600)는 근거리 무선 통신이 가능한 리더기와 통신을 수행할 수 있다. 외측 안테나(600)는 상기 리더기와 정보를 송수신하는 역할을 수행할 수 있다.

[0276] 근거리 통신 신호 처리부(미도시)는 접촉부(300)를 통해 외측 안테나(600)에서 수신한 신호를 전달받아 처리할 수 있다.

[0277] 외측 안테나(600)에서 사용되는 근거리 통신규격은 다양한 기술이 사용될 수 있으나, NFC(Near Field Communication)을 이용함이 바람직하다.

[0278] 일 실시 예에서 외측 안테나(600)는 내측 안테나(200)의 외곽에 배치될 수 있다. 도 38을 참조하면, 내측 안테나(200)가 자성 기판(100) 상에 배치된 경우, 외측 안테나(600)는 내측 안테나(200)를 감싸도록 자성 기판(100)의 외곽을 따라 배치될 수 있다. 외측 안테나(600)는 하나의 도선이 복수 번 권선된 사각형의 형태를 가질 수 있으나, 이에 한정될 필요는 없다.

[0279] 다시 도 37을 설명하면, 접착층(미도시)은 보호 필름(800)의 하측에 배치될 수 있고, 보호 필름(800)을 내측 안테나(200) 및 외측 안테나(600)에 부착시킬 수 있다. 이에 대해서는, 후술한다.

[0280] 제1 양면 접착층(710)은 내측 안테나(200), 외측 안테나(600)와 자성 기판(100) 사이에 배치되어, 내측 안테나(200)와 자성 기판(100)을 부착시킬 수 있다. 이에 대해서는 후술한다. 제1 양면 접착층(710)에는 자성 기판(100)과 마찬가지로 접촉부(300)의 형태와 동일한 형태의 수용 공간이 마련될 수 있다.

[0281] 도 39을 참조하면, 제2 양면 접착층(720)은 보호 필름(800)과 박리지층(730)을 부착시킬 수 있다. 이에 대해서는 후술한다.

[0282] 내측 안테나(200)는 자성기판(100) 상에 배치될 수 있고, 스파이럴 타입의 구조를 가질 수 있으나, 이에 한정될 필요는 없다.

[0283] 다음으로, 도 40 내지 도 48을 참조하여, 본 발명의 또 다른 실시 예에 따른 안테나 어셈블리(1000)의 제조 방법을 설명한다.

[0284] 공정이 시작되면, 도 40와 같이, 도전체(201), 접착층(700), 보호 필름(800)을 준비한다.

[0285] 일 실시 예에서 도전체(201)는 구리를 포함하는 합금으로 형성될 수 있으며, 구리는 압연박, 전해박 형태가 사용될 수 있다. 도전체(201)는 요구되는 제품의 사양에 따라 다양한 두께를 가질 수 있다. 일 실시 예에서 도전체(201)의 두께는 100um일 수 있으나, 이는 예시에 불과하다.

[0286] 접착층(700)은 도전체(201)와 보호 필름(800)의 접착력을 강화시키기 위한 것으로, 열경화성 수지가 사용될 수 있으나, 이에 한정될 필요는 없다. 바람직하게, 접착층(700)의 두께는 17um일 수 있으나, 이는 예시에 불과하다.

[0287] 보호 필름(800)은 도전체(201)가 일정한 도전 패턴을 형성하는 공정에서 도전체(201)를 보호하는 역할을 수행한다. 구체적으로, 보호 필름(800)은 후술할 에칭 공정에서 도전체(201)를 지지하여 일정한 도전 패턴을 형성하도록 도전체(201)를 보호할 수 있다.

[0288] 일 실시 예에서 보호 필름(800)은 폴리이미드 필름(PI Flim: Polyimide Film)이 사용될 수 있으나, 이에 한정될 필요는 없다.

[0289] 다음으로, 도 41과 같이, 도전체(201)와 보호 필름(800)은 접착층(700)을 통해 부착될 수 있다. 상기 부착은 라미네이팅(laminating) 공정이 이용될 수 있다. 라미네이팅(laminating) 공정은 소정의 열과 압력을 가하여 서로 다른 재료의 물질을 접착시키는 공정이다.

[0290] 다음으로, 도 42과 같이, 도전체(201)의 상면에 감광성 필름(900)을 부착한다. 감광성 필름은 도전체(201)를 에칭하여 일정한 도전 패턴을 형성하기 위한 것으로, UV 노광 타입 또는 LDI 노광 타입의 필름이 사용될 수 있다. 또 다른 실시 예에서 도전체(201)의 상면에는 감광성 필름(900) 대신 감광성 도포액이 도포될 수도 있다.

[0291] 다음으로, 도 43와 같이, 감광성 필름(900)을 노광하고, 현상하여 마스크 패턴(910)을 형성한다.

[0292] 마스크 패턴(910)은 상기 노광 및 현상 공정을 통해 일정한 도전 패턴이 형성될 위치의 상면에 형성될 수 있다.

[0293] 노광은 도전 패턴이 형성될 부분과 형성되지 않을 부분을 구분하여 감광성 필름(900)에 빛을 조사하는 것을 의미한다. 즉, 노광은 도전 패턴이 형성되지 않을 부분에 빛을 조사하는 공정이다. 현상은 노광에 의해 빛이 조사된 부분을 제거하는 공정을 의미한다.

[0294] 상기 노광 및 현상 공정에 의해 내측 안테나(200) 및 외측 안테나(600)가 형성될 부분에 마스크 패턴(910)이 형성될 수 있다. 마스크 패턴(910)에 의해 노출되는 도전체(201) 부분이 식각될 수 있다.

[0295] 다음으로, 도 44과 같이, 에칭(Etching) 공정을 통해 마스크 패턴(910)이 형성되지 않은 홈 부분이 식각될 수 있다. 에칭은 마스크 패턴(910)이 형성되지 않는 부분에 위치한 도전체(201)와 화학 반응하는 물질을 이용하여 마스크 패턴(910)이 형성되지 않는 부분에 위치한 도전체(201)를 부식시켜 없애는 공정을 의미한다. 일 실시 예에서 도전체(201)는 습식 또는 건식 식각에 의해 패터닝 될 수 있다.

[0296] 다음으로 도 45와 같이, 마스크 패턴(910)을 제거하면, 내측 안테나(200)의 외측 단자(210) 및 내측 단자(220), 외측 안테나(600)의 내측 단자(610) 및 외측 단자(620), 일정한 도전 패턴을 갖는 내측 코일(230) 및 일정한 도전 패턴을 갖는 외측 안테나(600)가 형성될 수 있다.

[0297] 다음으로, 도 46과 같이, 내측 안테나(200) 및 외측 안테나(600)가 접촉부(300)에 접속되도록 솔더링(soldering) 공정을 거친다. 일 실시 예에서 솔더링 공정은 reflow 공정이 사용될 수 있으나, 이에 한정될 필요는 없다. reflow 공정은 고온의 열원을 가하여 솔더 크림을 용융하여 내측 코일(230) 및 외측 안테나(600)와 접촉부(300)간의 전기적 접속을 안정되게 접합하는 공정이다.

[0298] 내측 안테나(200)의 외측 단자(210)는 접촉부(300)의 제1 연결 단자(311)와 솔더(30)에 의해 접속될 수 있고, 내측 안테나(200)의 내측 단자(220)는 접촉부(300)의 제2 연결 단자(312)와 솔더(30)에 의해 접속될 수 있고, 외측 안테나(600)의 내측 단자(610)는 접촉부(300)의 제3 연결 단자(313)와 솔더(30)에 의해 접속될 수 있고, 외측 안테나(600)의 외측 단자(620)는 접촉부(300)의 제4 연결 단자(314)와 솔더(30)에 의해 접속될 수 있다.

[0299] 다음으로, 도 47과 같이, 자성기판(100)은 접촉부(300)가 차지하는 면적 이외의 부분에 위치한 도전 패턴 즉, 내측 코일(230) 및 외측 안테나(600)의 상면에 적층될 수 있다.

[0300] 이 전에, 접촉부(300)에 대응하는 수용공간을 갖는 자성기판(100)을 획득할 수 있다. 자성기판(100)의 수용공간은 접촉부(300)의 형태에 일치하도록 형성될 수 있다.

[0301] 접촉부(300)는 도 37에서 설명한 것과 같이, 접촉부(300)가 자성기판(100)의 수용공간(130)에 배치됨에 따라 접촉부(300)의 두께만큼 안테나 어셈블리(1000)의 전체두께가 크게 감소될 수 있다. 이로 인해, 안테나 어셈블리(1000)가 장착된 휴대용 단말기와 같은 전자기기의 두께도 크게 감소될 수 있다.

[0302] 이 때, 내측 코일(230) 및 외측 안테나(600)와 자성기판(100)은 제1 양면 접착층(710)에 의해 부착될 수 있다. 일 실시 예에서 자성기판(100)의 두께는 100um 내지 800um의 범위를 가질 수 있으나, 이에 한정될 필요는 없다. 일 실시 예에서 제1 양면 접착층(710)의 두께는 10um 내지 50um의 범위를 가질 수 있으나, 이에 한정될 필요는 없다.

[0303] 다음으로, 도 48과 같이, 박리지층(730)은 제2 양면 접착층(720)을 통해 보호 필름(800)의 일 측에 부착될 수 있다. 박리지층(730)은 제2 양면 접착층(720)을 보호하기 위해 부착된 종이층으로, 휴대용 단말기와 같은 전자기기의 케이스에 부착시 제거될 수 있다.

[0304] 도 49는 본 발명의 실시에에 따른 안테나 어셈블리의 제조 방법의 흐름도이다.

[0305] 특히, 도 49는 도 1 내지 도 11에 따른 안테나 어셈블리의 제조 방법에 관한 것이다.

[0306] 도 49를 참고하면, 기판(400)이 형성된다(S101).

[0307] 다음으로 기판(400)의 상면에 직접 도전판(81)이 적층된다(S103). 이때, 도전판(81)은 동판일 수 있다.

[0308] 일 실시 예에서는 자성 기판(100)의 상면에 접착층이 적층된 후, 도전판(81)이 접착층 위에 적층될 수도 있다.

[0309] 또 다른 실시 예에서 도전판(81)를 소정의 온도에서 가열하고, 그 후 소정의 압력을 가하는 라미네이팅

(laminating) 공정이 사용될 수 있다. 라미네이팅(laminating) 공정이란, 열과 압력을 이용하여 서로 다른 종류의 금속박, 종이 등을 접착시키는 공정을 의미한다.

[0310] 다음으로, 도전판(81)의 상면에 마스크(83)가 부착된다(S105). 마스크(83)의 모양은 내측 안테나(200)의 모양과 외측 안테나(600)의 모양을 포함하는 모양일 수 있다.

[0311] 다음으로, 마스크(83)가 부착된 도전판(81)이 적층된 기판(400)을 에칭 용액에 넣으면(S107), 마스크(83)가 부착되지 않은 부분이 식각되어, 도전판(81)는 마스크(83) 모양의 패턴을 형성한다. 다음은 식각에 의해 형성되는 도전 패턴의 단면을 도 50과 도 51을 참고하여 설명한다.

[0312] 도 50과 도 51은 본 발명의 실시예에 따른 식각에 의해 형성되는 도전 패턴의 단면을 보여준다.

[0313] 특히, 도 50의 (A)는 본 발명의 실시예에 따른 부족 식각(under-etching)에 의해 형성되는 도전 패턴의 단면을 보여주고, 도 50의 (A)는 본 발명의 실시예에 따른 과 식각(over-etching)에 의해 형성되는 도전 패턴의 단면을 보여주며, 도 50의 (A)는 본 발명의 실시예에 따른 정 식각(fine etching)에 의해 형성되는 도전 패턴의 단면을 보여준다.

[0314] 도 50과 도 51을 참고하면, 코일 패턴에 해당하는 내측 코일(230)의 단면은 복수의 내부 각(inner angle)을 가지는 다각형으로 단순화될 수 있다. 이때, 단순화는 단면의 변들(sides) 내의 비교적 작은 요철이나 둥근 모서리의 평균화를 의미한다. 코일 패턴에 해당하는 내측 코일(230)의 단면은 사각형, 구체적으로 사다리꼴일 수 있다.

[0315] 코일 패턴에 해당하는 외측 코일(630)의 단면은 복수의 내부 각(inner angle)을 가지는 다각형으로 단순화될 수 있다. 코일 패턴에 해당하는 외측 코일(630)의 단면은 사각형, 구체적으로 사다리꼴일 수 있다.

[0316] 이하에서는 특히 내측 코일(230)의 단면은 사각형이고, 외측 코일(630)의 단면은 사각형인 경우를 설명한다.

[0317] 내측 코일(230)의 단면은 좌상측 내부 각(A1), 우상측 내부 각(A2), 좌하측 내부 각(A3), 우하측 내부 각(A4)을 가진다.

[0318] 외측 코일(630)의 단면은 좌상측 내부 각(A5), 우상측 내부 각(A6), 좌하측 내부 각(A7), 우하측 내부 각(A8)을 가진다.

[0319] 실시예에서, 내측 코일(230)과 외측 코일(630)이 동일한 도전판(81)으로부터 형성되므로, 내측 코일(230)은 두께와 외측 코일(630)은 두께는 동일할 수 있다. 또, 내측 코일(230)이 위치하는 레이어와 외측 코일(630)이 위치하는 레이어는 동일할 수 있다. 기판(400)의 상면과 내측 코일(230)의 상면은 평행하고, 기판의 상면(400)과 외측 코일(630)의 상면은 평행할 수 있다. 기판(400)의 상면으로부터 내측 코일(230)의 상면까지의 높이(Hp1)는 기판(400)의 상면으로부터 외측 코일(630)의 상면까지의 높이(Hp2)와 동일할 수 있다.

[0320] 실시예에서, 코일 패턴의 저항 성분을 줄여 Q 값을 높이기 위하여, 코일 패턴에 해당하는 내측 코일(230)과 외측 코일(630)의 두께는 일반적인 도선 패턴보다 큰 80um 이상일 수 있다. 코일 패턴의 저항 성분을 줄여 Q 값을 더욱 높이기 위하여, 코일 패턴에 해당하는 내측 코일(230)과 외측 코일(630)의 두께는 100um 이상일 수 있다.

[0321] 실시예에서, 내측 코일(230)과 외측 코일(630)이 동일한 도전판(81)으로부터 동일한 에칭 공정을 통해 형성되므로,

[0322] 내측 코일(230)의 단면의 좌상측 내부 각(A1)은 외측 코일(630)의 단면의 좌상측 내부 각(A5)과 동일할 수 있다. 내측 코일(230)의 단면의 우상측 내부 각(A2)은 외측 코일(630)의 단면의 우상측 내부 각(A6)과 동일할 수 있다. 내측 코일(230)의 단면의 좌하측 내부 각(A3)은 외측 코일(630)의 단면의 좌하측 내부 각(A7)과 동일할 수 있다. 내측 코일(230)의 단면의 우하측 내부 각(A4)은 외측 코일(630)의 단면의 우하측 내부 각(A8)과 동일할 수 있다.

[0323] 내측 코일(230)의 단면의 좌상측 내부 각(A1)은 내측 코일(230)의 단면의 우상측 내부 각(A2)과 동일할 수 있다. 내측 코일(230)의 단면의 좌하측 내부 각(A3)은 내측 코일(230)의 단면의 우하측 내부 각(A4)과 동일할 수 있다. 외측 코일(630)의 단면의 좌상측 내부 각(A5)은 외측 코일(630)의 단면의 우상측 내부 각(A6)과 동일할 수 있다. 외측 코일(630)의 단면의 좌하측 내부 각(A7)은 외측 코일(630)의 단면의 우하측 내부 각(A8)과 동일할 수 있다.

[0324] 정 에칭(fine etching)이 된다면, 내측 코일(230)의 단면의 좌상측 내부 각(A1), 우상측 내부 각(A2), 좌하측

내부 각(A3), 우하측 내부 각(A4)은 실질적으로 90도에 해당할 수 있다. 또, 정 에칭(fine etching)이 된다면, 외측 코일(630)의 단면의 좌상측 내부 각(A5), 우상측 내부 각(A6), 좌하측 내부 각(A7), 우하측 내부 각(A8)은 실질적으로 90도에 해당할 수 있다.

[0325] 부족 에칭(under-etching)이 된다면, 내측 코일(230)의 단면의 좌상측 내부 각(A1)은 내측 코일(230)의 단면의 우상측 내부 각(A2)보다 크다. 내측 코일(230)의 단면의 좌하측 내부 각(A3)은 내측 코일(230)의 단면의 우하측 내부 각(A4)보다 크다. 외측 코일(630)의 단면의 좌상측 내부 각(A5)은 외측 코일(630)의 단면의 우상측 내부 각(A6) 보다 크다. 외측 코일(630)의 단면의 좌하측 내부 각(A7)은 외측 코일(630)의 단면의 우하측 내부 각(A8) 보다 크다.

[0326] 과 에칭(over-etching)이 된다면, 내측 코일(230)의 단면의 좌상측 내부 각(A1)은 내측 코일(230)의 단면의 우상측 내부 각(A2)보다 작다. 내측 코일(230)의 단면의 좌하측 내부 각(A3)은 내측 코일(230)의 단면의 우하측 내부 각(A4)보다 작다. 외측 코일(630)의 단면의 좌상측 내부 각(A5)은 외측 코일(630)의 단면의 우상측 내부 각(A6)보다 작다. 외측 코일(630)의 단면의 좌하측 내부 각(A7)은 외측 코일(630)의 단면의 우하측 내부 각(A8)보다 작다.

[0327] 정 에칭(fine etching)된 안테나의 Q 값은 부족 에칭(under-etching)된 안테나나 과 에칭(over-etching)된 안테나의 Q 값보다 크므로, 정 에칭(fine etching)된 안테나의 성능이 부족 에칭(under-etching)된 안테나나 과 에칭(over-etching)된 안테나의 성능보다 낫다. 따라서, 부족 에칭이나 과 에칭된 안테나 패턴의 단면의 4개의 내부 각의 각도들 중에서 최대값을 95도 이하가 되도록 하고, 4개의 내부 각의 각도들 중에서 최소값을 85도 이상이 되도록 하면, 안테나 패턴의 성능 향상을 기대할 수 있다.

[0328] 다시 도 49를 설명한다.

[0329] 그 후, 마스크(83)를 제거하면(S109), 안테나 어셈블리(1000)의 내측 안테나(200)와 외측 안테나(600)가 형성된다.

[0330] 한편, 접촉부(300)가 형성된다(S111).

[0331] 일 실시예에서, 기판(400)과 접촉부(300)의 기판(330)이 일체로 형성되는 경우에, 상술한 단계(S103, S105, S107, S111)에 의해 안테나 어셈블리(1000)의 내측 안테나(200)와 외측 안테나(600), 그리고 접촉부(300)의 패턴들이 동시에 형성될 수 있다.

[0332] 또 다른 실시예에서, 기판(400)과 접촉부(300)의 기판(330)이 분리되어 형성되는 경우에, 접촉부(300)의 패턴들은 안테나 어셈블리(1000)의 내측 안테나(200)와 외측 안테나(600)의 형성 공정과는 별도의 공정에 의해 형성될 수 있다.

[0333] 이후, 연결부(500)가 형성된다(S113). 다양한 실시예에 따른 연결부(500)의 형성 방법에 관하여는 후술한다.

[0334] 접촉부(300)와 연결부(500)가 형성된 기판(400)의 상부에 접착층(700)이 형성된다(S115).

[0335] 접착층(700)의 상부에 자성 기판(100)이 형성된다(S117).

[0336] 다음은 접착층(700)에 의해 이격되는 자성 기판(100)과 안테나 패턴들 사이의 거리에 대해 도 50과 도 51을 참고하여 설명한다.

[0337] 도 50과 도 51을 참고하면, 내부 안테나(200)의 내부 코일(230)은 선폭(W1), 선간 간격(S1)을 가지며, 내부 코일(230)은 접착층(700)에 의해 자성 기판(100)과 이격 거리(Ha1)만큼 이격된다. 외부 안테나(600)의 외부 코일(630)은 선폭(W2), 선간 간격(S2)을 가지며, 외부 코일(630)은 접착층(700)에 의해 자성 기판(100)과 이격 거리(Ha2)만큼 이격된다. 내부 코일(230)을 자성 기판(100)과 이격하기 위하여 사용되는 접착층과 외부 코일(630)을 자성 기판(100)과 이격하기 위하여 사용되는 접착층이 동일하므로, 이격 거리(Ha1)는 이격 거리(Ha2)와 동일할 수 있다.

[0338] 표 1은 외부 안테나(600)가 NFC 안테나이고, 외부 안테나(600)의 선폭(W2)가 400um이고, 외부 안테나(600)의 선간 간격(S2)가 200um인 경우에, 접착층(700)에 의해 이격되는 자성 기판(100)과 외부 안테나(600) 사이의 거리(Ha2)에 따른 외부 안테나(600)의 NFC 통신 성능을 EMVCo Load modulation 테스트의 결과로서 보여준다.

표 1

[0339]

W: 400 / S: 200 (um)							
Gap (Thick. of Ad)		30 um		40 um		50 um	
Resonant freq.		15.79 MHz		15.935 MHz		16.225 MHz	
EMVCo Load modulation	(0,0,0) 8.8 < X < 80	29.15 mV	PASS	32.7 mV	PASS	34.58 mV	PASS
	(1,0,0) 7.2 < X < 80	12.7 mV	PASS	15.6 mV	PASS	19.2 mV	PASS
	(2,0,0) 5.6 < X < 80	6.4 mV	PASS	8.6 mV	PASS	11.0 mV	PASS
	(3,0,0) 4.0 < X < 80	3.8 mV	FAIL	4.6 mV	PASS	5.4 mV	PASS

[0340] 표 1에서, (x,y,z)는 테스트 장비와 안테나 어셈블리(1000) 사이의 상대적 위치 관계를 나타낸다. 특히, (x,y,z)에서 x 값은 테스트 장비와 안테나 어셈블리(1000) 사이의 거리를 나타낸다.

[0341] 또, 표 1에서, A < X < B는 테스트의 통과를 위한 성능 값의 범위를 나타낸다. 예컨데, 상대적 위치 관계 (0,0,0)에서, 테스트 통과를 위하여는 안테나의 성능 값이 8.8mV보다는 커야하고, 80mV보다는 작아야 한다. 이격 거리(Ha2)가 30um일 때, 공진 주파수는 15.79 MHz가 되며, 외부 안테나(600)의 안테나 성능은 29.15mv이므로, 400um의 선폭, 200um의 선간 간격, 30um의 이격 거리를 가지는 외부 안테나(600)는 적합한 것으로 결론내릴 수 있다.

[0342] 그러나, 상대적 위치 관계 (3,0,0)에서, 테스트 통과를 위하여는 안테나의 성능 값이 4.0mV보다는 커야하고, 80mV보다는 작아야 한다. 이격 거리(Ha2)가 30um일 때, 공진 주파수는 15.79 MHz가 되며, 외부 안테나(600)의 안테나 성능은 3.8mv이므로, 400um의 선폭, 200um의 선간 간격, 30um의 이격 거리를 가지는 외부 안테나(600)는 적합하지 않은 것으로 결론내릴 수 있다.

[0343] 표 2는 외부 안테나(600)가 NFC 안테나이고, 외부 안테나(600)의 선폭(W2)가 500um이고, 외부 안테나(600)의 선간 간격(S2)가 500um인 경우에, 접착층(700)에 의해 이격되는 자성 기판(100)과 외부 안테나(600) 사이의 거리(Ha2)에 따른 외부 안테나(600)의 NFC 통신 성능을 EMVCo Load modulation 테스트의 결과로서 보여준다.

표 2

[0344]

W: 500 / S: 500 (um)							
Gap (Thick. of Ad)		30 um		40 um		50 um	
Resonant freq.		16.37 MHz		16.515 MHz		16.805 MHz	
EMVCo Load modulation	(0,0,0) 8.8 < X < 80	32.7 mV	PASS	31.0 mV	PASS	25.6 mV	PASS
	(1,0,0) 7.2 < X < 80	20.2 mV	PASS	19.7 mV	PASS	18.2 mV	PASS
	(2,0,0) 5.6 < X < 80	12.2 mV	PASS	11.9 mV	PASS	10.4 mV	PASS
	(3,0,0) 4.0 < X < 80	6.1 mV	PASS	6.0 mV	PASS	5.9 mV	PASS

[0345] 표 1과 표 2에서 알 수 있듯이, 선폭의 증가와 선간 간격의 증가는 저항 성분의 감소로 이어지므로, Q값의 증가로 이어지고, 외부 안테나(600)의 성능은 향상될 수 있다.

[0346] 특히, 표 1과 표 2로부터, 외부 안테나(600)의 선폭이 400um보다 작고, 외부 안테나(600)의 선간 간격 200um보다 작으면, 외부 안테나(600)의 성능은 이격 거리(Ha2)에 의한 영향을 많이 받음을 알 수 있다. 외부 안테나(600)의 선폭이 400um보다 작고, 외부 안테나(600)의 선간 간격 200um보다 작은 경우에, 마진을 고려하면,

이격 거리(Ha2)는 35um 이상인 것이 좋음을 알 수 있다.

[0347] 이처럼, 일반적인 접착층의 두께인 10um 이상의 두께를 가지는 접착층(700)을 사용하므로써, 외부 안테나(600)의 성능 향상을 기대할 수 있다.

[0348] 표 3은 외부 안테나(600)가 NFC 안테나이고, 외부 안테나(600)의 선폭(W2)가 400um이고, 외부 안테나(600)의 선간 간격(S2)가 200um이고, 테스트 장비와 안테나 어셈블리(1000) 사이의 상대적 위치 관계가 (3,0,0)인 경우에, 접착층(700)에 의해 이격되는 자성 기판(100)과 외부 안테나(600) 사이의 거리(Ha2)에 따른 외부 안테나(600)의 NFC 통신 성능을 EMVCo Load modulation 테스트의 결과로서 보여준다.

표 3

[0349]

W: 400 / S: 200 (um)								
Gap (Thick. of Ad)		10 um	20 um	30 um	40 um	50 um	60 um	70 um
Resonant freq. (MHz)		15.0	15.22	15.79	15.935	16.225	16.32	16.51
Load modulation	(3,0,0)	0 mV	1.2 mV	3.8 mV	4.6 mV	5.4 mV	5.5 mV	3.9 mV
	4.0 < X < 80	FAIL	FAIL	FAIL	PASS	PASS	PASS	FAIL

[0350] 표 3으로부터,

[0351] 선폭(W2)이 400um이고, 선간 간격(S2)이 200um인 경우에, 이격 거리(Ha2)가 30um보다 작으면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과되지 못함을 알 수 있다. 따라서, 이격 거리(Ha2)는 30um보다 큰 것이 좋을 수 있다.

[0352] 선폭(W2)이 400um이고, 선간 간격(S2)이 200um인 경우에, 이격 거리(Ha2)가 70um보다 크면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과되지 못함을 알 수 있다. 따라서, 이격 거리(Ha2)는 70um보다 작은 것이 좋을 수 있다.

[0353] 선폭(W2)이 400um이고, 선간 간격(S2)이 200um인 경우에, 이격 거리(Ha2)가 40um보다 크고, 60um보다 작으면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과됨을 알 수 있다. 따라서, 이격 거리(Ha2)는 40um보다 크고, 60um보다 작은 것이 좋을 수 있다.

[0354] 표 4는 외부 안테나(600)가 NFC 안테나이고, 외부 안테나(600)의 선폭(W2)가 500um이고, 외부 안테나(600)의 선간 간격(S2)가 500um이고, 테스트 장비와 안테나 어셈블리(1000) 사이의 상대적 위치 관계가 (3,0,0)인 경우에, 접착층(700)에 의해 이격되는 자성 기판(100)과 외부 안테나(600) 사이의 거리(Ha2)에 따른 외부 안테나(600)의 NFC 통신 성능을 EMVCo Load modulation 테스트의 결과로서 보여준다.

표 4

[0355]

W: 500 / S: 500 (um)								
Gap (Thick. of Ad)		10 um	20 um	30 um	40 um	50 um	60 um	70 um
Resonant freq. (MHz)		15.95	16.117	16.37	16.515	16.805	16.91	17.15
Load modulation	(3,0,0)	0 mV	2.9 mV	6.1 mV	6.0 mV	5.9 mV	5.2 mV	3.3 mV
	4.0 < X < 80	FAIL	FAIL	PASS	PASS	PASS	PASS	FAIL

[0356] 선폭(W2)이 500um이고, 선간 간격(S2)이 500um인 경우에, 이격 거리(Ha2)가 20um보다 작으면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과되지 못함을 알 수 있다. 따라서, 이격 거리(Ha2)는 20um보다 큰 것이 좋을 수 있다.

[0357] 선폭(W2)이 500um이고, 선간 간격(S2)이 500um인 경우에, 이격 거리(Ha2)가 70um보다 크면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과되지 못함을 알 수 있다. 따라서, 이격 거리(Ha2)는 70um보다 작은 것이 좋을 수 있다.

[0358] 선폭(W2)이 500um이고, 선간 간격(S2)이 500um인 경우에, 이격 거리(Ha2)가30um보다 크고, 60um보다 작으면, 외부 안테나(600)의 EMVCo Load modulation 테스트는 통과됨을 알 수 있다. 따라서, 이격 거리(Ha2)는 30um보다 크고, 60um보다 작은 것이 좋을 수 있다.

[0359] 표 3과 표 4로부터, 이격 거리(Ha2)가 35um보다 크고 65um보다 작으면, 위의 두 번의 테스트는 모두 통과됨을 알 수 있다. 이는 이격 거리(Ha2)가 35um보다 크고 65um보다 작은 경우에 공진 주파수를 목표 주파수인 16.2 내지 16.3MHz의 범위 내로 두는 것이 용이함을 의미한다. 즉, 이는, 이격 거리(Ha2)가 소정의 값보다 작으면, 임피던스 매칭이 용이하지 않음을 의미한다.

[0360] 도 53은 본 발명의 일 실시예에 따른 안테나 어셈블리의 연결부(500)의 제조 방법의 흐름도이다.

[0361] 특히, 도 53은 도 4와 도 5에 따른 안테나 어셈블리의 연결부(500)의 제조 방법에 관한 것이다.

[0362] 먼저, 내측 안테나(200)와 외측 안테나(600)가 형성된 기판(400)의 상부에 절연층(531)이 형성된다(S301).

[0363] 절연층(531)은 내측 안테나(200)의 외측 단자(210)의 일부를 덮지 않고, 제1 서브 연결부(501)에 해당하는 전도성 브릿지(520)가 내측 코일(230)과 만나는 부분을 덮고, 제1 서브 연결부(501)에 해당하는 전도성 브릿지(520)가 외측 코일(630)과 만나는 부분을 덮을 수 있도록 하는 형상을 가질 수 있다.

[0364] 또, 절연층(531)은 내측 안테나(200)의 내측 단자(220)의 일부를 덮지 않고, 제2 서브 연결부(502)에 해당하는 전도성 브릿지(520)가 내측 코일(230)과 만나는 부분을 덮고, 제2 서브 연결부(502)에 해당하는 전도성 브릿지(520)가 외측 코일(630)과 만나는 부분을 덮을 수 있도록 하는 형상을 가질 수 있다.

[0365] 절연층(531)은 외측 안테나(600)의 내측 단자(610)의 일부를 덮지 않고, 제3 서브 연결부(503)에 해당하는 전도성 브릿지(520)가 내측 코일(230)과 만나는 부분을 덮고, 제3 서브 연결부(503)에 해당하는 전도성 브릿지(520)가 외측 코일(630)과 만나는 부분을 덮을 수 있도록 하는 형상을 가질 수 있다.

[0366] 절연층(531)은 외측 안테나(600)의 외측 단자(620)의 일부를 덮지 않고, 제4 서브 연결부(504)에 해당하는 전도성 브릿지(520)가 내측 코일(230)과 만나는 부분을 덮고, 제4 서브 연결부(504)에 해당하는 전도성 브릿지(520)가 외측 코일(630)과 만나는 부분을 덮을 수 있도록 하는 형상을 가질 수 있다.

[0367] 일 실시예에서, 절연층(531)은 절연 시트일 수 있다. 이 절연 시트는 접착층 또는 라미네이팅 공정에 의해 내측 안테나(200)와 외측 안테나(600)가 형성된 기판(400)의 상부에 부착될 수 있다.

[0368] 또 다른 실시예에서, 절연층(531)은 도포 후 건조된 절연 잉크일 수 있다. 이 경우, 내측 안테나(200)와 외측 안테나(600)가 형성된 기판(400)의 상부에 절연층(531)의 형성을 위한 마스크가 부착된다. 여기서, 절연층(531)의 형성을 위한 마스크는 내측 안테나(200)의 내측 단자(220), 내측 안테나(200)의 외측 단자(210), 외측 안테나(600)의 내측 단자(610)의 적어도 일부를 덮고, 제1 서브 연결부(501)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않고, 제2 서브 연결부(502)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않고, 제3 서브 연결부(503)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않도록 하는 모양을 가진다. 제4 서브 연결부(504) 또한 전도성 브릿지(520)에 해당한다면, 절연층(531)의 형성을 위한 마스크는 외측 안테나(600)의 외측 단자(620)의 적어도 일부를 덮고 제4 서브 연결부(504)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않도록 하는 모양을 가질 수 있다. 절연층(531)의 형성을 위한 마스크가 부착된 기판(400)의 상부에 절연 잉크를 도포하고, 건조한 후, 해당 마스크를 제거하면, 절연 잉크에 의한 절연층(531)이 형성될 수 있다.

[0369] 이후, 절연층(531)이 형성된 기판(400)의 상부에 전도성 브릿지(520)의 형성을 위한 마스크가 부착된다(S303). 전도성 브릿지(520)의 형성을 위한 마스크는 제1 서브 연결부(501)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제2 서브 연결부(502)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제3 서브 연결부(503)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제4 서브 연결부(504)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않고, 이들의 주변의 부분을 덮을 수 있다.

[0370] 전도성 브릿지(520)의 형성을 위한 마스크가 부착된 기판(400) 상부에 전도성 페이스트가 소정의 횟수만큼 인쇄되어(S305), 제1 서브 브릿지(521)가 형성된다.

[0371] 아래 표는 전도성 페이스트의 인쇄 횟수에 따른 전도성 브릿지의 성능을 보여준다.

표 5

[0372]

인쇄 횟수	L (uH)	R (옴)	Q	DCR (옴)
1	7.607	1.699	2.833	1.717
3	7.608	1.291	3.706	1.320
5	7.588	1.245	4.102	1.250
6	7.613	1.153	4.277	1.067

[0373] 도 54은 본 발명의 실시예에 따른 전도성 페이스트의 인쇄 횟수에 따른 전도성 브릿지의 성능을 보여주는 그래프이다.

[0374] 도 54에서 보여지는 바와 같이, 전도성 페이스트의 인쇄 횟수가 증가할수록, 전도성 브릿지의 저항값은 감소하고, Q 값은 증가한다.

[0375] 특히, 도 54에서 보여지는 바와 같이, 전도성 페이스트의 인쇄 횟수가 3회보다 적은 경우, 전도성 페이스트의 인쇄 횟수 증가에 따른 저항 값의 감소 또는 Q 값의 증가는 급격하다. 전도성 페이스트의 인쇄 횟수가 3회보다 큰 경우, 전도성 페이스트의 인쇄 횟수 증가에 따른 저항 값의 감소 또는 Q 값의 증가는 완만하다.

[0376] 안테나 어셈블리 내의 안테나들의 성능 향상을 위하여, 전도성 브릿지는 3회 이상의 전도성 페이스트의 인쇄에 해당하는 두께를 가질 수 있다.

[0377] 특히, 전도성 페이스트의 인쇄 횟수의 증가는 안테나 어셈블리(1000)의 제조 공정의 복잡도의 증가를 의미하므로, 전도성 브릿지는 3회의 전도성 페이스트의 인쇄에 해당하는 두께를 가질 수 있다.

[0378] 더더욱, 전도성 브릿지가 도금에 의해 형성되는 제2 서브 브릿지(522)를 포함하는 경우에는, 이 제2 서브 브릿지(522)에 의한 추가적인 저항 값 감소가 기대되므로, 전도성 브릿지는 1회 이상의 전도성 페이스트의 인쇄에 해당하는 두께를 가질 수 있다.

[0379] 제1 서브 브릿지(521)의 상부를 도금하여, 제2 서브 브릿지(522)가 형성된다(S307). 이때, 제1 서브 브릿지(521)의 상부는 구리로 도금될 수 있다.

[0380] 도 55는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 연결부(500)의 제조 방법의 흐름도이다.

[0381] 특히, 도 55는 도 6 내지 도 8에 따른 안테나 어셈블리의 연결부(500)의 제조 방법에 관한 것이다.

[0382] 먼저, 기판(400) 내에서 내측 안테나(200)의 외측 단자(210)의 하부, 내측 안테나(200)의 내측 단자(220)의 하부, 외측 안테나(600)의 내측 단자(610)의 하부, 외측 안테나(600)의 외측 단자(620)의 하부에 각각 비아홀(533)이 형성된다(S501).

[0383] 비아홀(533)이 형성된 기판(400)의 하부에 전도성 브릿지(520)의 형성을 위한 마스크가 부착된다(S503). 전도성 브릿지(520)의 형성을 위한 마스크는 제1 서브 연결부(501)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제2 서브 연결부(502)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제3 서브 연결부(503)에 해당하는 전도성 브릿지(520)가 형성되는 부분, 제4 서브 연결부(504)에 해당하는 전도성 브릿지(520)가 형성되는 부분을 덮지 않고, 이들의 주변의 부분을 덮을 수 있다.

[0384] 전도성 브릿지(520)의 형성을 위한 마스크가 부착된 기판(400) 상부에 전도성 페이스트가 소정의 횟수만큼 인쇄되어(S305), 제1 서브 브릿지(521)가 형성된다. 전도성 페이스트의 인쇄 횟수에 따른 전도성 브릿지의 성능은 앞서 설명한 바와 같다.

[0385] 제1 서브 브릿지(521)의 하부를 도금하여(S507), 제2 서브 브릿지(522)가 형성된다. 이때, 제1 서브 브릿지(521)의 하부는 구리로 도금될 수 있다.

[0386] 도 56는 본 발명의 또 다른 실시예에 따른 안테나 어셈블리의 연결부(500)의 제조 방법의 흐름도이다.

[0387] 특히, 도 56은 도 9 내지 도 11에 따른 안테나 어셈블리의 연결부(500)의 제조 방법에 관한 것이다.

[0388] 기판(400) 내에서 연결 단자들(311, 312, 313)의 하부에 비아홀이 형성된다(S701).

[0389] 확장 패턴들(541, 542, 543)의 단자의 상부에 비아홀이 형성된다(S703).

[0390] 절취선들(411, 412, 413)에 따라 기판(400)이 절취되어 서브 기판들(551, 552, 553)이 각각 형성된다(S705).

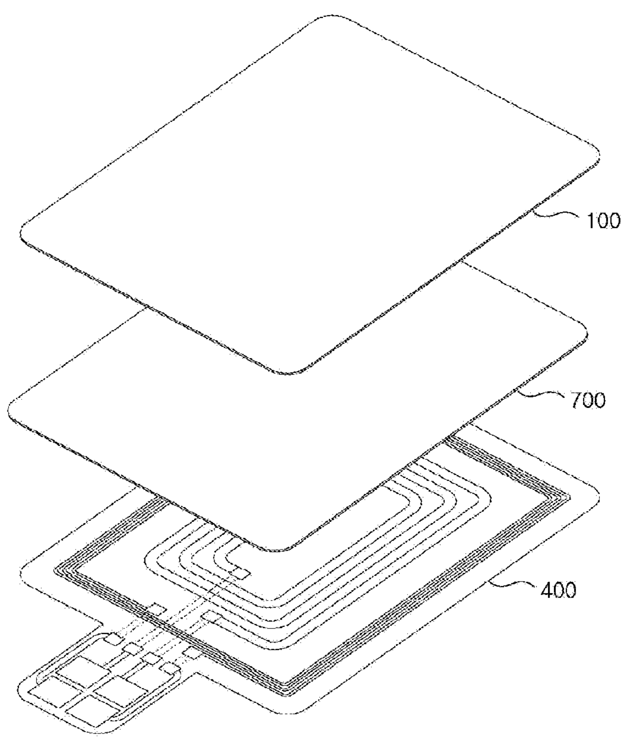
[0391] 접는 선들(421, 422, 423)에 따라 서브 기판들(551, 552, 553)이 접혀 기판(400)의 하부와 서브 기판들(551, 552, 553)의 상부가 접촉한다(S707).

[0392] 연결 단자들(311, 312, 313)의 하부의 비아홀과 확장 패턴들(541, 542, 543)의 단자들의 상부의 비아홀에 의해 연결 단자들(311, 312, 313)과 확장 패턴들(541, 542, 543)의 단자들이 각각 전기적으로 연결된다(S709). 연결 단자들(311, 312, 313)과 확장 패턴들(541, 542, 543)의 단자들은 비아홀(533)에서 제공되는 전도성 비아의 열압착, 그 전도성 비아 주변에 제공되는 전도성 물질에 의해 전기적으로 연결될 수 있다.

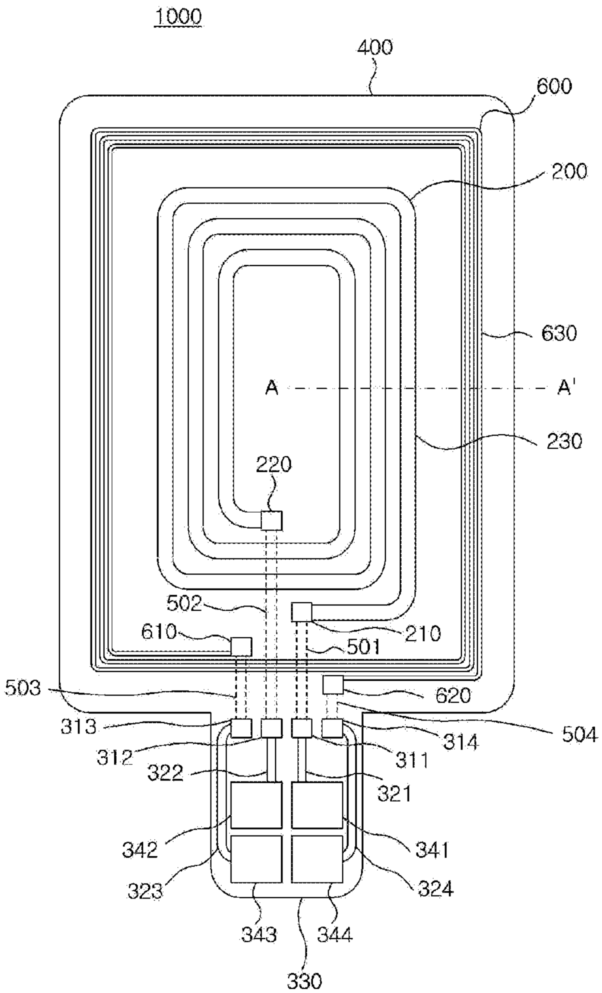
[0393] 이상에서는 본 발명의 바람직한 실시 예에 대하여 도시하고 설명하였지만, 본 발명은 상술한 특정의 실시 예에 한정되지 아니하며, 청구범위에서 청구하는 본 발명의 요지를 벗어남이 없이 당해 발명이 속하는 기술분야에서 통상의 지식을 가진 자에 의해 다양한 변형 실시가 가능한 것은 물론이고, 이러한 변형 실시들은 본 발명의 기술적 사상이나 전망으로부터 개별적으로 이해 되어서는 안될 것이다.

도면

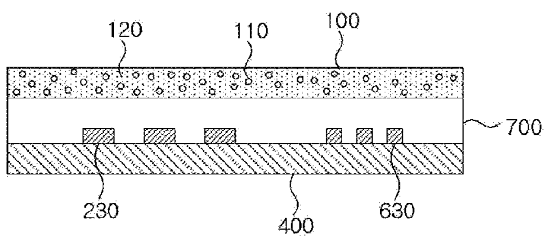
도면1



도면2


1000
400
600
200
630
A
A'
230
220
502
210
610
501
503
620
313
504
314
312
311
322
321
342
341
323
324
343
344
330

도면3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110
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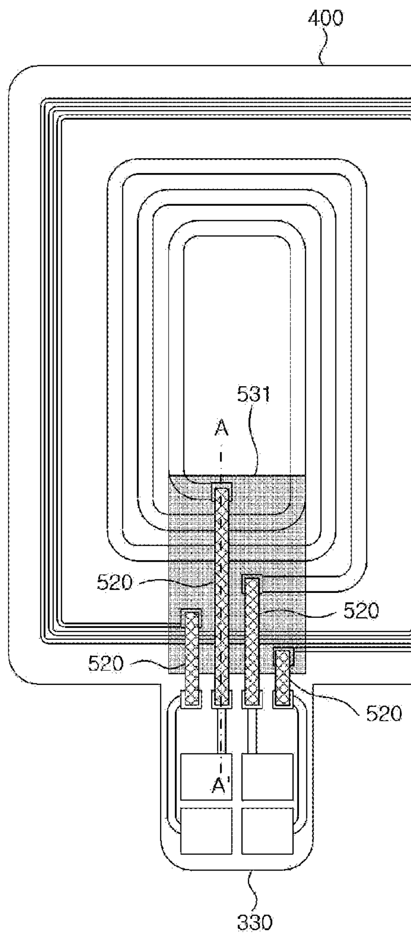
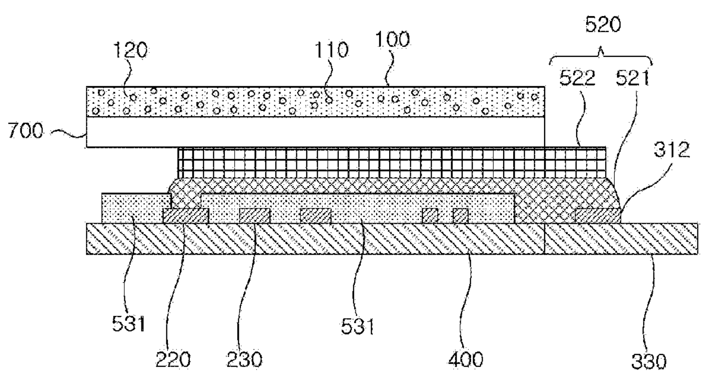
700
230
400
630

도면4


400
531
A
520
520
520
520
A'
330

도면5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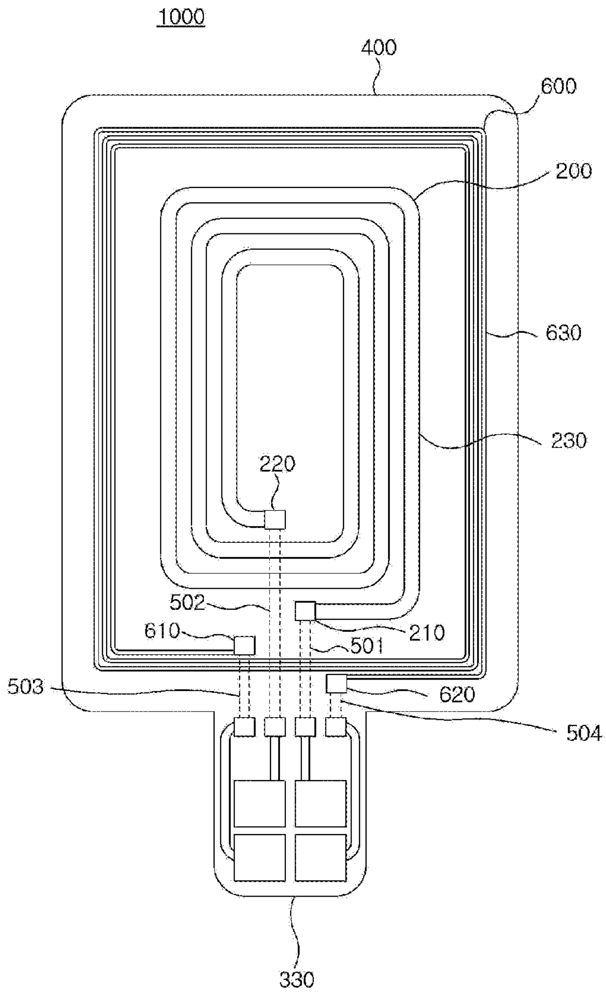
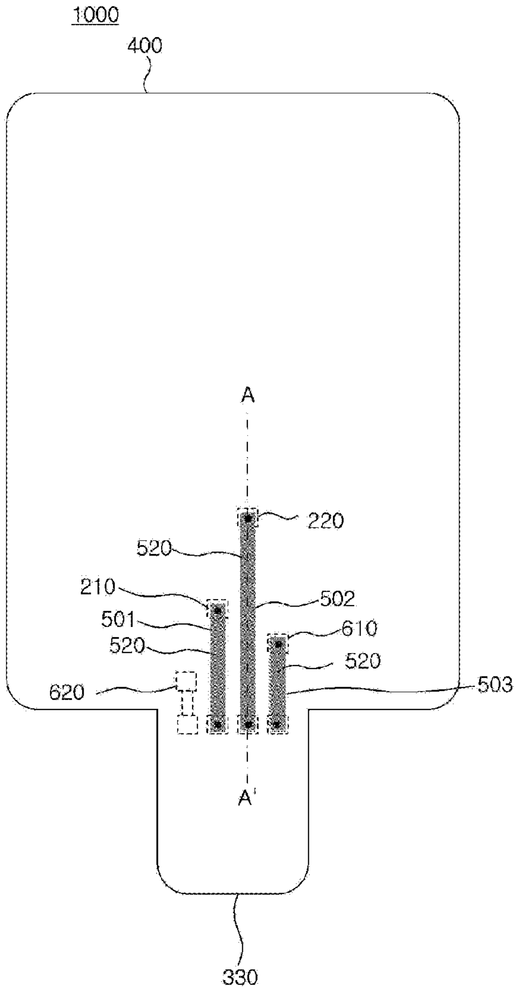
120
110
100
522
521
700
312
531
220
230
531
400
330

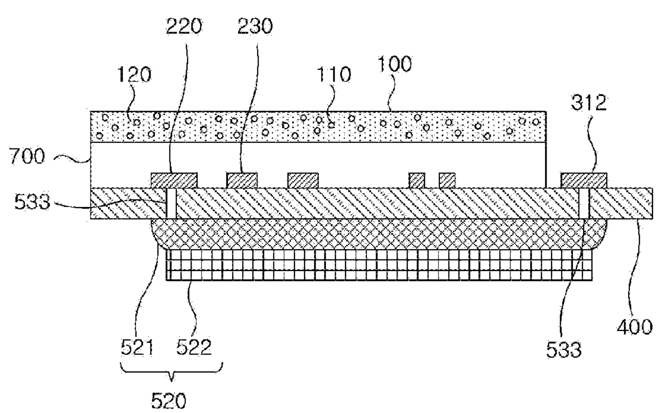
도면6



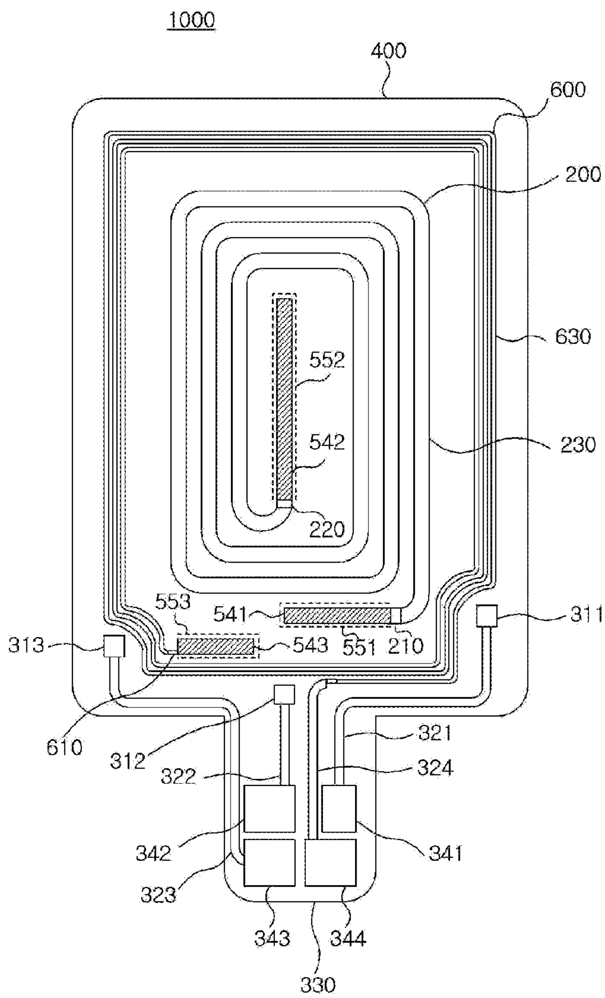
도면7


1000
400
A
220
520
210
502
501
610
520
520
620
503
A'
330

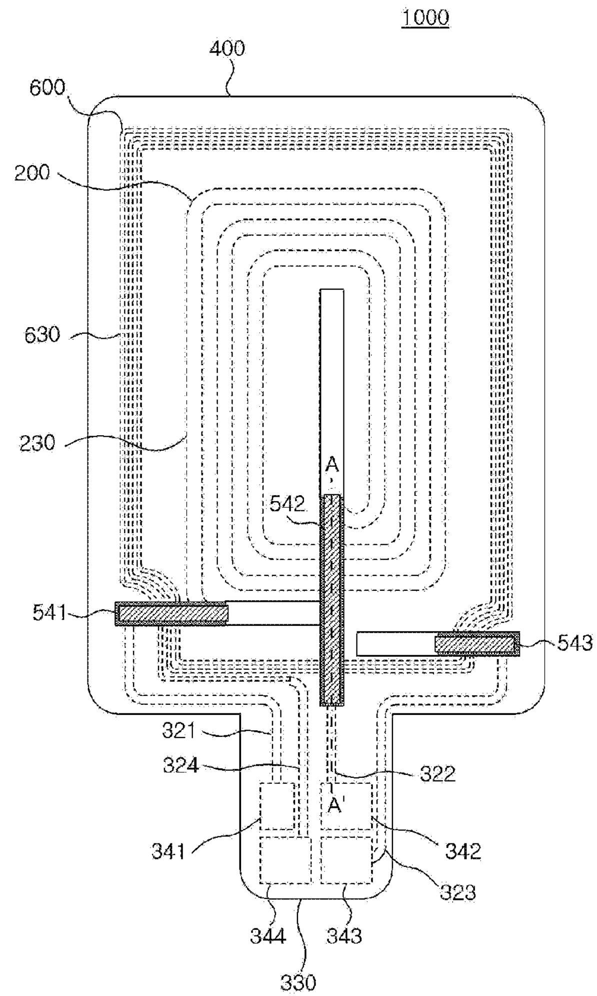
도면8


220
230
120
110
100
312
700
533
521
522
533
400
520

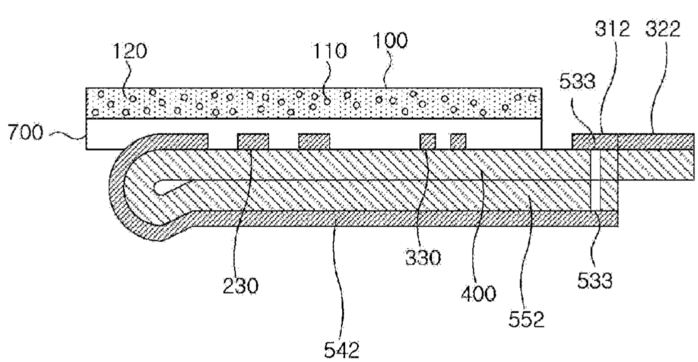
도면9


1000
400
600
200
630
552
542
230
220
553
541
543
551
210
313
311
610
312
321
322
324
342
341
323
343
344
330

도면10


1000
400
600
200
630
230
A
542
541
543
321
324
322
A'
341
342
323
344
343
330

도면11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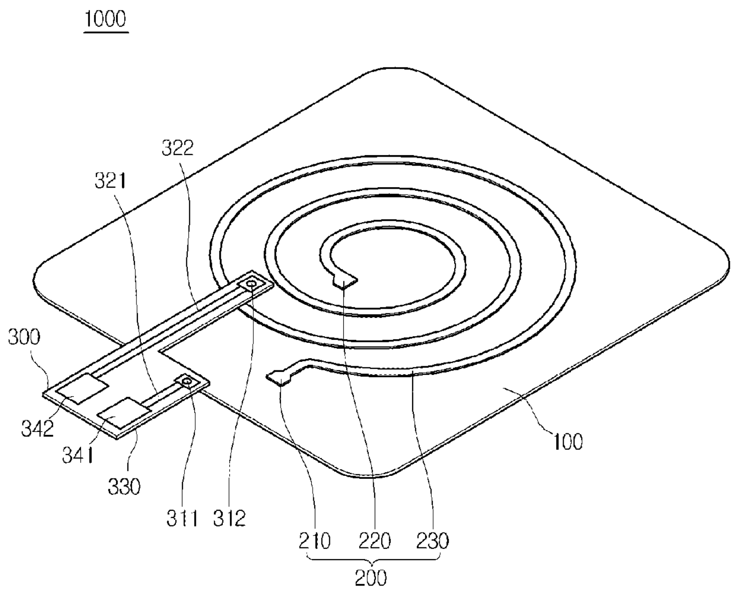
110
100
312
322
533
700
230
330
400
533
552
542

도면12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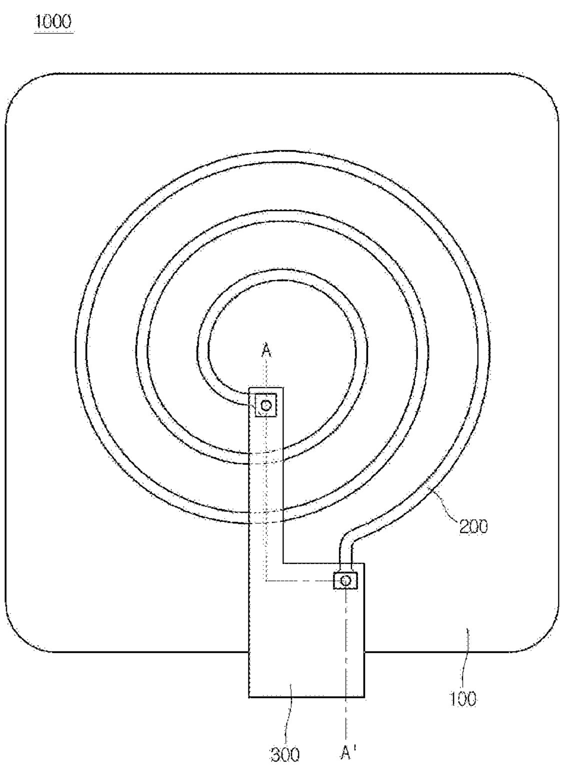
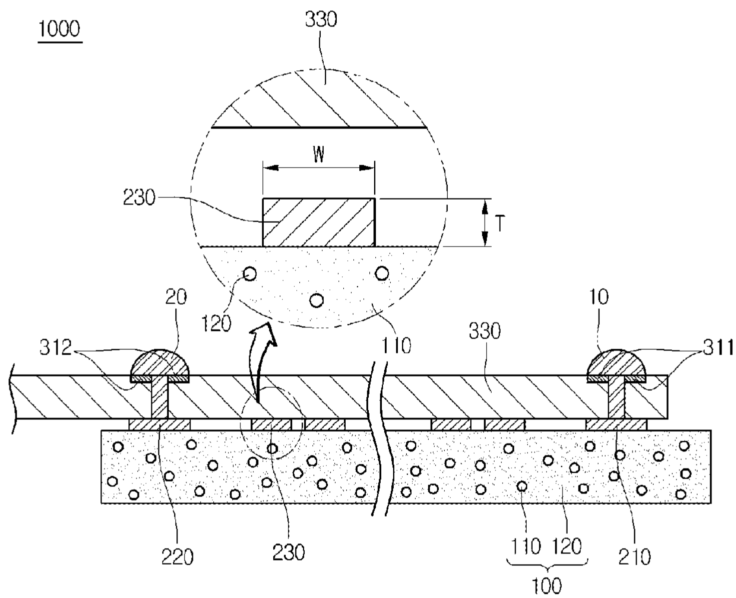
322
321
300
342
341
330
311
312
210
220
230
200
100

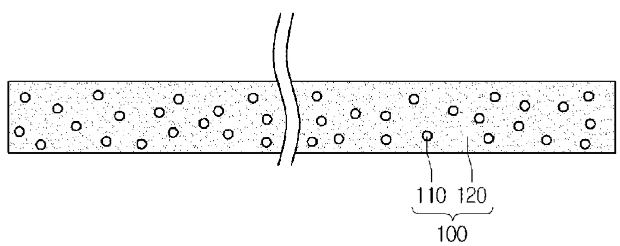
도면13


1000
A
200
100
300
A'

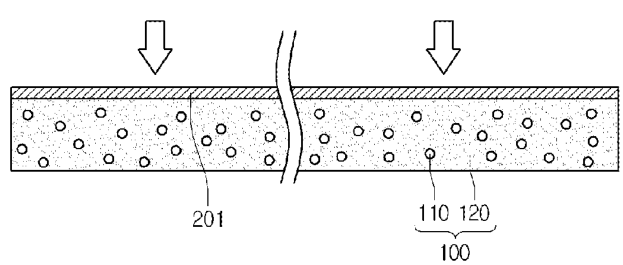
도면14



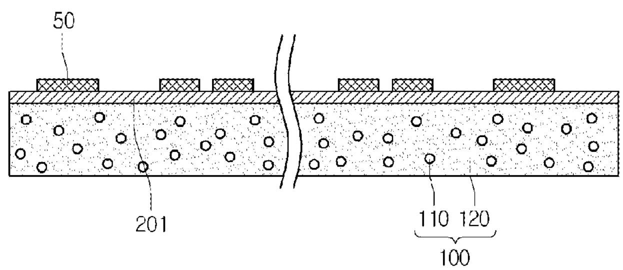
도면15



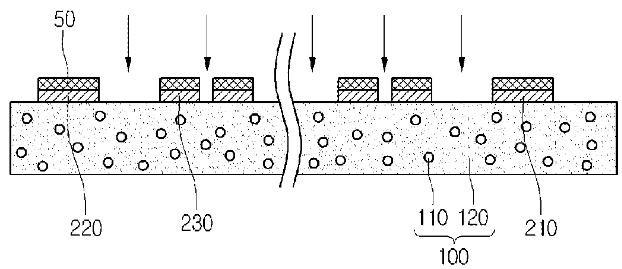
도면16



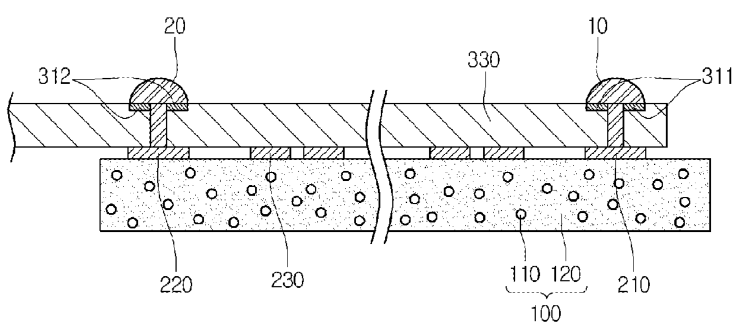
도면17



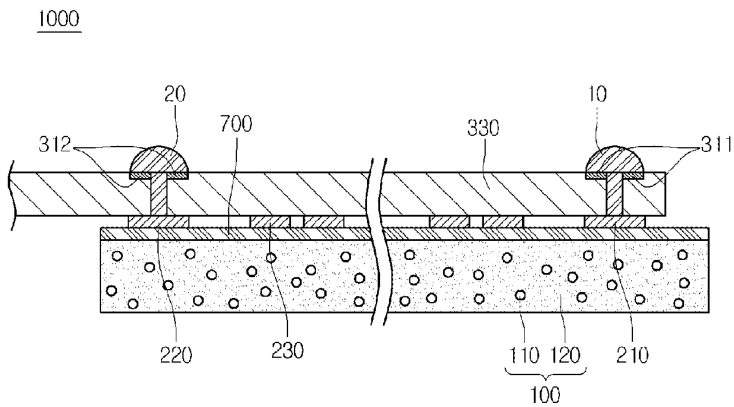
도면18



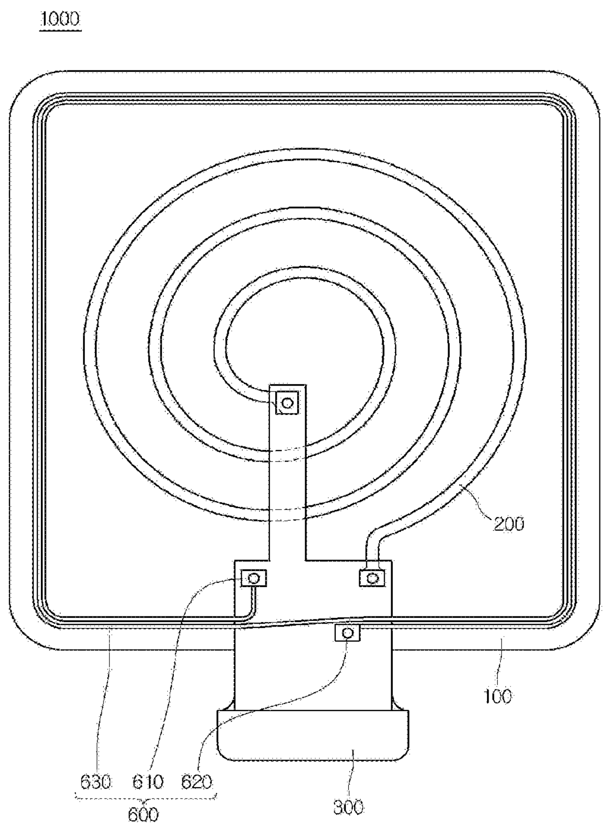
도면19



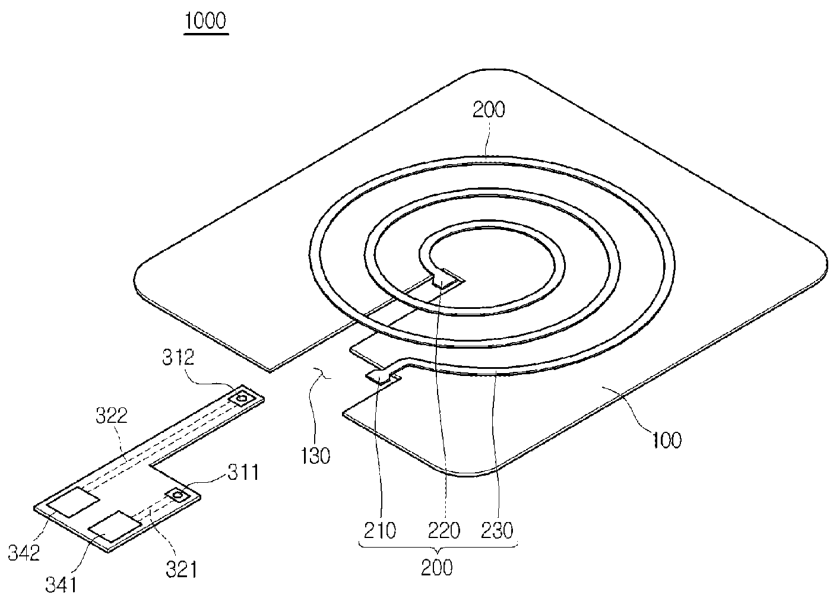
도면20


1000
20
10
312
700
330
311
220
230
110
120
210
100

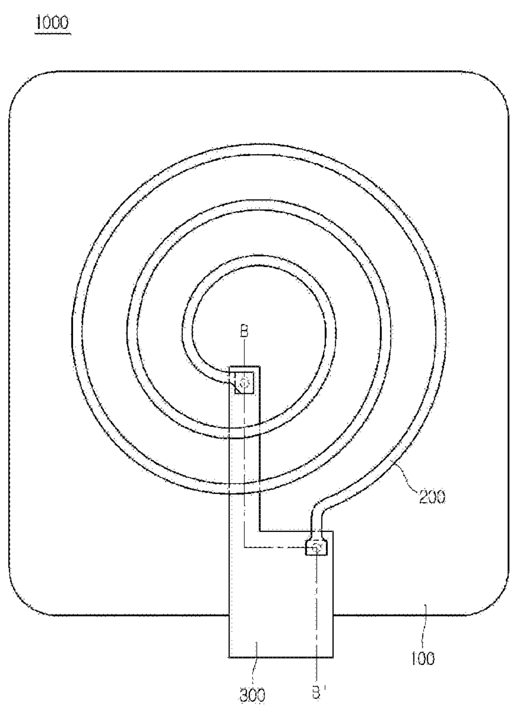
도면21


1000
200
100
630
610
620
600
300

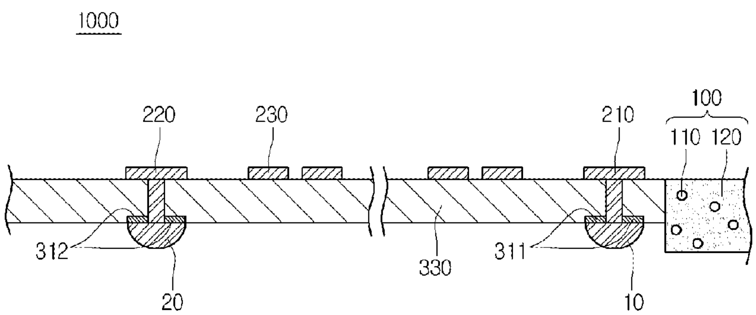
도면22


1000
200
312
322
311
130
100
342
341
321
210
220
230
200

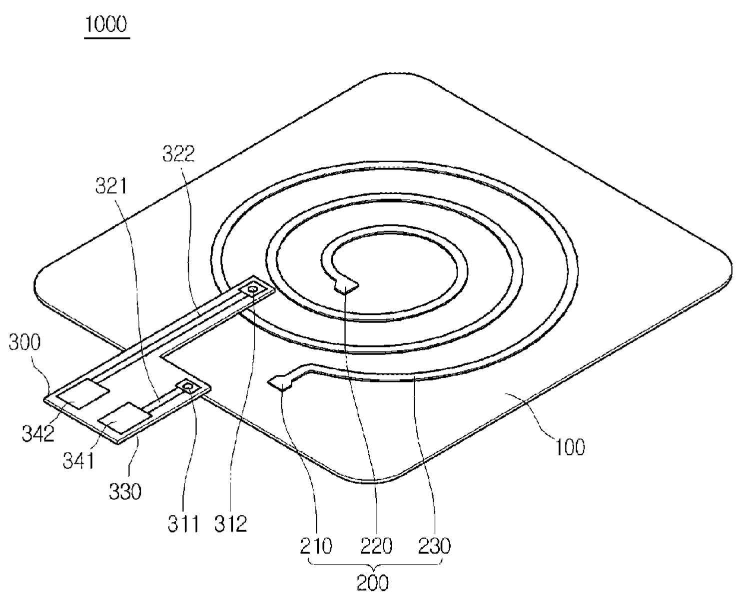
도면23


1000
B
200
100
300
B'

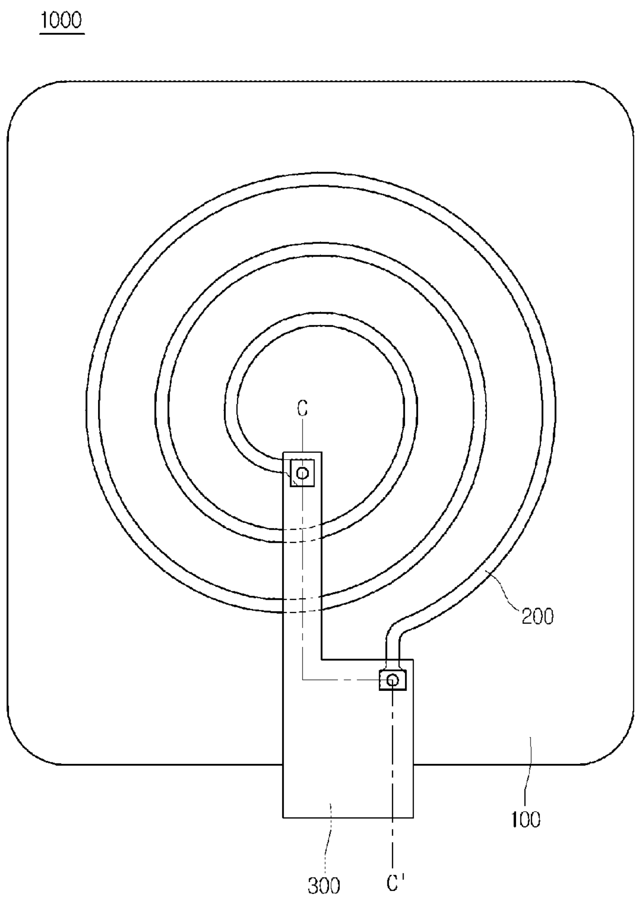
도면24


1000
100
220
230
210
110 120
312
311
330
20
10

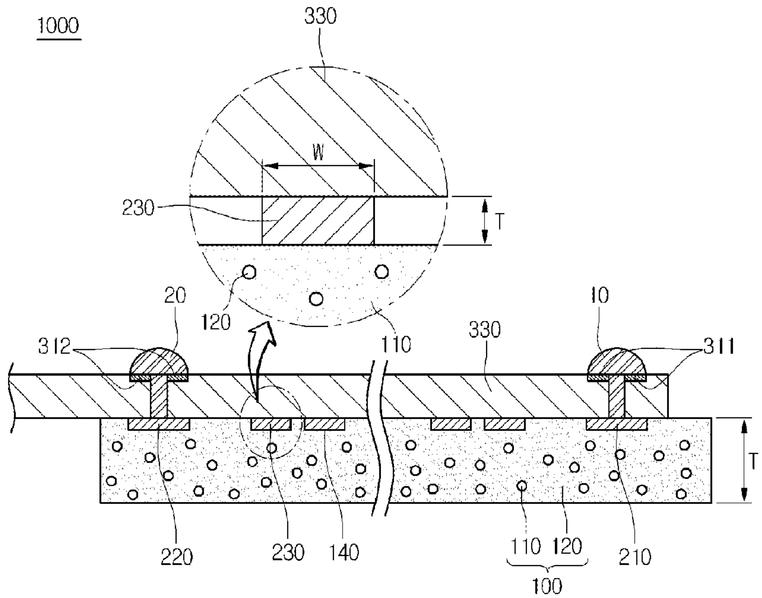
도면25


1000
322
321
300
342
341
330
311 312
210 220 230
200
100

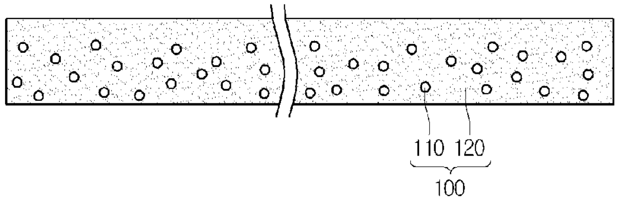
도면20



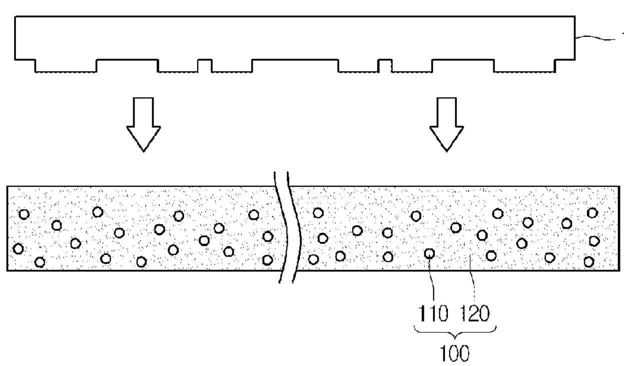
도면27



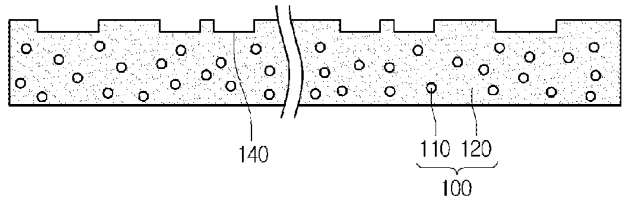
도면28



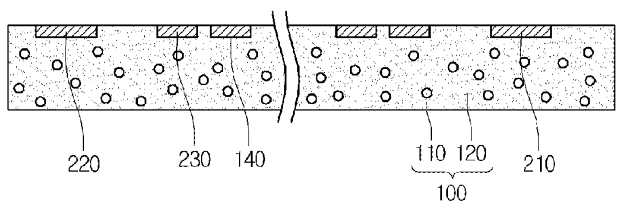
도면29



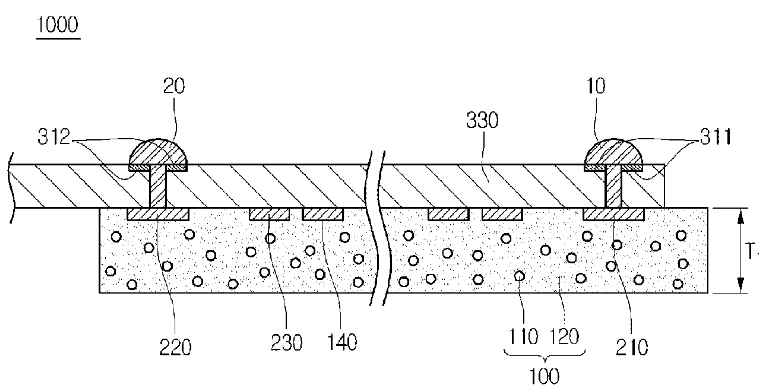
도면30



도면31



도면32



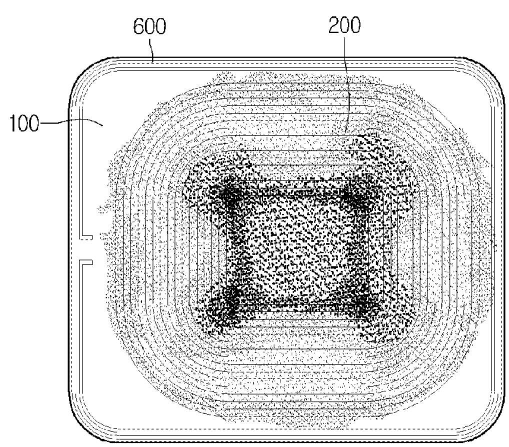
도면33

Freq[kHz]	Inductance Setup1 : Sweep	Resistance Setup1 : Sweep	Q Setup1 : Sweep
130.000000	10023.448082	0.809633	10.012480
131.000000	10021.543951	0.814464	10.028048
132.000000	10019.649417	0.819320	10.043115
133.000000	10017.764376	0.824199	10.057691
134.000000	10015.888496	0.829101	10.071784
135.000000	10014.021426	0.834027	10.085405
136.000000	10012.163025	0.838976	10.098561
137.000000	10010.312867	0.843948	10.111262
138.000000	10008.470902	0.848942	10.123517
139.000000	10006.636764	0.853960	10.135333
140.000000	10004.810399	0.859000	10.146721
141.000000	10002.991358	0.864062	10.157687
142.000000	10001.179585	0.869147	10.168241
143.000000	9999.374809	0.874254	10.178391
144.000000	9997.577015	0.879383	10.188142
145.000000	9995.785687	0.884534	10.197506
146.000000	9994.000944	0.889706	10.206488
147.000000	9992.222542	0.894900	10.215097
148.000000	9990.450319	0.900116	10.223339
149.000000	9988.684063	0.905352	10.231223
150.000000	9986.923648	0.910610	10.238756
151.000000	9985.169040	0.915889	10.245944
152.000000	9983.419964	0.921189	10.252794
153.000000	9981.676290	0.926509	10.259313
154.000000	9979.937950	0.931850	10.265510
155.000000	9978.204783	0.937212	10.271388
156.000000	9976.476722	0.942594	10.276956
157.000000	9974.753596	0.947996	10.282220
158.000000	9973.035485	0.953418	10.287185
159.000000	9971.321833	0.958860	10.291859
160.000000	9969.613051	0.964321	10.296247

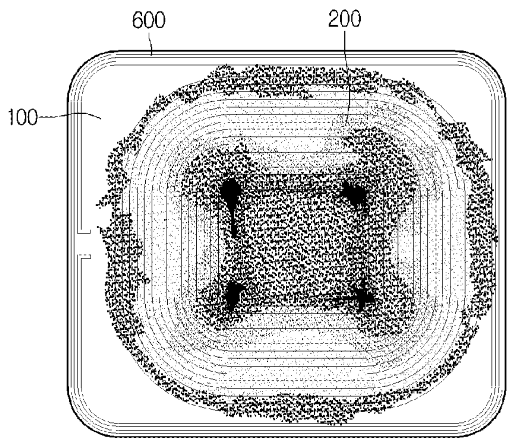
도면34

Freq[kHz]	Inductance Setup1 : Sweep	Resistance Setup1 : Sweep	Q Setup1 : Sweep
130.000000	10375.469101	0.760491	11.053420
131.000000	10373.611592	0.764922	11.072242
132.000000	10371.760893	0.769376	11.090493
133.000000	10369.916781	0.773853	11.108182
134.000000	10368.078898	0.778351	11.125322
135.000000	10366.247102	0.782872	11.141920
136.000000	10364.421100	0.787415	11.157989
137.000000	10362.600644	0.791979	11.173537
138.000000	10360.785303	0.796565	11.188574
139.000000	10358.975165	0.801173	11.203109
140.000000	10357.169752	0.805802	11.217153
141.000000	10355.369156	0.810452	11.230713
142.000000	10353.572957	0.815124	11.243801
143.000000	10351.780892	0.819816	11.256422
144.000000	10349.993078	0.824529	11.268591
145.000000	10348.209063	0.829263	11.280309
146.000000	10346.428853	0.834018	11.291589
147.000000	10344.652133	0.838792	11.302441
148.000000	10342.878918	0.843587	11.312871
149.000000	10341.108850	0.848402	11.322886
150.000000	10339.342085	0.853237	11.332499
151.000000	10337.578231	0.858092	11.341712
152.000000	10335.817245	0.862967	11.350536
153.000000	10334.058946	0.867867	11.358980
154.000000	10332.303299	0.872774	11.367050
155.000000	10330.550019	0.877706	11.374754
156.000000	10328.799305	0.882658	11.382099
157.000000	10327.050748	0.887629	11.389091
158.000000	10325.304351	0.892618	11.395741
159.000000	10323.560143	0.897626	11.402053
160.000000	10321.817935	0.902653	11.408035

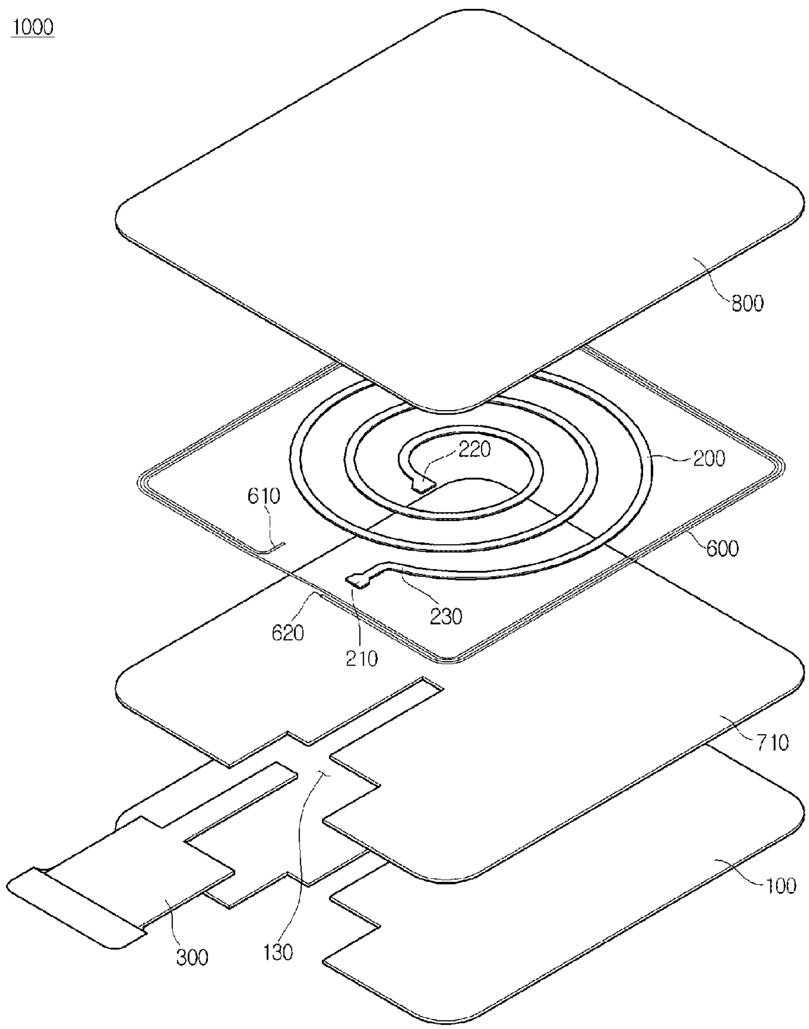
도면35



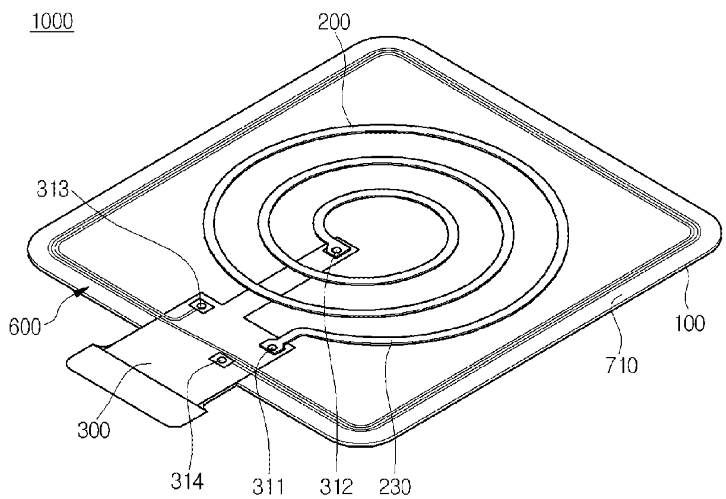
도면36



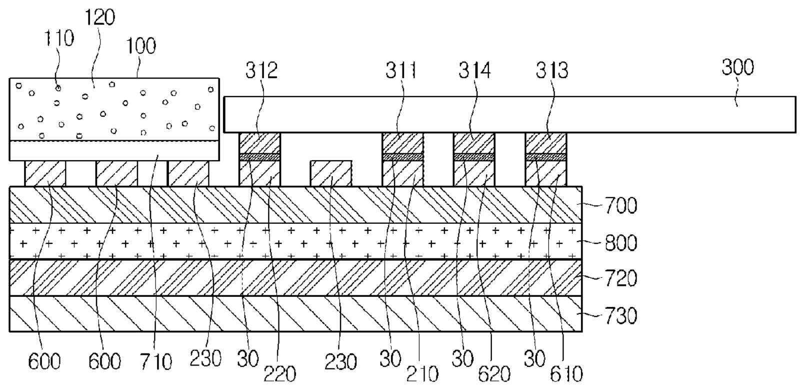
도면37



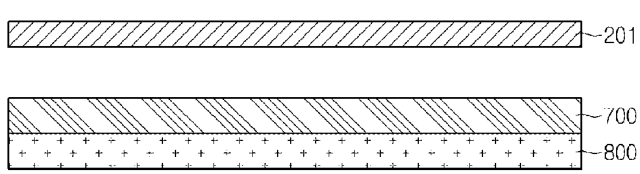
도면38



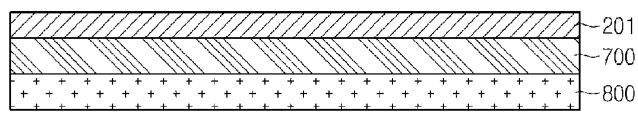
도면39



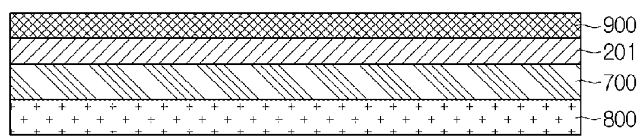
도면40



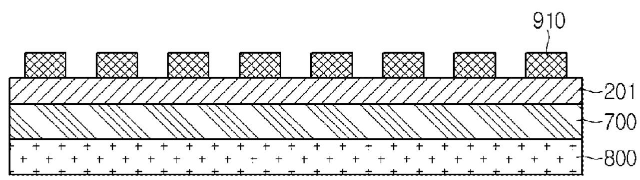
도면41



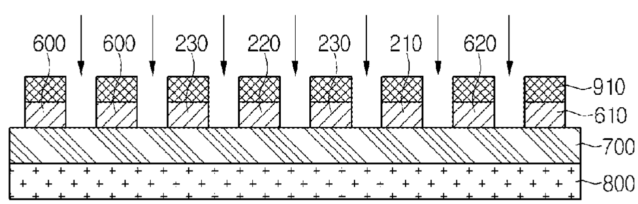
도면42



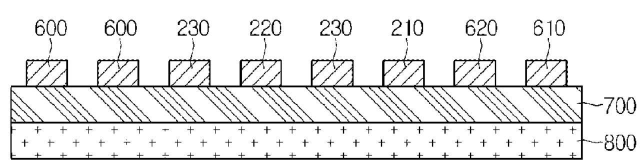
도면43



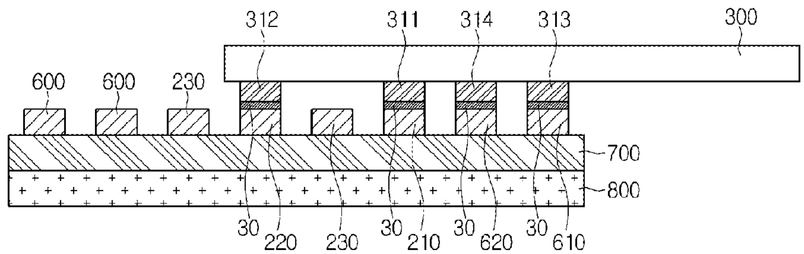
도면44



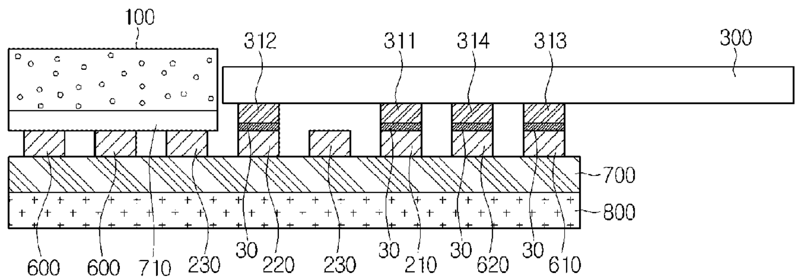
도면45



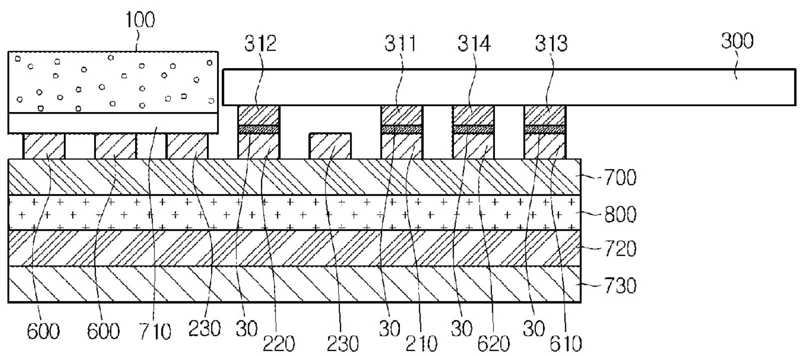
도면46



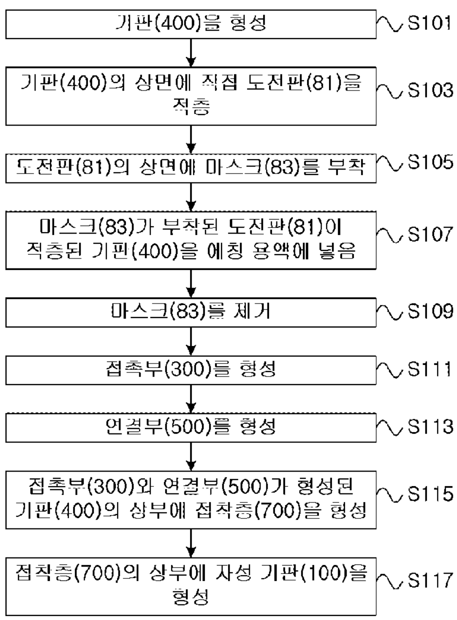
도면47



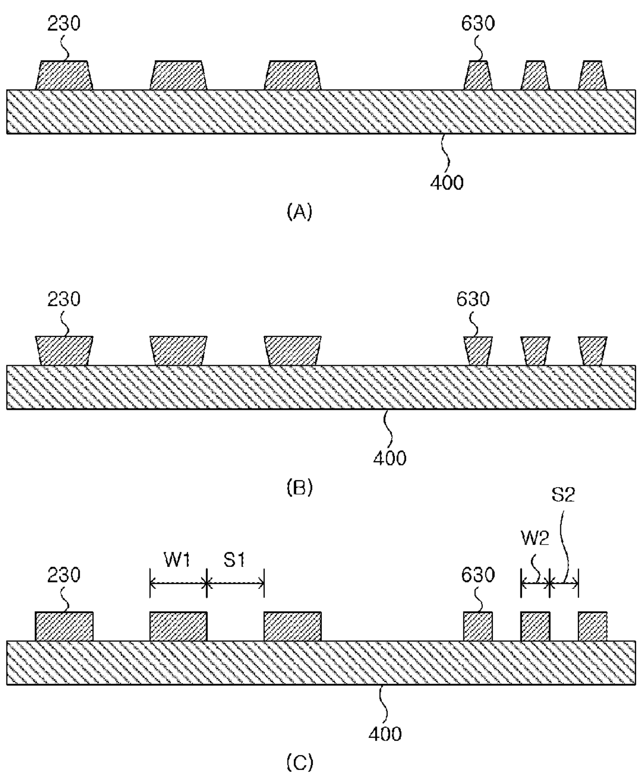
도면48



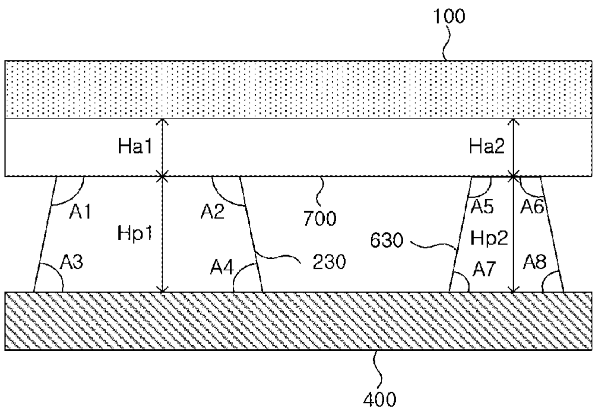
도면49


기판(400)을 형성
S101
기판(400)의 상면에 직접 도전판(81)을 적층
S103
도전판(81)의 상면에 마스크(83)를 부착
S105
마스크(83)가 부착된 도전판(81)이 적층된 기판(400)을 에칭 용액에 넣음
S107
마스크(83)를 제거
S109
접촉부(300)를 형성
S111
연결부(500)를 형성
S113
접촉부(300)와 연결부(500)가 형성된 기판(400)의 상부에 접착층(700)을 형성
S115
접착층(700)의 상부에 자성 기판(100)을 형성
S117

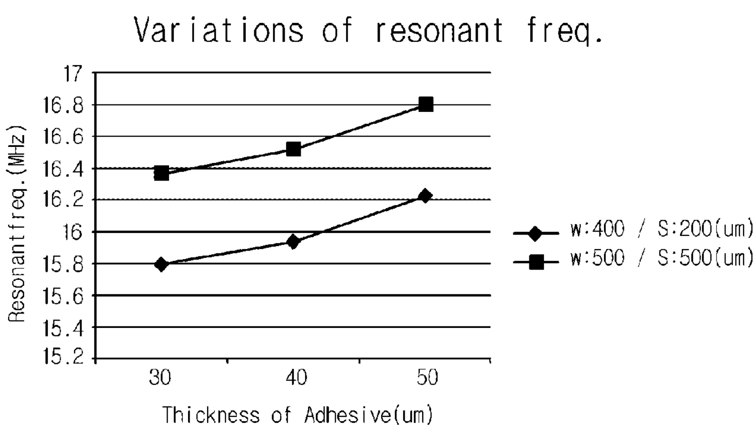
도면50


230
630
400
(A)
230
630
400
(B)
230
W1
S1
630
W2
S2
400
(C)

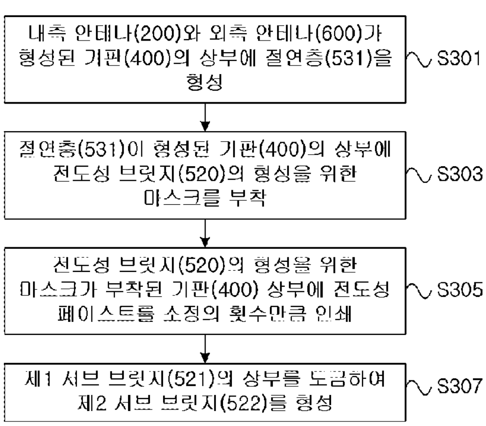
도면51



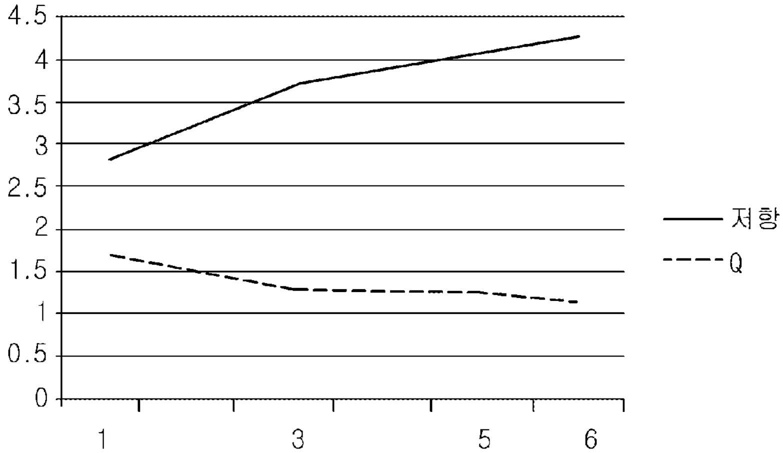
도면52



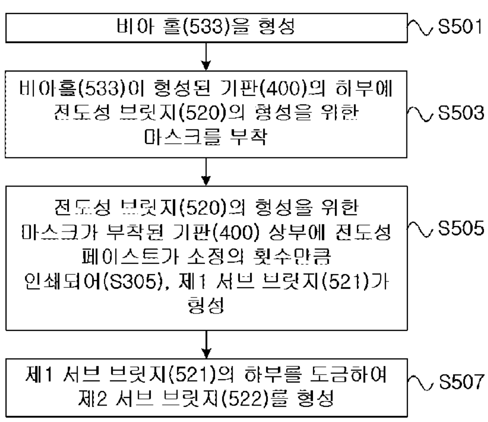
도면53



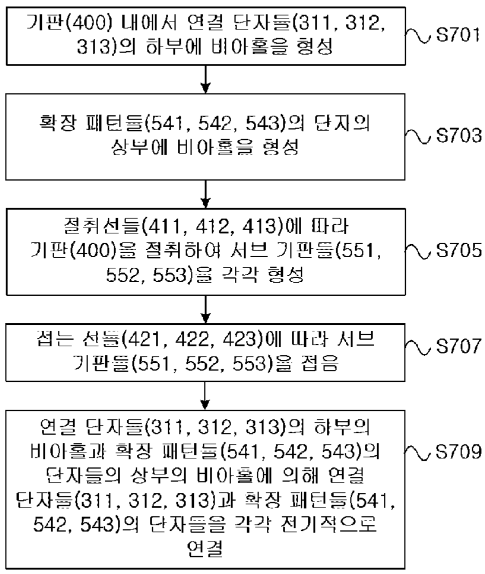
도면54


4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
3
5
6
저항
Q

도면55


비아 홀(533)을 형성
S501
비아홀(533)이 형성된 기판(400)의 하부에 전도성 브릿지(520)의 형성을 위한 마스크를 부착
S503
전도성 브릿지(520)의 형성을 위한 마스크가 부착된 기판(400) 상부에 전도성 페이스트가 소정의 횟수만큼 인쇄되어(S305), 제1 서브 브릿지(521)가 형성
S505
제1 서브 브릿지(521)의 하부를 도금하여 제2 서브 브릿지(522)를 형성
S507

도면56


기판(400) 내에서 연결 단자들(311, 312, 313)의 하부에 비아홀을 형성
S701
확장 패턴들(541, 542, 543)의 단자의 상부에 비아홀을 형성
S703
절취선들(411, 412, 413)에 따라 기판(400)을 절취하여 서브 기판들(551, 552, 553)을 각각 형성
S705
접는 선들(421, 422, 423)에 따라 서브 기판들(551, 552, 553)을 접음
S707
연결 단자들(311, 312, 313)의 하부의 비아홀과 확장 패턴들(541, 542, 543)의 단자들의 상부의 비아홀에 의해 연결 단자들(311, 312, 313)과 확장 패턴들(541, 542, 543)의 단자들을 각각 전기적으로 연결
S709

Electronic Patent Application Fee Transmittal

Application Number:	13663012
Filing Date:	29-Oct-2012
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/Megan Kuchenthal
Attorney Docket Number:	SUN.LGI.420

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Total in USD ($)			**180**

Electronic Acknowledgement Receipt

EFS ID:	30367650
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Megan Kuchenthal
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	14-SEP-2017
Filing Date:	29-OCT-2012
Time Stamp:	15:55:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$180
RAM confirmation Number	091517INTEFSW15554100
Deposit Account	190065
Authorized User	Megan Kuchenthal

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIDS10.pdf	205447 71d98778cbdd2aa339817f30c67f098c99e79c4d	yes	3

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	2
Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Foreign Reference	F1.pdf	5982747 ac9e9953904959a828de7bd69b8a6faa20885aff	no	55

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Other Reference-Patent/App/Search documents	R1.pdf	1132574 d9acecc728b2f8cbea517d1048ff286f241a8869	no	8

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Other Reference-Patent/App/Search documents	R2.pdf	1174288 922d288248d5ce59f6d2523558077bd016f085ea	no	8

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
5	Fee Worksheet (SB06)	fee-info.pdf	30726 428b3dda17bb9a82f5e8edb900f5191a47446657	no	2

Warnings:

Information:

Total Files Size (in bytes):	8525782

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on September 14, 2017.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached.

The undersigned hereby certifies that no item of information contained in this Supplemental Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in this Supplemental Information Disclosure Statement was known to any individual designated in 37

C.F.R. 1.56(c) more than three months prior to the filing of this Supplemental Information Disclosure Statement.

This Information Disclosure Statement is being submitted subsequent to the mailing of a Notice of Allowance but prior to payment of the Issue Fee. The fee of $180.00 was paid at the time this statement was filed.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

Jeff Lloyd
Patent Attorney
Registration No. 35,589
Phone No.: 352-375-8100
Fax No.: 352-372-5800
Address: Saliwanchik, Lloyd & Eisenschenk
A Professional Association
P.O. Box 142950
Gainesville, FL 32614-2950

JL/mrk

Attachments: Form PTO/SB/08; copies of references cited.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

23557 7590 06/26/2017

SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	
ART UNIT	PAPER NUMBER
2836	

DATE MAILED: 06/26/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

TITLE OF INVENTION: WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$960	$960	09/26/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23557 7590 06/26/2017
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

TITLE OF INVENTION: WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$960	$960	09/26/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
EVANS, JAMES P	2836	307-104000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________________
   2 ____________________
   3 ____________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies ____________________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ______________________________ Date ______________________________

Typed or printed name ______________________________ Registration No. ______________________________

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 06/26/2017
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	
ART UNIT	PAPER NUMBER
2836	

DATE MAILED: 06/26/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/663,012	Applicant(s) AN ET AL.	
	Examiner JAMES EVANS	**Art Unit** 2836	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Amendments and Arguments of 3/27/2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,3,7,9,11-13,19,21,23,25,30 and 32-39*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:

   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/DANIEL CAVALLARI/ Primary Examiner, Art Unit 2836	/JAMES EVANS/ Examiner, Art Unit 2836

DETAILED ACTION

Response to Amendment

1. Arguments and amendments received on 3/27/2017 have been received and entered in the case. Cancellation of Claims 6, 22, 24, 26-29 and 31 is acknowledged, along with new claims 33-39. Claims 2, 4-5, 8, 10, 14-18 and 20 were previously cancelled.

REASONS FOR ALLOWANCE

2. The following is an examiner's statement of reasons for allowance: Claims 1, 3, 7, 9, 11-13, 19, 21, 23, 25, 30 and 32-39 are allowed based on the amendments of 3/27/2017.

Claim 1 is allowed because there is no prior art available nor obvious motivation to combine elements of the prior art of record to disclose a wireless power receiver comprising: a substrate comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; a coil unit disposed on the substrate, the coil unit comprising a first connection terminal, a second connection terminal, and a coil: and a short-range communication antenna disposed on the substrate and surrounding the coil; wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is located at the other end of the coil, wherein the coil unit overlaps the receiving space in a first direction perpendicular to an upper surface of the substrate; wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the connecting unit overlaps the receiving space in a second direction parallel to the upper surface of the substrate, and wherein the connecting unit comprises: a third connection terminal connected to the first connection terminal of the coil unit; and a fourth connection terminal connected to the second connection terminal of the coil unit.

Of the earlier cited prior art, Kanno (US 2012/0187767) in view of Waffenschmidt, et al. (US 2013/0069444) discloses a wireless power receiver with the power coil and antenna with a substrate as cited in the original office action, but does not disclose the substrate comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; wherein the connecting unit is disposed in the receiving space and connected to the coil unit, or wherein the connecting unit overlaps the receiving space in a second direction parallel to the upper surface of the substrate.

Of the newly cited IDS prior art, Takanobu (JPH10282232) discloses (e.g., Fig. 4) a wireless receiver with a substrate (e.g., 102.211), a coil unit disposed on the substrate, the coil unit comprising a first connection terminal, a second connection terminal, and a coil (e.g., inner circumference antenna 302, Paragraph [0043]: for transfer of power) and a short-range communication antenna (e.g., periphery antenna 301, Paragraph [0043]: for data communications) disposed on the substrate and surrounding the coil (e.g., as shown in Fig. 4); wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is located at the other end of the coil.

Takanobu does not disclose the substrate comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the coil unit overlaps the receiving space in a first direction perpendicular to an upper surface of the substrate; or wherein the connecting unit overlaps the receiving space in a second direction parallel to the upper surface of the substrate.

Therefore the invention is novel and non-obvious.

Claims 3, 7, 9, 11-13, 19, 21, and 25 are allowed because of their dependence on allowable Claim 1.

Claim 23 is allowed because there is no prior art available nor obvious motivation to combine elements of the prior art of record to disclose a wireless power receiver as claimed.

Of the earlier cited prior art, Kanno in view of Waffenschmidt discloses a wireless power receiver with the coil and antenna limitations, with a substrate as cited in the original office action, but does not disclose a substrate comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the connecting unit overlaps the receiving space in a second direction parallel to the upper surface of the substrate, nor does Kanno in view of Waffenschmidt disclose wherein the connecting unit is disposed in the receiving space and wherein the coil unit is disposed on the connecting unit.

Of the newly cited IDS prior art, Takanobu discloses the same features in Claim 23 that are the same as discussed in claim 1, supra, and do not disclose the same essential features as discussed in claim 1, nor does Takanobu disclose wherein the coil unit is disposed on the connection unit.

Therefore the invention is novel and non-obvious.

Claims 30 and 32-39 are allowed because of their dependence on allowable Claim 23.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES P. EVANS whose telephone number is (571) 270-0639. The examiner can normally be reached on Monday-Friday 8 AM-5pm ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jared Fureman can be reached on 571-272-2391. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice .

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JAMES P EVANS/
Examiner, Art Unit 2836

/DANIEL CAVALLARI/

Primary Examiner, Art Unit 2836

Notice of References Cited	Application/Control No. 13/663,012	Applicant(s)/Patent Under Reexamination AN ET AL.
	Examiner JAMES EVANS	Art Unit 2836 / Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2014/0091758 A1	04-2014	Hidaka; Akio	H01F38/14	320/108
*	B	US-2007/0095913 A1	05-2007	Takahashi; Isao	G06K7/10336	235/451
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	824	H02J50/$.cpc. AND (H01Q$.cpc. OR H05K$.cpc.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:01
L5	311	L4 and (@pd or @ptad or @prad or @ad or @rlad)<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/15 13:04
L6	21	L5 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (communicat$3 or data) NEAR9 (surround$3 enclos$4 circl$3 encircl$3 outer outermost inner innermost inside outside) NEAR9 (coil loop winding antenna inductor inductance inductive pattern conductive)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:06
L7	127	L5 AND (substrate or base or core or "ferrite magnet layer" sheet)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:07
L8	118	L5 AND (substrate or base or core or "ferrite magnet layer" sheet) NOT L6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:24
L10	193	L5 NOT L8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:32
L11	1995863	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4 or COMMUNICAT$3 or charg$3)) OR (COMMUNICATION ADJ TERMINAL)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:41

L13	85	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$ or US-20140091758-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$ or US-7712672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$ or JP-2004364199-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/15 13:43
L15	118	L5 AND (substrate or base or core or "ferrite magnet layer" sheet "magnetic shield") NOT L6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:51
L16	17285	L11 AND (((coil loop winding antenna inductor inductance inductive pattern conductive or aerial) NEAR5 (communicat$3 or data or signal or	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2017/06/15 13:53

		information) NEAR9 (surround$3 enclos$4 circl$3 encircl$3 outer outermost inner innermost inside outside) NEAR9 (coil loop winding antenna inductor inductance inductive pattern conductive)))	EPO; JPO; DERWENT; IBM_TDB			
L18	12720	L16 AND (substrate or base or core or "ferrite magnet layer" sheet "magnetic shield")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 13:55
L35	2933	L16 AND ((substrate or base NOT (based or basis or base ADJ station) or core or "ferrite magnet layer" sheet "magnetic shield") WITH (space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" or "lay out" or lay-out or "laid out" OR concave or area OR slit))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 15:08
L45	179	L35 AND (connect$3 NEAR7 (overlap$5 overhang$3 fit fitt$3 insert$3 slid$3) NEAR5 (space or spacing or hole or area or void or opening or slot or slotted or slit or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" or concave))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 15:40
L48	33	L45 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3 overhang$3) NEAR5 (space or spacing or area or void or hole or opening or slot or slotted or slit or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" OR concave)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 15:43
L49	2	L48 AND ((307/104).ccls. OR (320/108).ccls. OR (H02J5/005).cpc. OR (H02J7/025).cpc. OR (H02J17/00).cpc. OR (H02J50/$).cpc. OR (H04B5/0025-0093).cpc. OR (B60L11/182).cpc. OR (B60L11/1829-1831).cpc. OR (Y02T90/122).cpc. OR (H01F38/14).cpc. OR (H01F2038/143-146).cpc. OR (A61B1/00029).cpc. OR (A61N1/3787).cpc.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 15:43
L59	4	L48 AND ((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (spiral spirally or helix or helically))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 16:04
L60	40	L13 AND ((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (spiral spirally or helix or helically))	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2017/06/15 16:05

			EPO; JPO; DERWENT; IBM_TDB			
L61	1	JP2008027015	JPO	OR	ON	2017/06/15 16:19
L62	85	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$ or US-20140091758-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$ or US-7712672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$ or JP-2004364199-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/15 16:20
L63	202614	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2017/06/15 16:33

			IBM_TDB			
L64	2	L48 AND L63	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/15 16:34
S1	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2015/01/20 10:41
S2	8	("20050046573" | "20080122570" | "20080154178" | "20080197957" | "20090058358" | "20100277004" | "20120057322" | "6008622").PN.	US-PGPUB; USPAT	OR	ON	2015/01/20 10:51
S3	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:23
S4	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:34
S5	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S6	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S7	158	S6 AND S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S8	398217	(coil$1 or winding$1) SAME (power or energy or current) SAME(terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S9	27303	(substrate or base or core or "ferrite magnet layer") SAME (space or shape or shaped) SAME (connector or "connecting unit") SAME (terminal or	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2015/01/20 12:23

		lead or "connecting land")	EPO; JPO; DERWENT; IBM_TDB			
S10	1934	S9 SAME S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:24
S11	392	WO adj "2008053599" WO adj "2013174340" EP adj "1870984" WO adj "2012169728" WO adj "2006127829" EP adj "0037921" WO adj "2005034152" WO adj "1992014254" WO adj "2006134712" WO adj "2007007516" WO adj "2007055265" "20030006657" EP adj "2642632" EP adj "2202499" EP adj "2642632" CN adj "1110225" "3634878" "3848208" "20130249302" WO adj "2006047953" CN adj "1151100" WO adj "2013149781" CN adj "103326473" JP adj "2012235630" "5724018" CN adj "100466382" CN adj "101071909" EP adj "2367263" WO adj "2011147451" WO adj "2014183352" EP adj "1487087" WO adj "2004045050" WO adj "2009070705" JP adj "2013138404" WO adj "2004030845" EP adj "2309620" JP adj "2005065018" JP adj "2004023961" JP adj "2010110168" EP adj "2256751" WO adj "2009155030" EP adj "2642591" WO adj "2012015839" EP adj "2814047" JP adj "2004072867" "2091798" WO adj "1993013532" WO adj "2008135507" "3660791" WO adj "2006101049" WO adj "2002046653" WO adj "2007049788" JP adj "2001144642" "3146419" EP adj "1868280" EP adj "1883998" JP adj "2014023281" "3792410" CN adj "201340774" "20060278387" CN adj "1855761" JP adj "2013157917" EP adj "1717967" CN adj "101189692" CN adj "102056328" "3848205" WO adj "2013022255" JP adj "2014027102" EP adj "1821556" "3767102" EP adj "2375531" JP adj "2008017141" WO adj "2005034307" JP adj "2010093386" EP adj "2629361" WO adj "2005030528" CN adj "1941230" "3163840" "3863040"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:52
S12	299	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:58
S13	3	EP adj "2642632"	US-PGPUB;	OR	ON	2015/01/20

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:51
S14	22	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$ or US-20130249302-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/20 15:01
S15	22	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 15:01
S16	2	"20080164840"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 17:13
S17	6	"39593692".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/20 17:15
S18	2	"20120044114"	US-PGPUB; USPAT	OR	ON	2015/01/20 17:26
S19	3	(("Jeong Wook") near2 (AN)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:52
S20	2	(("Jeong Wook") near2 (AN)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:54
S21	8	(("Jung Oh") near2 (LEE)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:55
S22	1	(("Jung Oh") near2 (LEE)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:57
S23	3	(("Sung Hyun") near2 (LEEM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:58
S24	0	(("Sung Hyun") near2 (LEEM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:04
S25	7	(("Yang Hyun") near2 (KIM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 09:05
S26	3	(("Yang Hyun") near2 (KIM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:19

S27	5	"47598569".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/23 11:34
S28	24	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$).did.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/26 13:45
S29	2993903	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:02
S30	1440492	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:07
S31	3326212	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:10
S32	2674608	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:19
S33	2115289	(connect$3 or link$3 or coupl$3 or join$3) near3 (terminal or node or lead or electrode or contact)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:22
S34	80414	S29 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:28
S35	2254	S34 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:29
S36	328	S35 SAME S32	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S37	52	S36 SAME S33	US-PGPUB;	ADJ	ON	2015/01/26

			USPAT; USOCR			14:30
S38	133047	S29 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S39	2254	S38 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S40	5809	S30 near3 S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:32
S43	27	jp and "2006042519"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 12:52
S44	0	jp and "04-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:35
S45	4911	jp and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:36
S46	0	jp and "rotary transformer" and "flexible substrate (35)"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S47	20	jp and "rotary transformer" and "flexible substrate"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S51	2	"4-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:42
S52	61	"hitachi ferrite" and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:49

S53	17	"hitachi ferrite" and "rotary transformer" and grooves	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:52
S57	4554	"satoshi" AND "shinji"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S58	100	murata AND S57	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S59	2	JP2010022098A	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 10:40
S60	38	"6008622"	US-PGPUB; USPAT	OR	ON	2015/01/28 17:01
S61	1	"6008622" and Norio	US-PGPUB; USPAT	OR	ON	2015/01/28 17:02
S62	1	"17402302".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/28 17:03
S63	336	H04B5/0037	US-PGPUB; USPAT	OR	ON	2015/01/28 17:30
S64	42	H04B5/0081	US-PGPUB; USPAT	OR	ON	2015/01/28 17:31
S65	38	H01F41/14	US-PGPUB; USPAT	OR	ON	2015/01/28 17:32
S66	1111	H02J17/00	US-PGPUB; USPAT	OR	ON	2015/01/28 17:55
S67	32971	H02J17/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/28 17:55
S68	6341	H01F41/14	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:19
S69	20594	H01Q7/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/01/29 08:27

			DERWENT; IBM_TDB			
S70	1439	H04B5/0081	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S71	21809	S70 OR S69	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S72	394	S71 and ("rectang$4" OR "square")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:38
S73	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/05/19 08:45
S74	18	S73 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/05/19 08:48
S92	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:16
S93	771	S92 AND ((substrate or base or core or "ferrite magnet layer") AND (space	US-PGPUB; USPAT;	OR	ON	2015/08/11 17:16

		or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S94	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S95	771	S94 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S96	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S95	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S97	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S98	771	S97 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S99	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S98	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S100	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S101	771	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23

S102	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S101	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S103	72	((coil or winding or antenna or resonator or "receiving element") WITH conductive WITH (layer or pattern)) AND S102	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S104	934	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:29
S105	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S106	934	S105 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S107	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S106	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S108	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/11 17:35

		or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S109	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S110	934	S109 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S111	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S112	0	S111 AND S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S113	165	S111 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:41
S114	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S115	372	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S116	0	S115 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2015/08/11 18:10

			IBM_TDB			
S117	389	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:11
S118	0	S117 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:11
S119	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S108) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:13
S120	27	S119 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:14
S121	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 13:32
S122	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S121) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:32
S123	27	S122 and S121	US-PGPUB;	OR	ON	2015/08/12

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:32
S124	11	S121 NOT S123	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 13:32
S125	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S126	934	S125 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S127	0	S126 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S128	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S129	389	S128 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S130	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:11
S131	160	S130 and spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2015/08/12 14:11

			EPO; JPO; DERWENT; IBM_TDB			
S132	165	S130 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:13
S133	160	S132 AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:13
S134	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 14:34
S135	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 14:36
S136	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S135) AND S134	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:36
S139	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or	US-PGPUB; USPAT;	ADJ	ON	2015/08/12 15:22

		"connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S140	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 15:22
S141	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S140) AND S139	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S142	253	S141 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S144	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 16:04
S145	38	(US-20130249302-$ or US-	US-PGPUB;	OR	ON	2015/08/12

<table>
<tr><td></td><td></td><td>20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.</td><td>USPAT; USOCR; FPRS; JPO; DERWENT</td><td></td><td></td><td>16:04</td></tr>
<tr><td>S146</td><td>385</td><td>(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S145) AND S144</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB</td><td>OR</td><td>ON</td><td>2015/08/12 16:04</td></tr>
<tr><td>S147</td><td>253</td><td>S146 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB</td><td>OR</td><td>ON</td><td>2015/08/12 16:04</td></tr>
<tr><td>S148</td><td>198</td><td>S147 and ((first near3 (connector|connect$3|terminal) SAME (second near3 (connector|connect$3|terminal))))</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB</td><td>OR</td><td>ON</td><td>2015/08/12 16:04</td></tr>
<tr><td>S149</td><td>28</td><td>S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal))))</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB</td><td>OR</td><td>ON</td><td>2015/08/12 17:00</td></tr>
<tr><td>S150</td><td>1</td><td>S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121029"</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB</td><td>OR</td><td>ON</td><td>2015/08/12 17:02</td></tr>
<tr><td>S151</td><td>2</td><td>S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121030"</td><td>US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;</td><td>OR</td><td>ON</td><td>2015/08/12 17:02</td></tr>
</table>

			DERWENT; IBM_TDB			
S152	6	S147 and ((first NEAR2 (connector|connect$3|terminal) SAME (second NEAR2 (connector|connect$3|terminal)))) AND @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:11
S153	0	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	JPO	ADJ	ON	2015/08/13 11:35
S154	11	((substrate or base or core or "ferrite magnet layer") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	JPO	ADJ	ON	2015/08/13 11:35
S155	9194	H01F38/14.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 11:59
S156	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 12:04
S157	164	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 12:05
S158	40	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2015/08/13 12:06

			IBM_TDB			
S161	477	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND (coil$1 or winding$1 or resonator or secondary or inductor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:10
S162	293	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND (space or notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:11
S164	30	S156 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:18
S165	8	"8,092,251"	USPAT	OR	ON	2015/08/13 19:28
S166	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:33
S167	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 19:34

S168	30	S167 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:34
S169	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:35
S170	5	S169 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:35
S171	21496	713/3??.ccls.	US-PGPUB; USPAT	OR	ON	2015/08/13 19:52
S172	10	S171 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:53
S173	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/17 08:34

		or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S174	21	S173 and flexible	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 08:34
S175	21	S173 and flexible and ((uniform$2 or consistent$2 or consistency or perfect$3 or balanc$3 or equaliz$3 or overcom$3 or eliminat$3 or advantag$6 or benefit$4 or beneficially or allow$3 or effect$3 or less or great$3 or better$3 or more or most or improv$5 or simplify$3 or well or simplification or fewer or fewest or least or better or best or superior or increas$3 or decreas$3 or enhanc$5 or lower$3 or lessen$3 or short$5 or higher or highest or lighter or lightest or brighter or brightest or cheap$3 or fast$3 or long$3 or lengthen$3 or shorten$3 or extend$3 or wide$2 or prolong$3 or prevent$3 or eliminat$5 or mitigat$3 or without or effective$4 or efficien$3 or reduc$4 or compact$3 or small$3 or enhanc$3 or boost$3 or simple$2 or simplify$3 or easy or ease$2 or easi$3 or inhibit$3 or $savin$1 or environment$4 or $1friendly or sav$3 or safe$2 or protect$3 or possible or possibilit$3 or mak$3 or possible or possibilit$3 or solv$2 or fix$2 or solution or maximum or maximiz$5 or accomplish$4 or minimiz$5 or minimum or optimiz$5 or low$1cost or reliable or reliably or avoid$3 or excellent or (very ADJ high) or (very ADJ low) or stable or stabili$6 or portable or modular or slow$3 or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 09:46

		speed$3 or hasten$3 or strenghthen$3 or resilien$3))				
S176	1	S173 and "modular power transmitting system"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:02
S177	358681	(coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:17
S178	5890	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/17 11:18
S179	380	S178 AND (coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:18
S180	180	S178 AND (coil|winding) SAME (groove$1|recess$2|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:19
S181	94	S178 AND (coil|winding) SAME (groove$1|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:22
S182	3191265	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S183	1498071	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S184	3523990	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14

		standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)				
S185	2858589	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S186	7009	S182 AND S183 AND S184 and S185 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:14
S187	2229	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:19
S188	437	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:21
S189	171977	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. H01F38/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S190	15	S188 AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S191	17651	S182 AND S183 AND S184 and S185 and (radial (helically or helix) Near3 (flat planar))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:37
S192	681	S191 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:38
S193	6	S192 AND S189	US-PGPUB;	OR	ON	2015/10/13

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			09:39
S194	25	(coil WITH overlap$4 NEAR4 connect$3) AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:44
S195	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/10/13 13:43
S196	15	S195 and overlap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 13:43
S197	1	"20120248981"	US-PGPUB	OR	ON	2015/10/13 13:44
S198	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 10:30
S202	51	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$	US-PGPUB; USPAT;	OR	ON	2016/01/16 10:52

		or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	USOCR; FPRS; JPO; DERWENT			
S207	546319	S198 AND (((receiv$3 or accept$3 or receipt or retriev$3 or acquir$3 or acquisition or fit$4 or accommodat$3) near3 (spac$3 or hole or opening or slot$3 or gap or notch$2 or port or area or shaped or cut-out or configured or size or shape or dimension or design or pattern or cutout or "cut out" or configuration or layout)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:03
S208	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:11
S209	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S210	1130997	S209 AND (space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S211	723742	(coil inductor inductance winding antenna) WITH (conductive	US-PGPUB; USPAT;	OR	ON	2016/01/16 11:28

		conducting copper etch$3 PCB printed layer pattern)	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S212	32986	S211 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:36
S213	7222	S212 AND S210	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:38
S214	723868	(coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S215	32995	S214 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S216	51	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/19 09:22

		JP-2010022098-$).did.				
S217	6	S215 AND S216	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S218	1658038	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/19 09:55
S219	287249	S218 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/19 09:55
S220	3911	S215 AND S219	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:08
S221	253	S220 AND (third ADJ2 (terminal electrode end terminus "connecting land" end contact pin)) AND (fourth ADJ2 (terminal electrode end terminus "connecting land" end contact pin))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:15
S222	167	S221 and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:23
S223	33	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 13:51
S224	62	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 14:23
S225	6	S221 AND ((coil loop inductor	US-PGPUB;	OR	ON	2016/01/19

		inductance pattern conductive) NEAR3 (cross$3 across)) NEAR3 (space gap)	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:13
S226	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4)) NEAR3 (space gap)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:18
S227	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (top)) NEAR3 (substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:29
S228	57	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/19 16:47
S237	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/20 09:57

		20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S238	57	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/20 09:57
S239	12	S238 NOT S237	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/20 09:57

S240	1	S238 AND Kato	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/20 10:07
S241	17	("20050072595" | "20050116874" | "20060166506" | "20070020932" | "20070254432" | "20070279002" | "20080129439" | "20080200210" | "20080266748" | "20100289341" | "20100308187" | "20110127070" | "20110267248" | "20110285494" | "20120019075" | "20120049986" | "20140091614").PN.	US-PGPUB; USPAT	OR	ON	2016/05/06 15:59
S242	74	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-20110127070-$ or US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/05/06 16:01
S243	1713929	(receiv$3 or reception or pick-up or	US-PGPUB;	ADJ	ON	2016/05/06

		pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			16:03
S245	1	WO ADJ "2012150293"	US-PGPUB; USPAT; DERWENT	OR	ON	2016/05/06 16:16
S246	0	"2005116874".PN.	US-PGPUB; USPAT	OR	ON	2016/05/06 16:21
S247	1	"20050116874".PN.	US-PGPUB; USPAT	OR	ON	2016/05/06 16:21
S248	1	"20140091640".pn.	US-PGPUB	ADJ	ON	2016/05/06 16:35
S249	76	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-20110127070-$ or US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/05/06 16:36

S250	47	S249 AND S243	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/06 16:36
S251	31	S250 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/06 16:39
S252	723389	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:02
S253	2787	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)) SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second 2nd another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:19
S254	901	S253 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:50
S255	648	S254 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or PCB or base))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/07 17:51
S256	245	S255 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)) WITH ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:06
S257	45	S256 AND ((coil inductor inductance winding antenna) WITH (third 3rd) ADJ2 (terminal electrode end terminus "connecting land" end) WITH (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:14

S258	349	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) NEAR5 substrate) SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second 2nd another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:36
S259	92	S258 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:44
S260	272	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) NEAR5 substrate) SAME ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:00
S261	27	S260 AND ((coil inductor inductance winding antenna) WITH (third 3rd) ADJ2 (terminal electrode end terminus "connecting land" end) WITH (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:01
S262	11	S261 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:01
S263	9	S261 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below)) AND ((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4) NEAR3 (receiv$3 reception))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:04
S288	81	(US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/10/04 09:21

		20090115681-$ or US-20130271328-$ or US-20110127070-$ or US-20050072595-$).did. or (US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S290	1	S288 and kuk.inv.	US-PGPUB; USPAT	OR	ON	2016/10/04 09:32
S292	81	(US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$ or US-20050072595-$).did. or (US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/10/04 13:42

		or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S293	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2016/10/04 13:46
S294	38	S292 and ((coil WITH conductive OR conducting) OR etch$3 OR plating or deposed or deposition or depositing)	US-PGPUB; USPAT	OR	ON	2016/10/04 13:57
S295	41	S292 and (coil WITH conductive OR conducting or conductor)	US-PGPUB; USPAT	OR	ON	2016/10/04 14:03
S296	41	S292 and ((coil or inductor) WITH conductive OR conducting or conductor)	US-PGPUB; USPAT	OR	ON	2016/10/04 14:04
S297	1	"20130106198".pn.	US-PGPUB; USPAT	OR	ON	2016/12/08 12:10
S298	82	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/12/08 12:11

		or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S300	1967455	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4 or COMMUNICAT$3)) OR (COMMUNICATION ADJ TERMINAL)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 15:53
S301	9420	S300 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (communicat$3 or data) NEAR9 (surround$3 enclos$4 circl$3 encircl$3 outer outermost inner innermost inside outside) NEAR9 (coil loop winding antenna inductor inductance inductive pattern conductive)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 16:12
S302	1	"7712672".pn.	US-PGPUB; USPAT	OR	ON	2017/06/14 16:29
S303	84	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/14 16:31

		20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$ or US-7712672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$ or JP-2004364199-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S304	6	S303 and S301	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/14 16:31
S305	0	S301 and (connect$3) NEAR5 (overlap$5 overhang$3) NEAR5 (space area) WITH (parallel$2) NEAR10 (substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 16:47
S306	223	S301 and (parallel$2) NEAR10 (substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 16:49
S307	6	S304 and (parallel$2 plane planar or coplanar or co-planar OR (structure or size or shape) NEAR5 ("same" correspond$3 or identical or identically) WITH (substrate))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 17:11
S310	1994403	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4 or COMMUNICAT$3 or charg$3)) OR (COMMUNICATION ADJ TERMINAL)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 18:43

S311	85	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$ or US-20140091758-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$ or US-7712672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$ or JP-2004364199-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/14 18:52
S312	494304	S310 and (parallel$2 plane planar or coplanar or co-planar OR (structure or size or shape) NEAR5 ("same" correspond$3 or identical$2) WITH substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 18:53
S313	2108	S310 and (connect$3) AND (overlap$5 overhang$3) AND (receiv$3 ADJ (space area))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2017/06/14 18:59

			DERWENT; IBM_TDB			
S314	0	S311 AND S313	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 18:59
S315	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2017/06/14 19:06
S316	1	S315 AND (overlap$5 overhang$3 connect$3 ADJ10 under ADJ2 coil)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 19:09
S317	54	S311 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out" OR concave) WITH (substrate or board or printed-circuit-board or PCB or base or sheet))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/14 19:31
S318	5	S310 and (connect$3) AND (connect$3 ADJ10 under ADJ2 coil) AND (receiv$3 ADJ (space area))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 19:38
S319	5	S317 and (connect$3 NEAR7 (overlap$5 overhang$3) NEAR5 (space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out" OR concave) OR connect$3 ADJ10 under ADJ2 coil)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2017/06/14 19:44
S321	82	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/15 08:00

		20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S322	85	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/15 08:00

		or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$ or US-20140091758-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$ or US-7712672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$ or JP-2004364199-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S323	3	S322 NOT S321	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2017/06/15 08:00

6/15/2017 4:38:25 PM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L50	1023012	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4 or COMMUNICAT$3 or charg$3)) OR (COMMUNICATION ADJ TERMINAL)	US-PGPUB; USPAT	OR	ON	2017/06/15 15:47
L51	2681	L50 AND (((coil loop winding antenna inductor inductance inductive pattern conductive or aerial) NEAR5 (communicat$3 or data or signal or information) NEAR9 (surround$3 enclos$4 circl$3 encircl$3 outer outermost inner innermost inside outside) NEAR9 (coil loop winding antenna inductor inductance inductive pattern conductive))).clm.	US-PGPUB; USPAT	OR	ON	2017/06/15 15:48
L52	63	"Term Removed" or "Term Removed" or "Term Removed" or "Term Removed" or "Term Removed" or "Term Removed" or "Term Removed"	US-PGPUB; USPAT	OR	ON	2017/06/15 15:49
L53	5	L52 and L51	US-PGPUB; USPAT	OR	ON	2017/06/15 15:49
L54	222	L51 AND ((substrate or base NOT (based or basis or base ADJ station) or core or "ferrite magnet layer" sheet "magnetic shield") WITH (space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" or "lay out" or lay-out or "laid out" OR concave or area OR slit)).clm.	US-PGPUB; USPAT	OR	ON	2017/06/15 15:51
L55	8	L54 AND (connect$3 NEAR7 (overlap$5 overhang$3 fit fitt$3 insert$3 slid$3) NEAR5 (space or spacing or hole or area or void or opening or slot or slotted or slit or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" or concave)).clm.	US-PGPUB; USPAT	OR	ON	2017/06/15 15:52
L56	1	L55 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3 overhang$3) NEAR5 (space or spacing or area or void or hole or opening or slot or slotted or slit or gap or notch or notched or recess or recessed or shape or shaped or cut-out or cutout or "cut out" OR concave))).clm.	US-PGPUB; USPAT	OR	ON	2017/06/15 15:59
L58	0	L56 AND ((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (spiral spirally or helix	US-PGPUB; USPAT	OR	ON	2017/06/15 16:03

		or helically)).clm.				
L65	23010	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.)	US-PGPUB; USPAT	OR	ON	2017/06/15 16:35
L66	0	L56 AND L65	US-PGPUB; USPAT	OR	ON	2017/06/15 16:35
S229	104681	((coil inductor inductance winding antenna loop) WITH (conductive conducting copper etch$3 PCB printed layer pattern)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:09
S230	21955	S229 AND ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:11
S231	4812	S230 AND (receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency))).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:12
S232	1227	S231 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base)).clm.	US-PGPUB; USPAT	ADJ	ON	2016/01/19 16:14
S233	35	S232 AND (third ADJ2 (terminal electrode end terminus "connecting land" end contact pin)) AND (fourth ADJ2 (terminal electrode end terminus "connecting land" end contact pin)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:20
S234	0	S233 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4) NEAR3 (space gap notch notched)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:41
S235	0	S233 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across)) NEAR3 (space gap notch).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:43
S236	0	S233 AND (((coil loop inductor inductance pattern conductive) NEAR3 (top)) NEAR3 (substrate)).clm.	US-PGPUB; USPAT	OR	ON	2016/01/19 16:46
S264	107183	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 18:56
S265	23	S264 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) NEAR5 substrate) SAME ((second 2nd)ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:05
S266	2	S265 AND ((coil inductor inductance	US-	OR	ON	2016/05/07

		winding antenna) WITH (third 3rd) ADJ2 (terminal electrode end terminus "connecting land" end) WITH (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	PGPUB; USPAT			19:06
S267	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2016/05/07 19:07
S268	31	S264 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) WITH substrate) SAME ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:08
S269	355	S264 AND (((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) WITH substrate)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:10
S270	66	S269 AND ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:11
S271	9	S270 AND ((fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:12
S272	66	S270 AND ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:12
S273	104	S269 AND ((space or spacing or hole or opening or slot or slotted or gap or notch$2 or recess$2 or shape$2 or cut-out or design or designed or pattern$2 or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or PCB or base) WITH (connect$3 coupl$3)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:23
S274	2	S273 AND ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end) AND (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end)).clm.	US-PGPUB; USPAT	OR	ON	2016/05/07 19:26
S291	2	"Term Removed"	US-PGPUB	OR	ON	2016/10/04 09:21
S299	1	"Term Removed"	US-PGPUB	OR	ON	2016/12/08 12:11
S308	1	"Term Removed"	US-PGPUB	OR	ON	2017/06/14 15:29
S309	1	"Term Removed"	US-PGPUB	OR	ON	2017/06/14 16:31
S320	1	"Term Removed"	US-PGPUB	OR	ON	2017/06/14 18:52

6/15/2017 4:38:42 PM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	13/663,012
				Filing Date	October 29, 2012
				First Named Inventor	Jeong Wook An
(use as many sheets as necessary)				**Art Unit**	2836
				Examiner Name	
Sheet	1	of	1	**Attorney Docket Number**	SUN.LGI.420

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2001027687-A	01-30-2001	ISHIKAWAJIMA HARIMA HEAVY IND	ALL	

Examiner Signature	/JAMES P EVANS/	Date Considered	06/14/2017

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kind Codes of USPTO Patent Documents at www.uspto.gov or MPEP901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard T.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

J:\SUN\LGI\420\IDS-Refs\5-25-17\PTO-SB-08(10).doc/mep

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	2836

CPC- SEARCHED

Symbol	Date	Examiner
H04B5/0037	1/29/2015	JPE
H04B5/0081	1/29/2015	JPE
H01F41/14	1/29/2015	JPE
H01F38/14	8/13/2015	JPE
Re-searched all symbols above	1/19/2016	JPE
Re-searched all symbols above	5/7/2016	JPE
Reviewed against new art	12/8/2016	JPE
Reviewed all above against amended claims	6/15/2017	JPE

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
307	104	1/29/2015	JPE
713	300	8/13/2015	JPE
Re-searched all above	Re-searched all subclasses above	1/19/2016	JPE
Re-searched all classes above	Re-searched all subclasses above	5/7/2016	JPE

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Search	1/21/2015	JPE
Keyword search	1/20/2015	JPE
IP.com search	1/20/2015	JPE
and all docs cited in European search report	1/20/2015	JPE
Search with SSE (Michael Obinna)	1/26/2015	JPE

/JAMES P EVANS/
Examiner.Art Unit 2836

SEARCH NOTES

Search Notes	Date	Examiner
Consulted Jared Fureman (SPE)	1/29/2015	JPE
Consulted Primary Dan Cavallari	8/13/2015	JPE
Consulted Primary Alex Gilman in Connectors	8/13/2015	JPE
Consulted Primary Carlos Amaya	8/14/2015	JPE
Consulted Primary Bob Deberadinis	8/17/2015	JPE
Searched amended claims	1/19/2016	JPE
Consulted Primary Ken Wells	1/19/2016	JPE
Added IDS docs, reviewed them, and performed augmented searches	5/7/2016	JPE
Consulted Primary Ken Wells	5/7/2016	JPE
Consulted Primary John Kim and SPE Jared Fureman	10/5/2016	JPE
Search Amended Claims with and without search classes	6/13/2017	JPE
Consulted Primary Dan Cavallari re: Allowance	6/15/2017	JPE

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04B	5/0037	1/19/2016	JPE
Re-searched above	Re-searched above	5/7/2016	JPE
H04B	5/0037 and many other classes See EAST history	6/15/2017	JPE

/JAMES P EVANS/ Examiner.Art Unit 2836	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	2836

CPC

Symbol						Type	Version
H02J		50	/	10		F	2016-02-01
Y10T		29	/	4902		A	2015-01-15
B60L		11	/	182		I	2013-01-01
G06K		19	/	0723		I	2013-01-01
H02J		5	/	005		I	2013-01-01
H02J		7	/	025		I	2013-01-01
H01F		41	/	14		I	2013-01-01
H04B		5	/	0037		I	2013-01-01
H04B		5	/	0081		I	2013-01-01
Y02T		90	/	122		A	2013-01-01
H02J		17	/	00		I	2013-01-01
Y02T		10	/	7005		A	2013-01-01
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Y02T		10	/	7072		A	2013-01-01
H02J		50	/	12		I	2016-02-01
H01F		38	/	14		I	2013-01-01
H04W		4	/	008		A	2013-01-01

CPC Combination Sets

Symbol					Type	Set	Ranking	Version
			/					
			/					

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	6/15/2017 (Date)	**Total Claims Allowed:** 20
/DANIEL CAVALLARI/ Primary Examiner.Art Unit 2836 (Primary Examiner)	06/16/2017 (Date)	O.G. Print Claim(s): 1 / O.G. Print Figure: 11

U.S. Patent and Trademark Office

Part of Paper No. 20170614

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	2836

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

INTERNATIONAL CLASSIFICATION					
CLAIMED					NON-CLAIMED
H	0	4	B	5 / 00 (2006.01.01)	
H	0	2	J	50 / 10	
H	0	2	J	50 / 12	

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	6/15/2017 (Date)	**Total Claims Allowed:** 20
/DANIEL CAVALLARI/ Primary Examiner.Art Unit 2836 (Primary Examiner)	06/16/2017 (Date)	O.G. Print Claim(s): 1 / O.G. Print Figure: 11

U.S. Patent and Trademark Office

Part of Paper No. 20170614

Issue Classification	**Application/Control No.** 13663012	**Applicant(s)/Patent Under Reexamination** AN ET AL.
	Examiner JAMES P EVANS	**Art Unit** 2836

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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-	2	-	18	15	34										
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-	15	-	31												
-	16	13	32												

/JAMES P EVANS/ Examiner.Art Unit 2836 (Assistant Examiner)	6/15/2017 (Date)	**Total Claims Allowed:** 20	
/DANIEL CAVALLARI/ Primary Examiner.Art Unit 2836 (Primary Examiner)	06/16/2017 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 11

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	James P. Evans
Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	2007/0095913-A1	05-03-2007	Takahashi *et al.*	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2004364199-A	12-24-2004	Sony Corp.	ALL	
	F2	JP-H10282232-A	10-23-1998	Toshiba Corp.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated February 14, 2017 in Japanese Application No. 2015501586.	

Examiner Signature	/JAMES P EVANS/	Date Considered	06/14/2017

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

Electronic Patent Application Fee Transmittal

Application Number:	13663012
Filing Date:	29-Oct-2012
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/Seneca Miller
Attorney Docket Number:	SUN.LGI.420

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	29344180
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Seneca Miller
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	30-MAY-2017
Filing Date:	29-OCT-2012
Time Stamp:	16:42:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$180
RAM confirmation Number	053117INTEFSW00004132190065
Deposit Account	190065
Authorized User	Seneca Miller

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	30621 7403ec47810bec34b4d400cbae8ac8238c482177	no	2

Warnings:

Information:

Total Files Size (in bytes):	30621

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Complete if Known	
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Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	
Attorney Docket Number	SUN.LGI.420

Sheet 1 of 1

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	F1	JP-2001027687-A	01-30-2001	ISHIKAWAJIMA HARIMA HEAVY IND	ALL	

Examiner Signature		Date Considered	

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Espacenet

Bibliographic data: JP2001027687 (A) — 2001-01-30

VENT PIPE BELLOWS-INSPECTING APPARATUS

Inventor(s): KOBAYASHI SHUNJI + (KOBAYASHI SHUNJI)

Applicant(s): ISHIKAWAJIMA HARIMA HEAVY IND + (ISHIKAWAJIMA HARIMA HEAVY IND CO LTD)

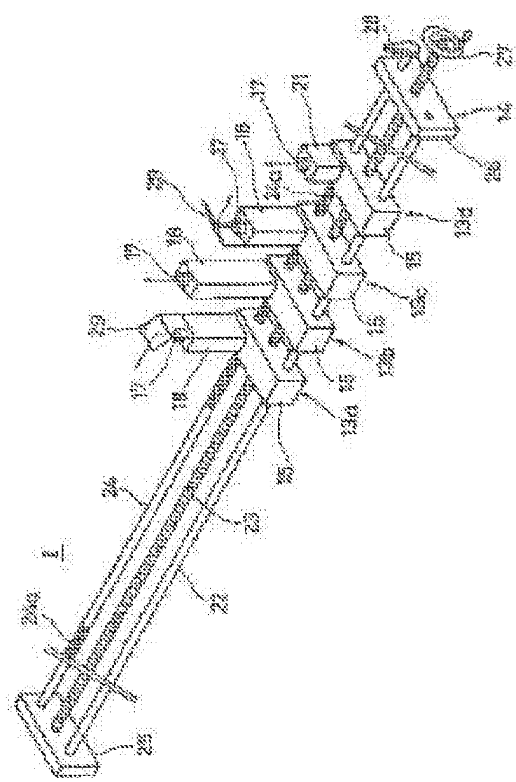
Classification: - **international:** ***G21C17/003; G21C9/004;*** (IPC1-7): G21C17/003; G21C9/004
- **cooperative:** Y02E30/40

Application number: JP19990200914 19990714 Global Dossier

Priority number (s): JP19990200914 19990714

Abstract of JP2001027687 (A)

PROBLEM TO BE SOLVED: To inspect a vent pipe bellows of a reactor from the side of an inner face in a simple operation. SOLUTION: In the vent pipe bellows-inspecting apparatus, an inspection unit 13a for inspecting a front belly part of a bellows, an inspection unit 13b for inspecting a ridge part, an inspection unit 13c for inspecting a rear belly part and an inspection unit 13d for inspecting a valley part are arranged in accordance with an interval of the bellows for absorbing a relative movement of a vent pipe and a suppression chamber. The inspection units 13a, 13b and 13c enable high trestles 18 with CCD cameras 17 set to leading ends to stand up and lie down. The inspection unit 13d has a low fixed trestle 21 having a CCD camera 17 set to a leading end part. Each of the inspection units 13a, 13b, 13c and 13d is moved in a longitudinal direction of the vent pipe by a movement operation mechanism 14.



(19)日本国特許庁（JP）　　(12) 公開特許公報（A）　　(11)特許出願公開番号

特開2001－27687

（P2001－27687A）

(43)公開日　平成13年1月30日(2001.1.30)

(51)Int.Cl.⁷	識別記号	FI	テーマコード（参考）
G21C 17/003	GDB	G21C 17/00	GDBE 2G002
9/004		9/00	A 2G075

審査請求　未請求　請求項の数4　OL　（全 8 頁）

(21)出願番号　特願平11－200914

(22)出願日　平成11年7月14日(1999.7.14)

(71)出願人　000000099
石川島播磨重工業株式会社
東京都千代田区大手町2丁目2番1号

(72)発明者　小林　俊二
神奈川県横浜市磯子区新中原町1番地　石川島播磨重工業株式会社横浜エンジニアリングセンター内

(74)代理人　100087527
弁理士　坂本　光雄

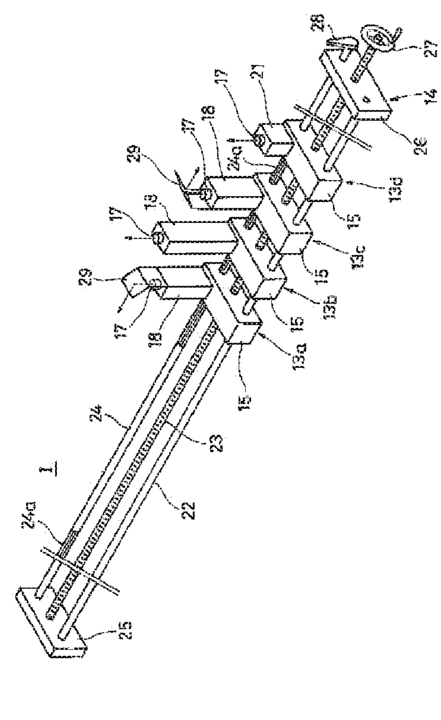
Fターム(参考)　2G002 AA02 EA10
2G075 AA03 BA17 CA10 DA15 FA13
FC03 FC14 GA02 GA09

(54)【発明の名称】　ベント管ベローズ点検装置

(57)【要約】

【課題】　原子炉のベント管ベローズを、簡単な段取りで内面側から点検できるようにする。

【解決手段】　ベント管とサプレッションチャンバとの相対変位を吸収するためのベローズの蛇腹間隔に合わせて、ベローズの前側腹部を点検する点検ユニット13aと、山部を点検する点検ユニット13bと、後側腹部を点検する点検ユニット13cと、谷部を点検する点検ユニット13dを配列する。点検ユニット13a，13b，13cは、先端にCCDカメラ17を取り付けた背丈の高い架台18を起伏可能に有する。点検ユニット13dは、先端部にCCDカメラ17を取り付けた背丈の低い固定の架台21を有する。各点検ユニット13a，13b，13c，13dを、移動操作機構14によりベント管の長手方向に沿わせて移動させる。



【特許請求の範囲】

【請求項１】　原子炉格納容器の下部に一端を取り付けたベント管の他端部をベントノズルを通してサプレッションチャンバ内に挿入し、途中に蛇腹形状のベローズを組み込んだ外管の一端を上記ベントノズルの先端側に接続すると共に、該外管の他端をベント管の外周面に接合して、ベント管の外周面とベントノズルの内周面との間の隙間をシールさせるようにしてあり、且つ上記ベローズの長手継手部を、該ベローズの全長にわたり点検するベント管ベローズ点検装置において、上記隙間を通過できる大きさとした複数の支持ブロックをガイドレールに沿い移動できるようにし、該各支持ブロック毎に架台を立ててその先端にＣＣＤカメラを取り付けてなるベローズ腹部点検ユニットとベローズ山部点検ユニットとベローズ谷部点検ユニットとを別々に構成して、各点検ユニットを上記ベローズの蛇腹間隔に合わせて配列し、且つ上記腹部点検ユニットと山部点検ユニットの各架台を各支持ブロックに起伏可能とし、更に、上記各点検ユニットを同時に前進後退させる移動操作機構を備えた構成を有することを特徴とするベント管ベローズ点検装置。

【請求項２】　腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、操作ロッドを各支持ブロックに回転自在に貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台を操作ロッドを中心に回転して傾動できるようにし、且つ該操作ロッドのベローズの領域に亘る範囲内に長手方向に延びる突条部を設け、一方、上記各架台の操作ロッド貫通部に、上記操作ロッド上の突条部と係合し得るスプライン溝をそれぞれ設け、更に、上記操作ロッドの突条部のない部分で各架台が倒伏できるようにする構成とした請求項１記載のベント管ベローズ点検装置。

【請求項３】　腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、傾動操作用のガイドレールを各支持ブロックに貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台をガイドレールを中心に回転して傾動できるようにし、且つ、該ガイドレールの外表面部に、ベローズの蛇腹間隔に合わせて９０°の範囲で波形に形成したガイド溝を長手方向へ一連に設け、一方、上記各架台のガイドレール貫通部に、上記ガイド溝に係合させるようにした突起を有する構成とした請求項１記載のベント管ベローズ点検装置。

【請求項４】　各点検ユニットの支持ブロックを一体化させた請求項１、２又は３記載のベント管ベローズ点検装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は原子炉圧力容器を格納する原子炉格納容器におけるベント管ベローズ点検装置に関するものである。

【０００２】

【従来の技術】原子力プラントで用いられている沸騰水形原子炉（ＢＷＲ）におけるＭＡＲＫ－Ｉ型と呼ばれる原子炉格納容器部分の構造は、図５に概略を示す如く、基礎１上に立設したＲＰＶペデスタル２上に、原子炉圧力容器（ＲＰＶ）３を支持させ、該原子炉圧力容器３及びＲＰＶペデスタル２を取り囲むように原子炉格納容器（ＰＣＶ）４を構築して、その外側を建屋で覆うようにし、更に、原子炉圧力容器３を格納する上記原子炉格納容器４の下部周辺部の建屋内に、環状のサプレッションチャンバ５を設置し、且つ原子炉格納容器４の下部の周方向複数個所に取り付けた複数本のベント管６を、サプレッションチャンバ５に対応させて取り付けたベントノズル７を通してサプレッションチャンバ５内に挿入し、ベント管６とベントノズル７とをシールして上記原子炉格納容器４とサプレッションチャンバ５とを接続するようにしている。

【０００３】上記ベント管６とベントノズル７との関係は、図６及び図７（イ）（ロ）に示す如く、原子炉格納容器４に一端を取り付けて内部に連通させたベント管６の先端側を、サプレッションチャンバ５に一端側を貫通させて取り付けて他端側を外方へ突出させてあるベントノズル７内を通してサプレッションチャンバ５内に挿入し、且つ該ベント管６の基端側となるサプレッションチャンバ５の外側に位置する外周面部分に、途中に補強用リング９にて補強された蛇腹形状のベローズ１０を組み込んで伸縮できるようにし且つベローズ１０をカバー１１で覆った構成としてある外管８を同心状に配置して、該外管８の一端を溶接にてベント管６の外側面に固定すると共に、該外管８の他端側（サプレッションチャンバ５側）をベントノズル７の先端部（上端部）に溶接することにより、ベント管６の外周面とベントノズル７の内周面との間の隙間Ｓをシールするようにし、原子炉格納容器４の膨張、収縮に伴うベント管６とサプレッションチャンバ５との間の相対変位をベローズ１０により吸収させるようにしてある。

【０００４】上記ベローズ１０は、たとえば、周方向に２分割されたものを溶接して一体化するようにしてあり、そのため、図７（ロ）に示す如く軸方向を長手とする継手部１２が形成されることになる。

【０００５】一方、上記ベローズ１０は蛇腹形状であることから、サプレッションチャンバ５内のプール水によって生じた水蒸気の結露現象により、塵埃等が凹凸部内面に付着することがあり、その付着量が多くなると局部電池作用でベローズ１０に孔食現象が生じる可能性があり、そのため、上記ベローズ１０の内面を清掃したり、点検したりする必要があり、特に、長手継手部１２を点検することは重要事項の一つとなっている。

【０００６】

【発明が解決しようとする課題】ところが、ベント管６

とベントノズル7との間の隙間Sは、通常、50㎜程度と狭隘であるため、ベローズ10の長手継手部12を内面側から点検することは困難である。因に、ベローズ10の内面を清掃する装置としては、特開平3−190284号公報に提案されているものがあるが、この清掃装置を応用したとしても、ベローズ10の山部の内面部分を周方向にしか点検することができず、ベローズ10の谷部や腹部の内面を含めて長手方向に点検を行うことはできない。したがって、これまでは、ベローズ10の長手継手部12を内面側から点検することは行われていなかった。

【0007】そこで、本発明は、ベローズの長手継手部の点検作業を、段取りに時間を要することなくベローズの内面側から容易に行うことができるようなベント管ベローズ点検装置を提供しようとするものである。

【0008】

【課題を解決するための手段】本発明は、上記課題を解決するために、原子炉格納容器の下部に一端を取り付けたベント管の他端部をベントノズルを通してサプレッションチャンバ内に挿入し、途中に蛇腹形状のベローズを組み込んだ外管の一端を上記ベントノズルの先端側に接続すると共に、該外管の他端をベント管の外周面に接合して、ベント管の外周面とベントノズルの内周面との間の隙間をシールさせるようにしてあり、且つ上記ベローズの長手継手部を、該ベローズの全長にわたり点検するベント管ベローズ点検装置において、上記隙間を通過できる大きさとした複数の支持ブロックをガイドレールに沿い移動できるようにし、該各支持ブロック毎に架台を立ててその先端にCCDカメラを取り付けてなるベローズ腹部点検ユニットとベローズ山部点検ユニットとベローズ谷部点検ユニットとを別々に構成して、各点検ユニットを上記ベローズの蛇腹間隔に合わせて配列し、且つ上記腹部点検ユニットと山部点検ユニットの各架台を各支持ブロックに起伏可能とし、更に、上記各点検ユニットを同時に前進後退させる移動操作機構を備えた構成とする。

【0009】ベローズの長手継手部を点検する場合は、ベントノズルの開口端から隙間を通して外管の奥側端部まで挿入し、移動操作機構の操作で各点検ユニットを前進させて行くようにする。この際、ベローズの谷部を通過させる場合は、背丈の高い架台は横倒しさせるようにし、通過後、起立させるようにする。これにより、各CCDカメラによってベローズの腹部、山部、谷部を順次撮像することができる。

【0010】又、腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、操作ロッドを各支持ブロックに回転自在に貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台を操作ロッドを中心に回転して傾動できるようにし、且つ該操作ロッドのベローズの領域に亘る範囲内に長手方向に延びる突条部を設け、一方、上記各架台の操作ロッド貫通部に、上記操作ロッド上の突条部と係合し得るスプライン溝をそれぞれ設け、更に、上記操作ロッドの突条部のない部分で各架台が倒伏できるようにする構成とした場合は、ベローズの領域で操作ロッドを90°回転させると、突条部とスプライン溝との係合により架台を横倒しできるので谷部を通過させることができ、ベローズのない領域では、操作ロッド表面に突条部がないので、各架台のスプライン溝は規制されることがなく、架台は横倒しされる。

【0011】更に、腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、傾動操作用のガイドレールを各支持ブロックに貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台をガイドレールを中心に回転して傾動できるようにし、且つ、該ガイドレールの外表面部に、ベローズの蛇腹間隔に合わせて90°の範囲で波形に形成したガイド溝を長手方向へ一連に設け、一方、上記各架台のガイドレール貫通部に、上記ガイド溝に係合させるようにした突起を有する構成とした場合は、支持ブロックの移動に伴い突起がガイド溝に沿わされるので、架台はベローズの領域で自動的に起伏させられることになる。

【0012】更に又、各点検ユニットの支持ブロックを一体化させた構成とすることによって、構造のより単純化を図ることができる。

【0013】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照して説明する。

【0014】図1乃至図3(イ)(ロ)は本発明の実施の一形態を示すもので、図6及び図7(イ)(ロ)に示したと同様に、原子炉格納容器4の下部に一端を取り付けたベント管6の他端部をベントノズル7を通してサプレッションチャンバ5内に挿入し、途中に蛇腹形状のベローズ10を組み込んで自在に伸縮できるようにした外管8の一端を上記ベントノズル7の先端側に接続すると共に、該外管8の他端をベント管6の外周面に接合して、ベント管6の外周面とベントノズル7の内周面との間の隙間Sをシールさせるようにしてある構成における上記ベローズ10の長手継手部12を、上記隙間Sに挿入して内面側から点検するためのベント管ベローズ点検装置Iとする。

【0015】上記ベント管ベローズ点検装置Iは、蛇腹形状のベローズ10の前側腹部10aを点検するための点検ユニット13aと、山部10bを点検するための点検ユニット13bと、後側腹部を10cを点検するための点検ユニット13cと、谷部10dを点検するための点検ユニット13dとを、ベローズ10の蛇腹間隔に合わせてベント管6の長手方向に沿う前後方向に所要間隔を隔てて配列し、且つこれら各点検ユニット13a,13b,13c,13dを前後方向へ移動させる移動操作

機構１４を備えている。
【００１６】上記各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄのうち、点検ユニット１３ａ，１３ｂ，１３ｃは、ほぼ同一構成としてあり、点検ユニット１３ａ，１３ｃについては、図３（イ）（ロ）に詳細を示す如く、隙間Ｓに対応させて横向きに配した直方体状の支持ブロック１５の一端部に、上面から側面に至る切り欠き溝１６を設けて、該切り欠き溝１６に、先端にＣＣＤカメラ１７を取り付けた架台１８の基端部を、スリーブ軸１９を介しほぼ９０°の範囲で起伏自在に組み付け、且つ上記スリーブ軸１９の長手方向一端部にねじりコイルばね２０を装着し、該ねじりコイルばね２０の一端部を、切り欠き溝１６の奥側延長底部１６ａに係合させると共に、ねじりコイルばね２０の他端部を、架台１８の前後面に係合させて、ねじりコイルばね２０の作用で架台１８に常時倒伏力が付与されるようにしてある。又、上記スリーブ軸１９の内周面には、架台１８の起立時と倒伏時で位相がずれるようにした適数本のスプライン溝１９ａが設けてある。
【００１７】なお、上記点検ユニット１３ａ，１３ｃの架台１８は、起立時にＣＣＤカメラ１７がベローズ１０の腹部１０ａ，１０ｃ内面に近接するような高さ（長さ）としてあり、且つ腹部１０ａ，１０ｃを撮像するために、それぞれ反射ミラー２９が装備されている。又、点検ユニット１３ｂの架台１８は、起立時にＣＣＤカメラ１７がベローズ１０の山部１０ｂ内面に近接するような高さ（長さ）としてある。一方、点検ユニット１３ｄは、ベローズ１０の谷部１０ｄ内面をＣＣＤカメラ１７で撮像するために、背丈の低い架台２１を支持ブロック１５の一端部上に固定設置してあり、更に、支持ブロック１５の一端部における上記スリーブ軸１９と同軸心線上の位置に、単なる貫通孔又はスプライン溝のないスリーブ軸が設けてある。
【００１８】上記移動操作機構１４は、ベントノズル７の開口端から外管８の閉塞端に至る長さよりも若干長くしたガイドレール２２とスクリューロッド２３と操作ロッド２４とを平行に配置し、且つ上記各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄの支持ブロック１５に、ガイドレール２２と操作ロッド２４を摺動自在に貫通させると共に、スクリューロッド２３を貫通螺合させ、更に、ガイドレール２２の両端部は前後の支持フレーム２５，２６に固定し、スクリューロッド２３と操作ロッド２４の両端部は前後の支持フレーム２５，２６に回転自在に支持させ、スクリューロッド２３を後端のハンドル２７の操作で回転させることにより、各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄがガイドレール２２に沿って移動できるようにしてある。又、上記操作ロッド２４は、上記スリーブ軸１９と共に架台１８を起伏させる機構を形成するようにしてあって、ベローズ１０と対応する位置のみに、スリーブ軸１９のスプライン溝１９ａに嵌合し得る突条部２４ａを長手方向に形成し、スリーブ軸１９のスプライン溝１９ａと突条部２４ａとの係合状態において、後端のレバー２８で操作ロッド２４を回動させることにより架台１８を起伏させられるようにしてある。
【００１９】ベローズ１０の長手継手部１２を点検する場合は、各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄを支持フレーム２６側に位置させておいた状態として、点検装置Ｉの支持フレーム２５側を、ベントノズル７の開口端から隙間１２を通して外管８の奥側端部まで挿入して、支持フレーム２６側部分がベントノズル７から露出位置するようにセットした後、スクリューロッド２３の回転操作で各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄをガイドレール２２に沿わせて前進させて行くようにするが、この場合、点検ユニット１３ａ，１３ｂ，１３ｃの各架台１８は、スリーブ軸１９のスプライン溝１９ａと操作ロッド２４の突条部２４ａとが係合していないときに、ねじりコイルばね２０の作用で横向きに倒れて隙間Ｓ内に介在する状態にあり、又、点検ユニット１３ｄの架台２１は背丈が低いため、ベローズ１０の位置に達するまでは隙間Ｓ内を支障なく前進することができる。
【００２０】上記において、架台１８が倒れているときのスリーブ軸１９のスプライン溝１９ａと、レバー２８を立てているときの操作ロッド２４の突条部２４ａとの位相がずれているように設定しておくと、たとえば、先頭の点検ユニット１３ａがベローズ１０の端部位置に到着したときに、スリーブ軸１９のスプライン溝１９ａは突条部２４ａに係合できないため、その時点で前進移動が停止させられてしまうことになる。そこで、このときに、レバー２８を横向きに倒して操作ロッド２４を９０°回転させるようにすると、図３（ロ）に示す如く、上記スリーブ軸１９のスプライン溝１９ａと操作ロッド２４の突条部２４ａの位相が一致するため、スクリューロッド２３を回転させると、スリーブ軸１９が突条部２４ａに乗り移ることになって、点検ユニット１３ａはベローズ１０の谷部１０ｄと干渉することなく前進を再開することができる。したがって、点検ユニット１３ａが所要量前進した後、レバー２８を立てて操作ロッド２４を９０°回転させると、図３（イ）に示す如く、架台１８はねじりコイルばね２０に抗し起立させられてベローズ１０の最初の内側凹部内に位置させられることになるので、ＣＣＤカメラ１７によりベローズ１０の最初の内側凹部の前側腹部１０ａを内面側から撮像することができる。
【００２１】更に、上記のように、先頭の点検ユニット１３ａがベローズ１０の内側凹部内に入っているとき、先頭から２番目の点検ユニット１３ｂはベローズ１０の端部位置に到着しているが、同様にそれ以上前進移動できないので、次に、再びレバー２８を横向きに倒して操

作ロッド２４を９０°回転させるようにする。これにより、２番目の点検ユニット１３ｂのスリーブ軸１９のスプライン溝１９ａと操作ロッド２４の突条部２４ａの位相が一致するため、スクリューロッド２３を回転させると、スリーブ軸１９が突条部２４ａに乗り移ることにより、２番目の点検ユニット１３ｂは前進を再開することができる。又、この時、先頭の点検ユニット１３ａも、上記操作ロッド２４の９０°の回転により倒伏状態となっており、その状態のまま、同時に前進させられることになる。したがって、所要量前進した後、レバー２８を立てて操作ロッド２４を回転させると、先頭の点検ユニット１３ａの架台１８がベローズ１０の端から２番目の内側凹部内に、又、２番目の点検ユニット１３ｂの架台１８がベローズ１０の最初の内側凹部内に起立位置させられることになる。これにより、先端の点検ユニット１３ａのＣＣＤカメラ１７によって、ベローズ１０の端から２番目の内側凹部の前側腹部１０ａを撮像することができると同時に、２番目の点検ユニット１３ｂのＣＣＤカメラ１７によって、ベローズ１０の最初の内側凹部の山部１０ｂを撮像することができる。

【００２２】このような操作を順次繰り返すことにより、ベローズ１０の各内側凹部の前側腹部１０ａ、山部１０ｂ、後側腹部１０ｃ、谷部１０ｄを各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄのＣＣＤカメラ１７で順次撮像して行くことでベローズ１０の長手継手部１２を点検することができる。

【００２３】図２において、ベローズ１０はベント管６の長手方向の２個所に組み付けられているため、サプレッションチャンバ５側のベローズ１０の点検が終了した後は、原子炉格納容器４側のベローズ１０の点検に移行することになるが、この場合、点検ユニット１３ａ，１３ｂ，１３ｃは、前進に伴い、操作ロッド２４の突条部２４ａから突条部のない部分に乗り移ることになり、スリーブ軸１９が突条部２４ａから離脱した時点でねじりコイルばね２０の作用で架台１８が横倒しされることになるので、二点鎖線で示すように、各点検ユニット１３ａ，１３ｂ，１３ｃ及び１３ｄは両側のベローズ１０間の狭隘部でも支障なく移動することができる。各点検ユニット１３ａ，１３ｂ，１３ｃ及び１３ｄが原子炉格納容器４側のベローズ１０の位置に到着した後は、上述した操作と同様な操作を行うことにより、原子炉格納容器４側のベローズ１０の長手継手部１２を内面側から点検することができる。

【００２４】このように、本発明では、点検装置Ｉを、ベントノズル７とベント管６との間の隙間Ｓに後端部を除いて全体的に挿入位置させるだけでよいので、段取りが容易である。又、点検ユニット１３ａ，１３ｂ，１３ｃの各架台１８はねじりコイルばね２０により自動的に横倒れするようにしてあるため、ベント管６の下側に挿入配置する場合でも、架台１８が垂れ下がることはなく、隙間Ｓ内を支障なく通過できるので、点検作業を短時間にて行うことができる。

【００２５】次に、図４（イ）（ロ）は本発明の実施の他の形態として、点検ユニット１３ａ，１３ｂ，１３ｃ（図では１３ａのみを示す）の架台１８を起伏させるための別の機構例を示すものである。

【００２６】すなわち、図１乃至図３（イ）（ロ）に示した実施の形態における突条部２４ａを有する操作ロッド２４に代えて、支持フレーム２５，２６間にロッド状の傾動操作用ガイドレール２９を固定支持させて、該ガイドレール２９を、各架台１８のスリーブ軸１９に摺動自在に貫通させ、且つ該ガイドレール２９の外表面部に、ベローズ１０の領域では蛇腹間隔に合わせて９０°の範囲で波形に変向すると共にベローズ１０のない狭隘部の領域では直線状に延びるようにしたガイド溝３０を、長手方向に沿い一連に設け、一方、架台１８側のスリーブ軸１９の内面に、上記ガイド溝３０に係合させるようにした半球状の如き突起１９ｂを設けて、突起１９ｂがガイド溝３０に沿わされることにより架台１８が起伏させられるようにした構成としてある。その他は図１乃至図３（イ）（ロ）に示したものと同様な構成としてある。

【００２７】図４（イ）（ロ）に示す実施の形態の場合には、スクリューロッド２３の回転操作で各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄを前進させて行くと、ベローズ１０のない領域では、架台１８側の突起１９ｂがガイドレール２９側のガイド溝３０の直線状部分に沿わされるので、各架台１８は倒伏姿勢に維持されたまま隙間Ｓ内を支障なく通過することができ、更に、ベローズ１０の領域に到着すると、上記突起１９ｂがガイド溝３０の波形部分に沿わされることから、架台１８は、ベローズ１０の内側凹部の位置では図４（イ）おいて実線で示す如く自動的に起立させられ、ベローズ１０の谷部１０ｄの位置を通過するときには二点鎖線で示す如く自動的に倒伏させられる。したがって、スクリューロッド２３の回転操作のみで架台１８の起伏を自動的に行わせることができるので、図１乃至図３（イ）（ロ）に示した実施の形態の場合よりも、ベローズ１０の長手継手部１２の点検作業をより簡単に行うことができる。

【００２８】なお、本発明は上記実施の形態にのみ限定されるものではなく、たとえば、支持ブロック１５に設ける架台１８の位置は逆側の端部であってもよいこと、ガイドレールの本数は任意に選定し得ること、図３（イ）（ロ）におけるねじりコイルばね２０に代えて、所要位置に圧縮ばね又は引張ばねを取り付けてもよいこと、又、これらばねを用いることなく架台が自動で倒れるようにしてもよいこと、更に、各点検ユニット１３ａ，１３ｂ，１３ｃ，１３ｄの間隔を全く調整する必要のないときには、各支持ブロック１５を一体化することにより一つの点検ユニットとして構造の更なる単純化を

図るようにしてもよいこと、その他本発明の要旨を逸脱しない範囲内において種々変更を加え得ることは勿論である。

【0029】

【発明の効果】以上述べた如く、本発明のベント管ベローズ点検装置によれば、原子炉格納容器の下部に一端を取り付けたベント管の他端部をベントノズルを通してサプレッションチャンバ内に挿入し、途中に蛇腹形状のベローズを組み込んだ外管の一端を上記ベントノズルの先端側に接続すると共に、該外管の他端をベント管の外周面に接合して、ベント管の外周面とベントノズルの内周面との間の隙間をシールさせるようにしてあり、且つ上記ベローズの長手継手部を、該ベローズの全長にわたり点検するベント管ベローズ点検装置において、上記隙間を通過できる大きさとした複数の支持ブロックをガイドレールに沿い移動できるようにし、該各支持ブロック毎に架台を立ててその先端にCCDカメラを取り付けてなるベローズ腹部点検ユニットとベローズ山部点検ユニットとベローズ谷部点検ユニットとを別々に構成して、各点検ユニットを上記ベローズの蛇腹間隔に合わせて配列し、且つ上記腹部点検ユニットと山部点検ユニットの各架台を各支持ブロックに起伏可能とし、更に、上記各点検ユニットを同時に前進後退させる移動操作機構を備えた構成としてあるので、ベント管とベントノズルとの間の隙間に全体的に挿入するだけで段取りを行うことができ、又、移動操作機構により各点検ユニットを長手継手部の方向に沿わせて移動させることができ、且つベローズの谷部を通過させるときには腹部点検ユニットと山部点検ユニットの架台を横倒しすることができることから、ベローズの長手継手部を内面側から簡単に点検することができ、又、腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、操作ロッドを各支持ブロックに回転自在に貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台を操作ロッドを中心に回転して傾動できるようにし、且つ該操作ロッドのベローズの領域に亘る範囲内に長手方向に延びる突条部を設け、一方、上記各架台の操作ロッド貫通部に、上記操作ロッド上の突条部と係合し得るスプライン溝をそれぞれ設け、更に、上記操作ロッドの突条部のない部分で各架台が倒伏できるようにする構成としたものとすることにより、スクリューロッドと操作ロッドの回転操作によって腹部点検ユニットと山部点検ユニットの架台を容易に倒伏させることができ、更に、腹部点検ユニットと山部点検ユニットの架台を起伏させる機構として、傾動操作用のガイドレールを各支持ブロックに貫通させると共に各点検ユニットの各架台の基端部に摺動自在に貫通させて、各架台をガイドレールを中心に回転して傾動できるようにし、且つ、該ガイドレールの外表面部に、ベローズの蛇腹間隔に合わせて90°の範囲で波形に形成したガイド溝を長手方向へ一連に設け、一方、上記各架台のガイドレール貫通部に、上記ガイド溝に係合させるようにした突起を有する構成としたものとすることにより、スクリューロッドの回転操作のみで架台を倒伏させることができてより有利となり、更に又、各点検ユニットの支持ブロックを一体化させた構成とすることによって、構造のより単純化を図ることができる、等の優れた効果を発揮する。

【図面の簡単な説明】

【図1】本発明のベント管ベローズ点検装置の実施の一形態を示す全体の概略斜視図である。

【図2】本発明のベント管ベローズ点検装置で点検しているときの状態を示す概略側面図である。

【図3】本発明のベント管ベローズ点検装置における前側の腹部点検ユニットの詳細を示すもので、(イ)は架台の起立状態を示す一部切断背面図、(ロ)は架台の倒伏状態を示す一部切断背面図である。

【図4】本発明の実施の他の形態を示すもので、(イ)は前側の腹部点検ユニットの部分を拡大して示す斜視図、(ロ)は(イ)のA－A方向矢視図である。

【図5】沸騰水型原子炉の格納容器部分の構造の一例を示す概略図である。

【図6】ベント管とベントノズルとの関係を示す断面図である。

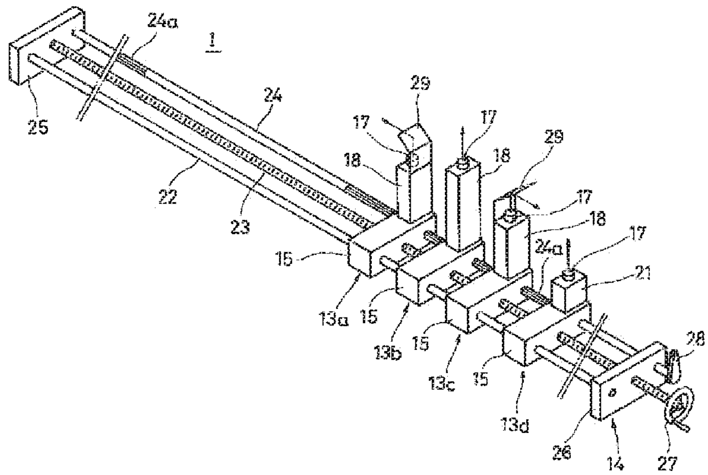
【図7】図6のB部を拡大して示すもので、(イ)は切断側面図、(ロ)は(イ)のC－C方向矢視図である。

【符号の説明】

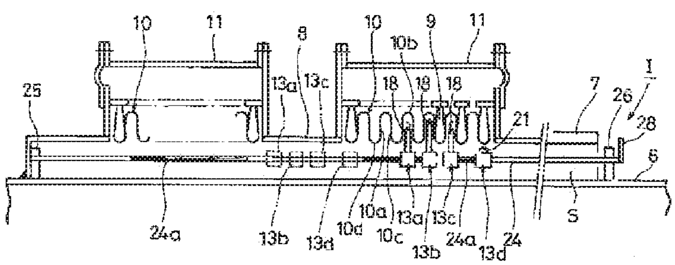
4　原子炉格納容器
5　サプレッションチャンバ
6　ベント管
7　ベントノズル
8　外管
10　ベローズ
10a　前側腹部
10b　山部
10c　後側腹部
10d　谷部
12　長手継手部
13a，13b，13c，13d　点検ユニット
14　移動操作機構
15　支持ブロック
17　CCDカメラ
18　架台
19a　スプライン溝
19b　突起
21　架台
22　ガイドレール
24　操作ロッド
24a　突条部
29　ガイドレール
30　ガイド溝

S　隙間

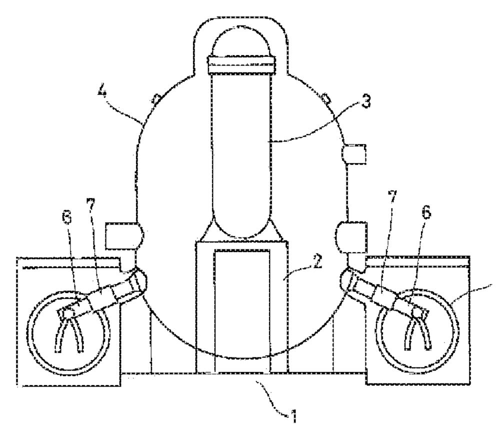
【図1】



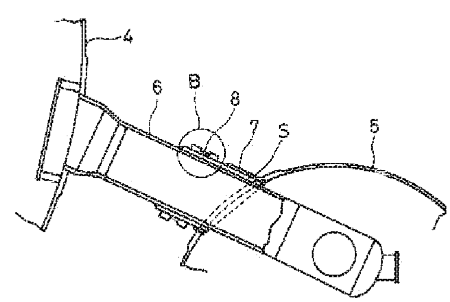
【図2】



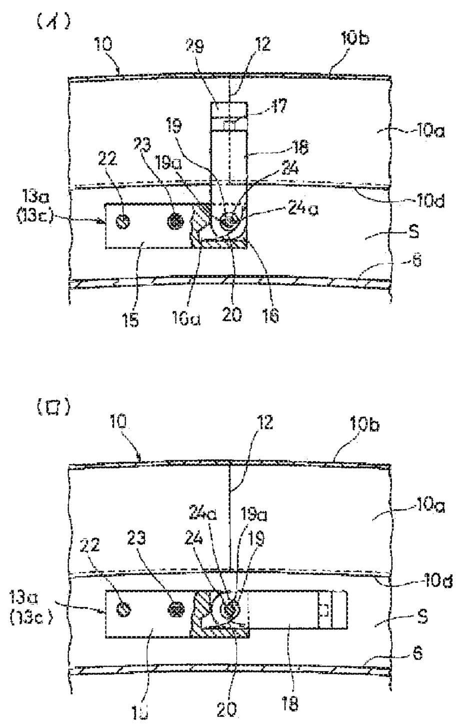
【図5】



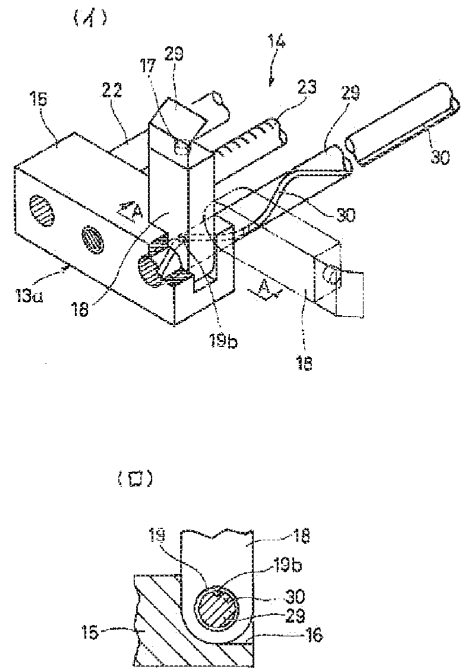
【図6】



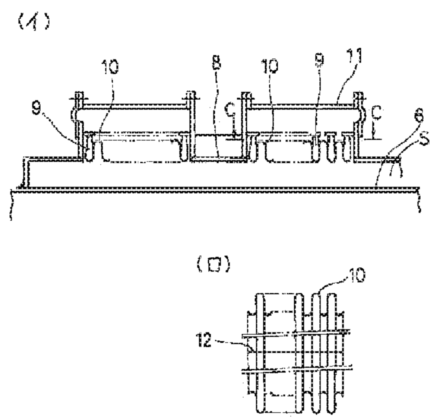
【図3】


(イ)
10
29
12
10b
17
10a
19
18
22
23
19a
24
13a
(13c)
10d
24a
S
6
15
16a
20
16
(ロ)
10
12
10b
10a
24a
19a
22
23
24
19
10d
13a
(13c)
S
6
20
18

【図4】


(イ)
29
14
17
22
23
29
15
30
A
30
13a
18
A
19b
18
(ロ)
19
18
19b
30
29
15
16

【図7】


(イ)
10
8
10
9
11
9
C
C
6
S
(ロ)
10
12

Electronic Patent Application Fee Transmittal

Application Number:	13663012
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First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/MORGAN LAMPP
Attorney Docket Number:	SUN.LGI.420

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Pages:				
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Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Submission- Information Disclosure Stmt	1806	1	180	180
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1		SIDS9.pdf	184550 d5208986b8630639fa758e5b2eded93ccc43418e	yes	3

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**		**End**
	Transmittal Letter		1		2
	Information Disclosure Statement (IDS) Form (SB08)		3		3
Warnings:					
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2	Foreign Reference	F1.pdf	6912483 24c25de4b012e0ef79a40653c86e672b6892b175	no	9
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Information:					
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Warnings:					
Information:					
		Total Files Size (in bytes):	7127655		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on May 26, 2017.

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

SUPPLEMENTAL INFORMATION
DISCLOSURE STATEMENT
UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the reference listed below and on the attached form PTO/SB/08 is being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. A copy of the cited reference is attached.

Applicants note that Japanese Publication No. 2001027687, cited as F1 on the attached form PTO/SB/08, was written in a foreign language; however, an English language Abstract is provided herewith. Applicants respectfully request that the reference be made of record and considered in the examination of the subject application.

This information is being submitted subsequent to the later of three months after the filing date of the present application or the mailing of the first Office Action on the merits, but before the mailing of a final action or the Notice of Allowance. The fee of $180.00 was paid at the time this statement was filed.

J:\SUN\LGI\420\IDS-Refs\5-25-17\SIDS9.doc/mep

It is respectfully requested that the Examiner indicate consideration of the cited reference by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

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JL/mep

Attachments: Form PTO/SB/08; copy of reference cited.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	James P. Evans
Attorney Docket Number	SUN.LGI.420

Sheet 1 of 1

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	2007/0095913-A1	05-03-2007	Takahashi *et al.*	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2004364199-A	12-24-2004	Sony Corp.	ALL	
	F2	JP-H10282232-A	10-23-1998	Toshiba Corp.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated February 14, 2017 in Japanese Application No. 2015501586.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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Espacenet

Bibliographic data: JP2004364199 (A) — 2004-12-24

ANTENNA MODULE AND PORTABLE COMMUNICATION TERMINAL EQUIPPED THEREWITH

Inventor(s): TAKAHASHI ISAO; AKIYASU HIROSHI ± (TAKAHASHI ISAO, ; AKIYASU HIROSHI)

Applicant(s): SONY CORP ± (SONY CORP)

Classification:
- international: ***B42D15/10; G06K17/00; G06K19/07; G06K19/077; G06K7/08; H01Q1/22; H01Q1/24; H01Q1/38; H01Q1/52; H01Q21/28; H01Q7/00; H04B1/59; H04B5/02;*** (IPC1-7): B42D15/10; G06K17/00; G06K19/07; G06K19/077; H01Q1/24; H01Q1/38; H01Q1/52; H01Q21/28; H01Q7/00; H04B1/59; H04B5/02
- cooperative: **G06K7/10336; H01Q1/22; H01Q1/2216; H01Q1/2225; H01Q1/242; H01Q7/00**

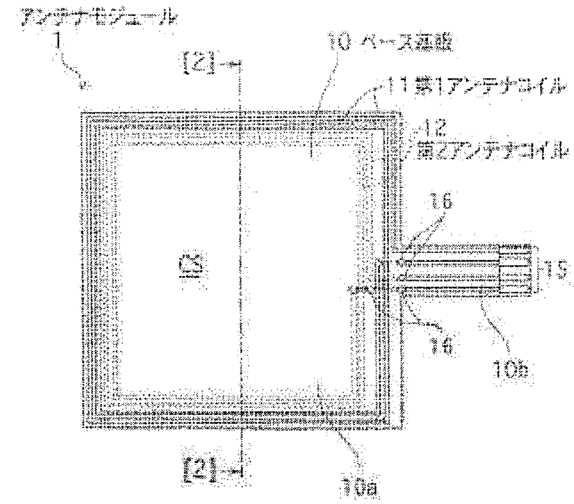
Application number: JP20030163055 20030606 Global Dossier

Priority number(s): JP20030163055 20030606

Also published as: EP1633017 (A1) US2007095913 (A1) US7712672 (B2) TW200516802 (A) TWI248699 (B) more

Abstract of JP2004364199 (A)

PROBLEM TO BE SOLVED: To provide an antenna module which combines two performances which are long communication functions as a tag and a wide transmission area as a reader writer while saving a space, and a portable communication terminal equipped with the antenna module. ;SOLUTION: A first antenna coil 11 for communication with the reader writer and a second antenna coil 12 for communication with the IC tag are arranged and formed on a base substrate 10. The first antenna coil 11 is arranged at the outermost peripheral side of the base substrate 10, and a communication range is secured. The second antenna coil 12 is arranged at the inner peripheral side of the first antenna coil 11, and the miniaturization of the whole module is attained. ;COPYRIGHT: (C)2005,JPO&NCIPI


アンテナモジュール
1
[2]
10 ベース基板
11 第1アンテナコイル
12
第2アンテナコイル
16
15
16
10b
[2]
10a

(19) 日本国特許庁(JP)　(12) 公開特許公報(A)　(11) 特許出願公開番号
特開2004-364199
(P2004-364199A)
(43) 公開日 平成16年12月24日(2004.12.24)

(51) Int.Cl.[7]	F I		テーマコード（参考）
H01Q 21/28	H01Q 21/28		2C005
B42D 15/10	B42D 15/10	521	5B035
G06K 17/00	G06K 17/00	F	5B058
G06K 19/07	H01Q 1/24	C	5J021
G06K 19/077	H01Q 1/38		5J046

審査請求 未請求　請求項の数 22　OL　（全 17 頁）　最終頁に続く

(21) 出願番号　特願2003-163055 (P2003-163055)
(22) 出願日　平成15年6月6日 (2003.6.6)

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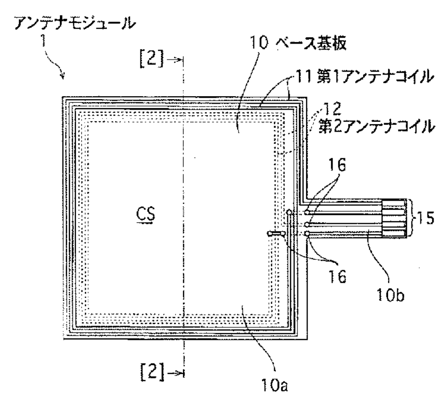
東京都品川区北品川６丁目７番３５号　ソニー株式会社内

Fターム(参考)　2C005 MA33 MB05 NA08 NA09 RA22
5B035 BA03 BA05 BB09 CA01 CA08 CA23
5B058 CA15 KA24 KA40
最終頁に続く

(54)【発明の名称】アンテナモジュール及びこれを備えた携帯型通信端末

(57)【要約】
【課題】省スペース化を実現できると同時に、タグとしての長い通信機能とリーダーライタとしての広い通信エリアという２つの性能を兼ね備えたアンテナモジュール及びこれを備えた携帯型通信端末を提供すること。
【解決手段】ベース基板１０上に、リーダーライタとの通信用の第１アンテナコイル１１と、ＩＣタグとの通信用の第２アンテナコイル１２とを配置形成する。第１アンテナコイル１１はベース基板１１の最外周側に配置して通信距離を確保する。第２アンテナコイル１２は第１アンテナコイル１１の内周側に配置してモジュール全体の小型化を図る。
【選択図】　図１



【特許請求の範囲】
【請求項１】
同一基板上に、
リーダーライタとの通信用の第１アンテナコイルと、
ＩＣタグとの通信用の第２アンテナコイルとを備えた
ことを特徴とするアンテナモジュール。
【請求項２】
前記第１アンテナコイルと前記第２アンテナコイルとが、それぞれ前記基板の面内で渦巻き状に巻回された空芯コイルでなり、
一方のアンテナコイルが他方のアンテナコイルの内周側に配置されている
ことを特徴とする請求項１に記載のアンテナモジュール。
【請求項３】
前記基板の一方側の主面には、磁性シートを介して金属板が貼着されている
ことを特徴とする請求項１に記載のアンテナモジュール。
【請求項４】
前記基板には、第１アンテナコイル及び／又は第２アンテナコイルが複数種配置されている
ことを特徴とする請求項１に記載のアンテナモジュール。
【請求項５】
同一基板上に、
リーダーライタとの通信用の第１アンテナコイルと、
ＩＣタグとの通信用の第２アンテナコイルと、
前記第１，第２アンテナコイルを介して通信される情報を記憶したＩＣ記憶媒体を含む信号処理回路とを備えた
ことを特徴とするアンテナモジュール。
【請求項６】
前記基板には、前記信号処理回路を覆うように電波吸収体が設けられている
ことを特徴とする請求項５に記載のアンテナモジュール。
【請求項７】
前記電波吸収体の表面には金属層が設けられている
ことを特徴とする請求項６に記載のアンテナモジュール。
【請求項８】
前記第１アンテナコイルと前記第２アンテナコイルとは、それぞれ前記基板の面内で渦巻き状に巻回された空芯コイルでなり、
一方のアンテナコイルは他方のアンテナコイルの内周側に配置され、
前記信号処理回路は前記他方のアンテナコイルの内周側に配置されている
ことを特徴とする請求項５に記載のアンテナモジュール。
【請求項９】
前記基板は、前記第１，第２アンテナコイルが搭載される環状のアンテナ搭載基板と、前記信号処理回路が搭載される回路搭載基板との結合体でなる
ことを特徴とする請求項８に記載のアンテナモジュール。
【請求項１０】
前記基板には、前記信号処理回路を覆うように電波吸収体が設けられている
ことを特徴とする請求項９に記載のアンテナモジュール。
【請求項１１】
前記電波吸収体の表面には金属層が設けられている
ことを特徴とする請求項１０に記載のアンテナモジュール。
【請求項１２】
前記基板の一方側の主面には、磁性シートが貼着されている
ことを特徴とする請求項５に記載のアンテナモジュール。

【請求項１３】
前記基板の一方側の主面には、磁性シートを介して金属板が貼着されている
ことを特徴とする請求項５に記載のアンテナモジュール。
【請求項１４】
前記磁性シートには、その中央部に開口が形成されており、当該開口には前記基板上の信号処理回路部が収容されている
ことを特徴とする請求項１２に記載のアンテナモジュール。
【請求項１５】
前記基板には、前記信号処理回路を覆うように電波吸収体が設けられている
ことを特徴とする請求項１４に記載のアンテナモジュール。
【請求項１６】
前記電波吸収体の表面には金属層が設けられている
ことを特徴とする請求項１５に記載のアンテナモジュール。
【請求項１７】
前記基板には、第１アンテナコイル及び／又は第２アンテナコイルが複数種配置されている
ことを特徴とする請求項５に記載のアンテナモジュール。
【請求項１８】
通信ネットワークを介しての情報通信機能を備えた携帯型通信端末であって、
同一基板上に、リーダーライタとの通信用の第１アンテナコイル及びＩＣタグとの通信用の第２アンテナコイルが配置されたアンテナモジュールと、
前記第１，第２アンテナコイルを介して通信される情報を記憶したＩＣ記憶媒体とを備えた
ことを特徴とする携帯型通信端末。
【請求項１９】
前記アンテナモジュールと端末本体の取付部との間には、磁性シート及び金属板が介装されている
ことを特徴とする請求項１８に記載の携帯型通信端末。
【請求項２０】
前記第１アンテナコイルと前記第２アンテナコイルとが、それぞれ前記基板の面内で渦巻き状に巻回された空芯コイルでなり、
一方のアンテナコイルが他方のアンテナコイルの内周側に配置されている
ことを特徴とする請求項１８に記載の携帯型通信端末。
【請求項２１】
前記基板の中央部には、前記ＩＣ記憶媒体を含む信号処理回路が形成されている
ことを特徴とする請求項１８に記載の携帯型通信端末。
【請求項２２】
前記基板には、第１アンテナコイル及び／又は第２アンテナコイルが複数種配置されている
ことを特徴とする請求項１８に記載の携帯型通信端末。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、ＲＦＩＤ（無線周波数識別：Ｒａｄｉｏ Ｆｒｅｑｕｅｎｃｙ Ｉｄｅｎｔｉｆｉｃａｔｉｏｎ）システムに用いられるアンテナモジュール及びこれを備えた携帯型通信端末に関する。
【０００２】
【従来の技術】
従来より、非接触ＩＣカードシステムに代表されるＲＦＩＤ技術においては、ＩＣカード等の識別用ＩＣタグにアンテナコイルを内蔵させ、リーダーライタの送受信アンテナから

発信される電波との誘導結合によりデータ通信を行うようにしている。

【０００３】

現在、ＩＣタグとリーダーライタとでデータ通信を行う形態の一例として、ＩＣカードで電車運賃の支払いを行う利用形態がある。この例において、ＩＣカードの利用状況を確認するためには、駅構内にある券売機や、ＩＣカードの情報を読み込むことができる特別なビューアが必要になる。ＩＣカードに課金するためにも、駅構内にある券売機か、リーダーライタを備えたパーソナルコンピュータ等により、ネット上からＩＣカードに課金（サイバー課金）する必要がある。

【０００４】

さて、ＩＣタグとリーダーライタとでデータ通信を行う形態は今後、多様化が進むことが予想されている。例えば、更に利便性を高めるため、携帯電話やＰＤＡ（Ｐｅｒｓｏｎａｌ Ｄｉｇｉｔａｌ Ａｓｓｉｓｔａｎｔ）等の携帯型通信端末にタグ機能とリーダーライタ機能とを持たせることが考えられる。

【０００５】

携帯電話にタグ機能を持たせることにより、例えば、携帯電話を改札にかざすことで電車運賃の支払いを行うことができるようになる。また、携帯電話の通信機能を利用してサイバー課金が可能になる。加えて、携帯電話の表示機能を利用して端末内のタグの残高確認が可能になる。

【０００６】

また、携帯電話にリーダーライタ機能を持たせるようにすれば、当該携帯電話が駅構内の券売機の代替機能を有するようになるので、例えば、他のＩＣタグ（ＩＣカード）の残高などの情報を確認することができるようになり、更にサイバー課金も可能になる。

【０００７】

なお、この出願の発明に関連する先行技術文献を以下に示す。

【０００８】

【特許文献１】

特開平８－１９４７８５号公報

【特許文献２】

特開平１１－６６２６０号公報

【特許文献３】

特開２００２－１５２８８号公報

【特許文献４】

特開２００２－３２５０１３号公報

【０００９】

【発明が解決しようとする課題】

上述したように、携帯電話等にタグ機能とリーダーライタ機能とを持たせることになると、端末本体に、タグ機能及びリーダーライタ機能それぞれに適合した専用のアンテナモジュールを個々に搭載する必要が生じる。つまり、タグとして用いる場合は外部リーダーライタとの通信に利用されるアンテナモジュールが必要であり、リーダーライタとして用いる場合は外部ＩＣタグ（ＩＣカード）との通信に利用されるアンテナモジュールが必要である。

【００１０】

すなわち、近年における１３．５６ＭＨｚの周波数により動作するＲＦＩＤシステムにおいては、確実な動作環境が求められており、例えば通信特性においてもできるだけ長い通信距離や、リーダーライタとＩＣタグとが相対する場合の平面状の広い通信エリアが求められている。

【００１１】

一般的に、ＩＣタグとして重要な性能は通信距離であり、リーダーライタとして重要な性能は通信距離より通信範囲とされている。タグ機能に要求されるアンテナモジュールの通信特性と、リーダーライタ機能に要求されるアンテナモジュールの通信特性は相異なるも

のであり、各々異なるアンテナ形状を必要とするので、１個のアンテナコイルで両機能を満足させることは殆ど不可能である。
【００１２】
なお、上記特許文献１には、ＩＣカードとリーダーライタとの間の通信距離を長くするためのリーダーライタのアンテナコイルの改良に関する技術が開示されている。また、特許文献２には情報伝送効率の向上を図ったアンテナコイルをもつＩＣカードの構成が記載され、特許文献３には異なる複数の応答器（ＩＣタグ）と多重交信を行い得るリーダーライタの構成が記載されている。更に、特許文献４には取付対象物との相互干渉による通信特性の劣化を回避するためのアンテナモジュールの構成が開示されている。
【００１３】
一方、携帯型通信端末に代表される電子機器の分野においては軽薄短小化の要求が非常に高く、電子部品の小型化、高密度実装化、高集積化等でこれに対応している。したがって、新規機能の追加のための新たなモジュールの付加を受け入れるだけの空間的自由度は殆ど残っておらず、上記２種類のアンテナモジュール及びその信号処理用回路（ＲＦＩＤ回路）部品等を組み込むことは、端末本体の大型化を余儀なくすることになる。
【００１４】
また、アンテナモジュールの小型化によって端末本体の大型化を抑制することも考えられるが、この場合、通信特性の劣化は避けられなくなる。求められる通信特性（通信距離、通信エリア等）を満足するためには、アンテナに一定以上の面積を確保することが必要だからである。
【００１５】
本発明は上述の問題に鑑みてなされ、省スペース化を実現できると同時に、タグとしての長い通信距離とリーダーライタとしての広い通信エリアという二つの性能を兼ね備えたアンテナモジュール及びこれを備えた携帯型通信端末を提供することを課題とする。
【００１６】
【課題を解決するための手段】
以上の課題を解決するに当たり、本発明のアンテナモジュールは、同一基板上に、リーダーライタとの通信用の第１アンテナコイルと、ＩＣタグとの通信用の第２アンテナコイルとを備えていることにより、タグ機能に要求される長い通信距離とリーダーライタ機能に要求される広い通信エリアとを兼ね備えた省スペースのアンテナモジュールを構成することができる。
【００１７】
アンテナモジュールの更なる省スペース化を図る上では、第１アンテナコイルと第２アンテナコイルとをそれぞれ基板の面内で渦巻き状に巻回された空芯コイル（ループコイル）で構成すると共に、一方のアンテナコイルを他方のアンテナコイルの内周側に配置する構成が有利である。これにより、例えば長い通信距離が必要とされるリーダーライタとの通信用の第１アンテナコイルの形成領域と同等の大きさに当該アンテナモジュールを構成することができる。
【００１８】
また、本発明の他のアンテナモジュールは、同一基板上に、リーダーライタとの通信用の第１アンテナコイルと、ＩＣタグとの通信用の第２アンテナコイルと、これら第１，第２アンテナコイルを介して通信される情報を記憶したＩＣ記憶媒体を含む信号処理回路とを備えたことを特徴とする。この構成により、アンテナモジュールの更なる省スペース化を実現できる。
【００１９】
アンテナモジュールの更なる省スペース化を図る上では、第１アンテナコイルと第２アンテナコイルとをそれぞれ基板の面内で渦巻き状に巻回された空芯コイルで構成すると共に、一方のアンテナコイルを他方のアンテナコイルの内周側に配置し、上記信号処理回路を前記他方のアンテナコイルの内周側に配置する構成が有利である。
【００２０】

更に、本発明の携帯型通信端末は、通信ネットワークを介しての情報通信機能を備えた携帯型通信端末であって、同一基板上に、リーダーライタとの通信用の第１アンテナコイル及びＩＣタグとの通信用の第２アンテナコイルが配置されたアンテナモジュールと、第１，第２アンテナコイルを介して通信される情報を記憶したＩＣ記憶媒体とを備えたことを特徴とする。

【００２１】

この構成により、タグ機能とリーダーライタ機能とを兼ね備えた携帯型通信端末を構成することが可能となるので、例えば、当該端末のタグ機能を利用して電車運賃の支払いを行ったり、当該端末のリーダーライタ機能を利用してＩＣタグの残高などの情報を確認する等の利用が可能となる。

【００２２】

また、１つのアンテナモジュールでリーダーライタとの通信用の第１アンテナコイルとＩＣタグとの通信用の第２アンテナコイルが構成されているので、省スペース化を実現でき、端末本体の大型化を防止することができる。

【００２３】

【発明の実施の形態】

以下、本発明の各実施の形態について図面を参照して説明する。

【００２４】

（第１の実施の形態）

図１及び図２は本発明の第１の実施の形態によるアンテナモジュール１の構成を示している。ここで、図１はアンテナモジュール１の平面図、図２は図１における［２］－［２］線方向断面図である。

【００２５】

本実施の形態のアンテナモジュール１は、リーダーライタとの通信用の第１アンテナコイル１１と、ＩＣタグとの通信用の第２アンテナコイル１２とが、共通のベース基板１０に配置形成されている。

なお、図中破線で示す第２アンテナコイル１２は、後述するように、ベース基板１０の裏面側（紙面裏側）に配置形成されているものとする。

【００２６】

ベース基板１０は絶縁性の材料で構成されている。ベース基板１０は、ガラスエポキシ基板等のリジッド性（自己支持性）のある材料で構成されていてもよいし、ポリイミドやＰＥＴ、ＰＥＮ等のフレキシブル性のある材料で構成されていてもよい。

【００２７】

ベース基板１０は、第１アンテナコイル１１及び第２アンテナコイル１２が形成される大面積のコイル形成部１０ａと、第１，第２アンテナコイル１１，１２の各端部と電気的に接続される外部端子接続部１５が形成される小面積の連結部１０ｂとを有している。外部端子接続部１５には図示しないＩＣチップの端子や当該ＩＣチップが実装されたプリント配線板上の端子に接続される。

【００２８】

なお、図１において符号１６は、ベース基板１０の表裏を電気的に接続するためのスルーホールであり、これらを介して第１，第２アンテナコイル１１，１２が外部端子接続部１５の所定位置に接続されている。また、ベース基板１０の表裏面には、絶縁材料でなるオーバーコート材１４がそれぞれ設けられている。

【００２９】

第１アンテナコイル１１及び第２アンテナコイル１２は導電材料でなり、アルミニウムや銅等の金属薄膜、導電ペーストの印刷体で構成することができる。なお、各アンテナコイルの形成幅や形成長、膜厚あるいは塗膜厚は、求められる通信性能に応じて適宜設定することができる。

【００３０】

第１，第２アンテナコイル１１，１２は、ベース基板１０の平面内で巻回された空芯コイ

ル（ループコイル）で構成されている。第１アンテナコイル１１と第２アンテナコイル１２との配置関係は特に限定されないが、本実施の形態では、第２アンテナコイル１２を第１アンテナコイル１１の内周側に配置している。

【００３１】
この構成により、第１アンテナコイル１１の形成領域を広く確保でき、一般的に通信距離が求められるタグ機能の向上を図ることが可能となる。また、アンテナモジュール１の大きさを第１アンテナコイル１１の形成面積と略同等に構成できるので、第１，第２アンテナコイル１１，１２を並置形成する場合に比べてアンテナモジュール１の小型化を図ることができる。

【００３２】
なお、以上の構成例においては第１アンテナコイル１１を第２アンテナコイル１２の外周側に配置したが（図３Ａ参照）、求められる通信性能が異なれば、第２アンテナコイル１２を第１アンテナコイル１１の外周側に配置することも可能である（図４Ｂ参照）。

【００３３】
第１アンテナコイル１１及び第２アンテナコイル１２のアンテナ形状は、求められる通信特性に応じて各々適宜設定でき、図示する矩形状に限らず、円形状等の他の形状でもよい。また、図の例では各アンテナコイル１１，１２をそれぞれ２ターンで構成しているが、ターン数も仕様に応じて各々適宜設定できる事項である。

【００３４】
なお、第１アンテナコイル１１と第２アンテナコイル１２とは互いに磁気的な結合を生じさせない、すなわち各々の通信特性に障害を生じさせない程度の隙間を介して配置されているものとする。

【００３５】
図９に第２アンテナコイル１２の形状の変形例を示す。図において破線で示す第２アンテナコイル１２Ａは、ベース基板１０の裏面側（紙面裏側）に形成されているものとする。

【００３６】
図示する第２アンテナコイル１２Ａは、その中心部を挟んで相対向する各巻線間の間隔及び線幅を一の方向において異ならせた非対称形状とされている。すなわち、この第２アンテナコイル１２は、一の方向（図９において横方向）において、その各巻線間の間隔及び線幅が狭くなる右側部１２ａと、その各巻線間の間隔及び線幅が広くなる左側部１２ｂとを有している。

【００３７】
この場合、第２アンテナコイル１２Ａによる磁場分布は、巻線間の間隔や線幅が対称な第１アンテナコイル１１による対称な磁場分布とは異なり、第２アンテナコイル１２Ａの各巻線間の間隔及び線幅が広くなる左側部１２ｂが強調された非対称なものとなる。

【００３８】
したがって、第２アンテナコイル１２Ａを図示するような形状に構成することにより、ＩＣタグ（ＩＣカード）との通信エリアを広げることができると共に、通信可能な位置を一の方向においてシフトさせることが可能となる。また、第２アンテナコイル１２Ａの大きさをＩＣタグ側のアンテナコイルよりも小さくすることが可能となることから、第１アンテナコイル１１の内周側に設けても通信性能の劣化を生じさせることもない。

【００３９】
次に、第１アンテナコイル１１は、アンテナモジュール１の通信面ＣＳ側（ベース基板１０の表面側）に配置され、第２アンテナコイル１２はアンテナモジュール１の通信面ＣＳとは反対側の面（ベース基板１０の裏面）に配置されている（図２，図３Ａ）。この構成により、通信距離が求められるタグ機能の向上を図ることができる。

【００４０】
但し、求められる通信性能が異なれば（例えば、リーダーライタ機能にも一定以上の通信距離を確保する必要がある場合など）、第２アンテナコイル１２をアンテナモジュール１の通信面ＣＳ側に配置してもよい（図３Ｂ，図４Ａ，Ｂ）。この場合、第１アンテナコイ

ル１１はアンテナモジュール１の通信面ＣＳとは反対側の面に配置するか（図３Ｂ）、第２アンテナコイル１２と共にアンテナモジュール１の通信面ＣＳ側に配置される（図４Ａ，Ｂ）。

【００４１】

なお、図４Ａ，Ｂに示すように、各アンテナコイル１１，１２の配置関係は上述したように任意であり、どちらを外周側あるいは内周側に配置するかは、求められる通信性能に応じて選定される。

また、ベース基板１０の各面にそれぞれ配置される第１アンテナコイル１１及び第２アンテナコイル１２は、磁気的結合を回避するために、互いに重なり合わないようにして配置されるように留意する必要がある。

【００４２】

一方、ベース基板１０上に形成される第１アンテナコイル１１及び／又は第２アンテナコイル１２は各々１種類ずつに限られない。つまり、同じアンテナモジュール１で、通信仕様の異なる複数種のＩＣタグ又はリーダーライタとの通信が行えるように、第１，第２アンテナコイル１１，１２を複数種配置形成することも可能である。

【００４３】

例えば図５Ａは、ベース基板１０の表面側に第１アンテナコイル１１を外周部と内周部とに計２種類配置し、その間に１種類の第２アンテナコイル１２を配置した例を示している。図５Ｂは、第１アンテナコイル１１をベース基板１０の表面側に計２種類配置し、１種類の第２アンテナコイル１２をベース基板１０の裏面側に配置した例を示している。また、図５Ｃは、ベース基板１０の表面側に第２アンテナコイル１２を外周部と内周部とに計２種類配置し、その間に１種類の第１アンテナコイル１１を配置した例を示している。

【００４４】

以上のように構成される本実施の形態のアンテナモジュール１においては、共通のベース基板１０上にリーダーライタとの通信用の第１アンテナコイル１１とＩＣタグとの通信用の第２アンテナコイル１２とを備えた構成としているので、タグ機能とリーダーライタ機能とを１つのアンテナモジュール１で構成することができるようになる。これにより、省スペース化にも十分に対応できると同時に、タグ機能及びリーダーライタ機能の双方に要求される通信性能を確保することができる。

【００４５】

続いて、図７及び図８は、当該アンテナモジュール１を搭載した携帯型通信端末２０の断面模式図である。図では、アンテナモジュール１が携帯型通信端末２０の端末本体２１の上部背面側に内装された例を示している。

【００４６】

端末本体２１には、通信ネットワークを介しての情報通信機能を備えた当該携帯型通信端末２０の諸機能を制御するＣＰＵその他の電子部品を搭載した電子回路基板２２やバッテリ２５が内蔵され、その表面の一部は液晶ディスプレイ等の表示部２３で構成されている。また、図示せずとも通信ネットワークを介しての情報の送受信に必要な送受信用アンテナを含む通信手段や、操作入力部、電話機能に必要なマイクロフォン及びスピーカ等が備え付けられている。

【００４７】

アンテナモジュール１と端末本体２１の取付部との間には、アンテナモジュール１側から磁性シート１８及び金属板１９が介装されている。本実施の形態では、図６に示すように、アンテナモジュール１の通信面ＣＳとは反対側の主面に、非導電性の磁性シート１８及び金属板１９を貼着することによって、アンテナモジュール１と磁性シート１８と金属板１９とをユニット化している。

【００４８】

磁性シート１８は、例えば合成樹脂材料中にセンダスト（Ｆｅ－Ａｌ－Ｓｉ系）粉を混合してシート状に加工したものが用いられるが、これ以外にも、磁性粉としてパーマロイ（Ｆｅ－Ｎｉ系）やアモルファス（Ｆｅ－Ｓｉ－Ａｌ－Ｂ系）、フェライト（Ｎｉ－Ｚｎフ

ェライト、Ｍｎ－Ｚｎフェライトなど）、焼結フェライト等の軟磁性材料が適用可能であり、目的とする通信性能や用途に応じて使い分けられる。

【００４９】

磁性シート１８がアンテナモジュール１と金属板１９との間に介装されることによって、アンテナモジュール１と金属板１９との間の電磁干渉による通信性能の劣化を回避できると同時に、アンテナモジュール１と金属板１９との間の隙間を少なく設定できるという利点がある。

【００５０】

一方、金属板１９は、シールド板としての機能を果たし、携帯型通信端末２０の通信動作とアンテナモジュール１の通信動作を隔絶するために設けられる。これにより、例えばアンテナモジュール１の通信動作時における携帯型通信端末２０に誤作動や機能上の不具合の発生を防止することができる。

なお、金属板１９の構成材料としては、導電性であれば特に制限されず、ステンレス板や銅板、アルミニウム板などが好適である。

【００５１】

磁性シート１８及び金属板１９の厚さは、アンテナモジュール１に貼着された際、全体の厚さが大きくなり過ぎない程度に仕上げられるのが好ましい。例えば、アンテナモジュール１を３００μｍ厚とした場合、磁性シート１８を５００μｍ厚、金属板１９を３００μｍ厚程度とすれば、モジュール全体として１ｍｍ強の厚さに抑えられる。これにより、アンテナモジュール１の省スペース性を損なわずに、端末本体２１の内部の限られたスペースへ組み込むことができる。

【００５２】

アンテナモジュール１は、その通信面ＣＳを外方に向けて端末本体２１に内装される。このとき、アンテナモジュール１の外部端子接続部１５は、例えば、当該アンテナモジュール１のために用意されたＩＣチップ２４に接続される。

【００５３】

ＩＣチップ２４には、第１アンテナコイル１１を介して外部リーダーライタ５と通信する際に読み出されるＩＤその他の各種情報が記憶されている。また、このＩＣチップ２４には、第２アンテナコイル１２を介して外部タグ（ＩＣカード）６と通信する際に、当該外部タブ６に記憶された情報を読み出したり書き込むのに必要なアクセス手順（プログラム）や鍵情報等が必要に応じて格納されている。

【００５４】

以上のように構成される本実施の形態の携帯型通信端末２０においては、図７に示すように、外部のリーダーライタ５と通信する際にはアンテナモジュール１の第１アンテナコイル１１を介してＩＣチップ２４に格納された所定情報が送信される。これにより、この携帯型通信端末２０のタグ機能を利用して、例えば電車運賃の支払いを行うことが可能となる。

【００５５】

また、図８に示すように、外部のＩＣタグ（ＩＣカード）６と通信する際にはアンテナモジュール１の第２アンテナコイル１２を介してＩＣタグ６内のＩＣチップ６Ａに格納された所定情報が読み出される。これにより、この携帯型通信端末２０のリーダーライタ機能を利用して、例えばＩＣタグ６の残高などの情報を表示部２３を介して確認することができる。

【００５６】

なお、リーダーライタ機能を利用する際の電力源としては、携帯型通信端末２０のバッテリー２５を用いることができる。この場合、第１，第２アンテナコイルの設計の最適化により携帯型通信端末２０の低消費電力化に貢献できる。

【００５７】

更に、本実施の形態によれば、アンテナモジュールが１つだけであるので、携帯型通信端末２０に求められる省スペース化に貢献できると共に、省スペースによって得られるスペ

ースを不要輻射等の干渉防止対策に活かすことが可能となり、携帯型通信端末２０としての品質向上に貢献できる。

【００５８】

（第２の実施の形態）

図１０及び図１１は本発明の第２の実施の形態によるアンテナモジュール２の構成を示している。なお、図において上述の第１の実施の形態と対応する部分については同一の符号を付し、その詳細な説明は省略するものとする。

ここで、図１０はアンテナモジュール２の平面図、図１１は図１０における［１１］－［１１］線方向断面図である。

【００５９】

本実施の形態のアンテナモジュール２は、ベース基板１０上に、リーダーライタとの通信用の第１アンテナコイル１１と、ＩＣタグとの通信用の第２アンテナコイル１２と、これら第１，第２アンテナコイルを介して通信される情報を記憶したＩＣチップ２４を含むＲＦＩＤ回路部３０とを備えている。

【００６０】

ＲＦＩＤ回路部３０は、本発明に係る「信号処理回路」に対応し、ＩＣチップ２４以外に第１，第２アンテナコイルを介しての通信動作に必要な送受信信号の生成や信号処理等に供される電子部品の一式で構成されている。なお、各部品を電気的に接続する配線パターンの図示は省略している。

【００６１】

ＲＦＩＤ回路部３０は、図の例では第２アンテナコイル１２の内周側に配置されている。この構成により、第２アンテナコイル１２の内周部（空芯部）の有効利用が図られ、アンテナモジュール２の小型化に貢献できる。

【００６２】

ＲＦＩＤ回路部３０は、図の例ではアンテナモジュール２の通信面ＣＳ側（ベース基板１０表面側）に配置しているが、これに限らず、アンテナモジュール２の通信面ＣＳとは反対側の主面に配置してもよい。また、第２アンテナコイル１２の内周領域にＲＦＩＤ回路部を形成しきれない場合には、第２アンテナコイル１２の形成面とは反対側の面にＲＦＩＤ回路部を形成することも可能である。

【００６３】

以上のようにして構成されるアンテナモジュール２は、リーダーライタ又はＩＣタグとの通信に必要なＲＦＩＤ回路部３０を第１，第２アンテナコイル１１，１２と共に同一のベース基板１０上に配置した基板ユニットとして構成されているので、ＲＦＩＤ回路が形成された配線基板を別途用意する必要がなくなり、省スペース化に非常に優れたアンテナモジュールとすることができる。

【００６４】

本実施の形態のアンテナモジュール２は、上述の第１の実施の形態と同様に、通信ネットワークを介しての情報通信機能を備えた携帯型通信端末に内装される。この場合、ＲＦＩＤ回路部３０が当該アンテナモジュール２としてユニット化されているので、端末本体に大きな空間的スペースを要求することなくこれを実装することができる。

【００６５】

また、ＲＦＩＤ回路部３０がアンテナモジュール２としてユニット化されているので、携帯型通信端末に対するＲＦＩＤ機能の組込み、追加あるいは削除が容易となり、メンテナンス性やアフターサービス等の利便性を高めることができる。これにより、例えば端末本体の機種変更にも容易に対応できるようになり、利用履歴等の個人情報が記憶されているアンテナモジュール２（ＩＣチップ２４）を引き続き新機種端末においてもそのまま利用できる等の利便性を高めると同時に、セキュリティの確保が図られる。

【００６６】

同様な趣旨として、ベース基板１０をアンテナコイル１１，１２の形成領域とＲＦＩＤ回路部３０の搭載領域との結合構造として、ＲＦＩＤ回路部３０に対して異種のアンテナコ

イル１１，１２を接続できる構成とすることも可能である。

【００６７】

例えば図１５に示すように、ベース基板１０を第１，第２アンテナコイル１１，１２が搭載される環状のアンテナ搭載基板１０Ａと、ＲＦＩＤ回路部３０が搭載される回路搭載基板１０Ｂとの結合体で構成する。アンテナ搭載基板１０Ａと回路搭載基板１０Ｂとの間の電気的接続は、例えば、結合時に整列し合う複数組の接続ランド１０ＡＬ，１０ＢＬ間をはんだ等の導電性接合材で接合したり、各ランド間をワイヤボンディングする等の手法が採用できる。

この場合、回路搭載基板１０Ｂはアンテナ形状に関わりなく常に同一のものを適用できるようにし、更に、回路搭載基板１０Ｂの形状等はモジュール間で統一されているのが好ましい。

【００６８】

このような構成により、ＲＦＩＤ回路部３０（ＩＣチップ２４）は引き続き利用可能としながらアンテナコイル１１，１２のみ異なる仕様に変更することが可能となる。また、仕様に応じて複数種のアンテナ搭載基板１０Ａを用意しておけば、あとは共通化された回路搭載基板１０を組み込むだけで所望のアンテナモジュールを構成できるので、在庫管理や生産性向上も図れることになる。

【００６９】

さて、図１０に示したアンテナモジュール２を端末本体に内装するに当たっては、上述の第１の実施の形態と同様に、アンテナモジュール２の通信面ＣＳとは反対側の主面と端末本体の取付部との間に、非導電性の磁性シート及び金属板がそれぞれ介装されるのが好ましい。なお、磁性シート及び金属板を介装することにより得られる効果については、上述の第１の実施の形態と同様であるのでここでは説明を省略する。

【００７０】

図１２Ａ，Ｂはアンテナモジュール２の通信面ＣＳとは反対側の主面に磁性シート１８を貼着した構成例である。図１２ＡはＲＦＩＤ回路部３０をアンテナモジュール２の通信面ＣＳ側に配置した場合の磁性シート１８の貼着例である。

【００７１】

一方、図１２ＢはＲＦＩＤ回路部３０をアンテナモジュール２の通信面ＣＳとは反対側の主面に配置した場合の磁性シート１８の貼着例である。この例では磁性シート１８の中央部に、ＲＦＩＤ回路部３０を収容できる大きさの開口１８ａを形成している。アンテナコイルの形成されていないモジュール中央領域に開口１８ａを形成しても、磁性シート１８による電磁干渉抑制効果を十分果たせるからである。この構成によれば、開口１８ａ内にＲＦＩＤ回路部３０を収容できるので、図１２Ａの構成例に比してモジュール全厚を薄くでき、更なる省スペース化に貢献できる。

【００７２】

次に、図１３Ａ，Ｂに金属板１９の貼着例を示す。図１３ＡはＲＦＩＤ回路部３０をアンテナモジュール２の通信面ＣＳ側に配置した場合の金属板１９の貼着例である。金属板１９は磁性シート１８を介してアンテナモジュール２に貼着されている。

【００７３】

一方、図１３ＢはＲＦＩＤ回路部３０をアンテナモジュール２の通信面ＣＳとは反対側の主面に配置した場合の金属板１９の貼着例である。この例では、中央部にＲＦＩＤ回路部３０を収容できる大きさの開口１８ａが形成された磁性シート１８を介して、金属板１９がアンテナモジュール２に貼着されている。この構成によれば、磁性シート１８の開口１８ａ内にＲＦＩＤ回路部３０を収容できるので、図１３Ａの構成例に比してモジュール全厚を薄くでき、更なる省スペース化に貢献できる。

【００７４】

なお、図１４に示すように、金属板１９に対してもその中央部にＲＦＩＤ回路部３０を臨む開口１９ａを形成することも可能である。この場合、ＲＦＩＤ回路部３０を構成する部品の実装空間の自由度が高められ、これにより、実装高さの比較的大きな部品の実装が可

能となる。

【００７５】

また、金属板１９に開口部１９ａを形成することによって、ＲＦＩＤ回路部３０と端末本体側との間で電磁的に影響を及ぼし合うおそれがある場合には、例えば図１６～図１８に示すように、アンテナモジュール２のベース基板１０に、ＲＦＩＤ回路部３０を覆うように電波吸収体を設けるのが好ましい。

【００７６】

図１６は、ＲＦＩＤ回路部３０全域をフレキシブル性のあるシート状の電波吸収体３１で覆った例を示している。この電波吸収体３１を構成する軟磁性材料は、ＲＦＩＤ回路部３０から放射されるノイズ電波の周波数帯域に応じて選定される。また、必要に応じて、ベース基板１０の上面（回路非搭載面）側にも同様な電波吸収体３２を貼着し、ベース基板上面側への不要輻射を抑えるようにしてもよい。なお、電波吸収体３１，３２の外表面側に金属層を追加で設ければ、更にノイズ防止効果を高めることができる。

【００７７】

一方、図１７はＲＦＩＤ回路部３０をベース基板１０の両面から電波吸収体３３，３４を介して一対の金属板３５，３６で挟み込んだ例を示している。この場合の電波吸収体３３，３４はコンパウンド状のものを用いることができ、ＲＦＩＤ回路部３０を覆うようにベース基板１０と一体成形することによって構成できる。もしくは、電波吸収体３３，３４としてペースト状のものを用いることができ、ＲＦＩＤ回路部３０を覆うように塗布された後、硬化処理がなされる。また、金属板３５，３６はノイズ防止効果を高めると同時に、ＲＦＩＤ回路部３０を外部ストレスから保護する補強板としても機能する。

【００７８】

ＲＦＩＤ回路部３０からの不要輻射対策と同時に、ＲＦＩＤ回路部３０の外部ストレスからの保護を図ることができる他の構成例として、図１８に示すものがある。これは、所定強度を備えた略箱状の金属製カバー３７でＲＦＩＤ回路部３０を覆っており、このカバー３７の内面にはシート状の電波吸収体３８を貼着した例を示している。なおこれに代えて、カバー３７の内部空間を電波吸収体で充填してもよい。また、必要に応じて、ＲＦＩＤ回路部３０の形成領域に対応するベース基板１０の上面側にも電波吸収体３９を設けてもよいし、更にこの電波吸収体３９の上に金属層を形成してもよい。この金属層は、ノイズ対策として適用する場合は箔状で十分であるが、強度アップをも目的する場合には一定の厚さが必要になる。

【００７９】

なお、ここで請求項にいう「信号処理回路を覆うように電波吸収体が設けられている」という意味は、ベース基板１０の回路搭載面側の回路形成領域と、その反対側の面の回路形成領域の双方又は何れか一方に電波吸収体が設けられていることを意味するものとする。

【００８０】

以上のＲＦＩＤ回路部３０の不要輻射対策（及び外部ストレスからの保護対策）は、金属板１９が貼着されたアンテナモジュール２にのみ適用される場合に限らず、例えば図１２Ｂに示したような構成例にも適用可能である。この例では、アンテナモジュール２に磁性シート１８のみを貼着した構成であるが、このような形態は、端末本体の取付部側に金属板１９又はこれに準ずる部材が前もって備え付けられている場合等に採用できる。そこで、端末本体側にＲＦＩＤ回路部３０との電磁干渉防止策が施されていない場合に、上記電波吸収体を設置することで対応できるようになる。

【００８１】

ここで、上述のＲＦＩＤ回路部３０を覆う電波吸収体は、アンテナモジュール２の第１，第２アンテナコイル１１，１２の直下に貼着される磁性シート１８とは異なる目的で構成されるものである。つまり、上記電波吸収体はＲＦＩＤ回路部３０から放射されるノイズ成分の吸収を目的として設けられるもので、ノイズ帯域を効率良く吸収できる磁性粉が選択されて構成される。これに対し、磁性シート１８はアンテナモジュール２に所定の通信性能を持たせることを主目的として設けられるもので、アンテナコイルのインダクタンス

や通信周波数等に対して最適な通信性能（例えば透磁率等）が得られる磁性粉が選択されて構成される。

【００８２】

なお、図１６～図１８の例では、ベース基板１０をアンテナ搭載基板１０Ａ及び回路搭載基板１０Ｂの結合基板（図１５参照）として構成したが、これに限らず、図１０に示したような一体基板としてベース基板１０を構成した場合にも同様に適用可能である。

【００８３】

以上、本発明の各実施の形態について説明したが、勿論、本発明はこれらに限定されることなく、本発明の技術的思想に基づいて種々の変形が可能である。

【００８４】

例えば以上の実施の形態では、本発明に係るアンテナモジュールを携帯電話やＰＤＡ等の携帯型通信端末に適用した例について説明したが、適用例は上記携帯型通信端末に限らず、例えば携帯型ゲーム機や専用の携帯型ＲＦＩＤ通信機等にも本発明は適用可能である。

【００８５】

また、本発明に係るアンテナモジュールの第２アンテナコイルによって情報が読み出されるＩＣタグとしては、上述のＩＣカードだけに限らず、コイン状、スティック状等の他の形態のＩＣタグも本発明は適用可能である。

【００８６】

更には、以上の各実施の形態で説明したアンテナモジュールの第１，第２アンテナコイルは、一枚の共通のベース基板上に各々配置形成される例について説明したが、これに代えて、第１アンテナコイルを形成した第１フィルム基板と第２アンテナコイルを形成した第２フィルム基板を積層して、本発明に係るベース基板を構成することも可能である。

【００８７】

【発明の効果】

以上述べたように、本発明のアンテナモジュールによれば、同一基板上に、リーダーライタとの通信用の第１アンテナコイルと、ＩＣタグとの通信用の第２アンテナコイルとを備えさせたので、タグ機能に要求される長い通信距離とリーダーライタ機能に要求される広い通信エリアとを兼ね備えた省スペースのアンテナモジュールを構成することができる。

【００８８】

また、本発明の携帯型通信端末によれば、端末本体の大型化を招くことなく、タグ機能とリーダーライタ機能とを兼ね備えた携帯型通信端末を構成することができる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態によるアンテナモジュール１の平面図である。

【図２】図１における［２］－［２］線方向断面図である。

【図３】アンテナモジュール１の第１アンテナコイル１１と第２アンテナコイル１２との配置態様を説明する要部拡大断面図である。

【図４】アンテナモジュール１の第１アンテナコイル１１と第２アンテナコイル１２との配置態様を説明する要部拡大断面図である。

【図５】アンテナモジュール１の第１アンテナコイル１１と第２アンテナコイル１２との配置態様を説明する要部拡大断面図である。

【図６】アンテナモジュール１に磁性シート１８及び金属板１９を貼着してユニット化した状態を示す側断面図である。

【図７】アンテナモジュール１を内装した携帯型通信端末２０の構成及びその一作用を説明する模式図である。

【図８】アンテナモジュール１を内装した携帯型通信端末２０の構成及びその一作用を説明する模式図である。

【図９】アンテナモジュール１の第２アンテナコイル１２Ａの形状の変形例を示す平面図である。

【図１０】本発明の第２の実施の形態によるアンテナモジュール２の平面図である。

【図１１】図１０における［１１］－［１１］線方向断面図である。

【図１２】アンテナモジュール２への磁性シート１８の貼着例を示す側断面図である。
【図１３】アンテナモジュール２への磁性シート１８及び金属板１９の貼着例を示す側断面図である。
【図１４】図１３Ｂの構成の変形例を説明する側断面図である。
【図１５】アンテナモジュール２のベース基板１０の構成の変形例を説明する平面図である。
【図１６】図１３Ｂの構成の他の変形例を説明する側断面図である。
【図１７】図１３Ｂの構成の更に他の変形例を説明する側断面図である。
【図１８】図１３Ｂの構成の更に他の変形例を説明する側断面図である。
【符号の説明】
１，２…アンテナモジュール、５…リーダーライタ、６…ＩＣタグ、１０…ベース基板、１０Ａ…アンテナ搭載基板、１０Ｂ…回路搭載基板、１１…第１アンテナコイル、１２，１２Ａ…第２アンテナコイル、１４…オーバーコート材、１５…外部端子接続部、１６…スルーホール、１８…磁性シート、１８ａ…開口、１９…金属板、２０…携帯型通信端末、２１…端末本体、２２…電子回路基板、２３…表示部、２４…ＩＣチップ、２５…バッテリー、３０…ＲＦＩＤ回路部、３１～３４，３８，３９…電波吸収体、ＣＳ…通信面。

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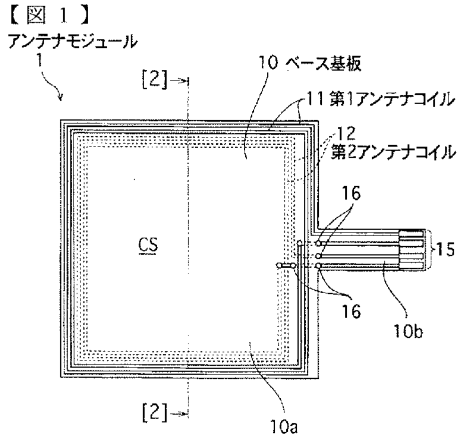

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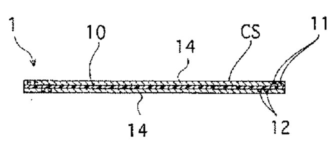

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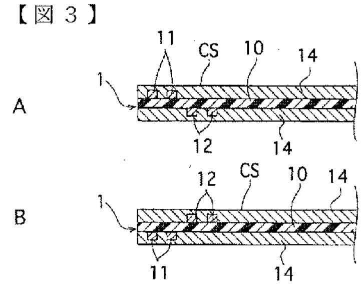

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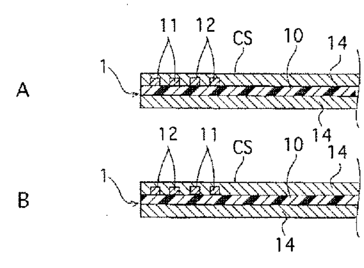

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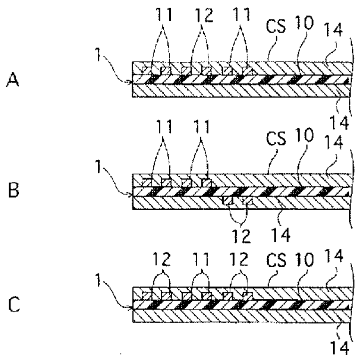
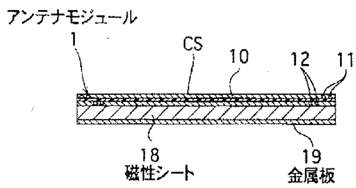
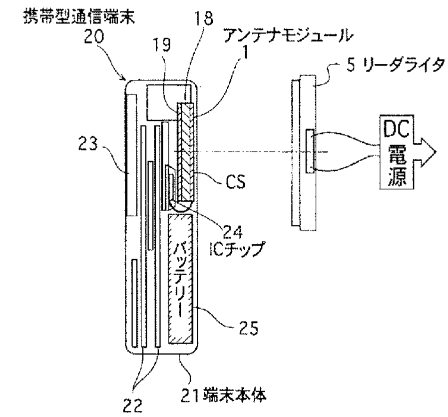

A
B
C
1
11
12
CS
10
14

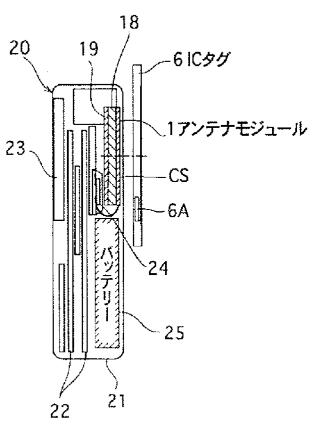
【図６】


アンテナモジュール
1
CS
10
12
11
18
磁性シート
19
金属板

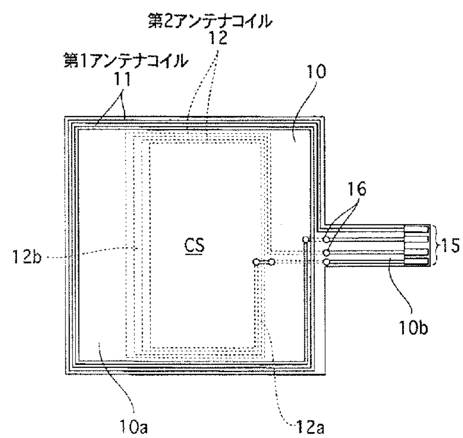
【図７】


携帯型通信端末
20
18
19
アンテナモジュール
1
5 リーダライタ
23
DC
電源
CS
24
ICチップ
バッテリー
25
22
21端末本体

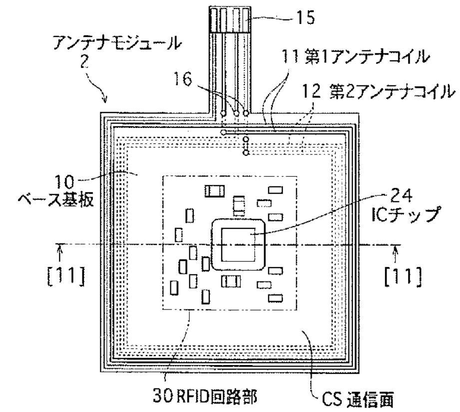
【図８】


20
19
18
6 ICタグ
1アンテナモジュール
23
CS
6A
24
バッテリー
25
22
21

【図９】


第2アンテナコイル
12
第1アンテナコイル
11
10
16
15
CS
12b
10b
10a
12a

【図１０】



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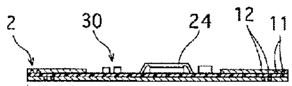

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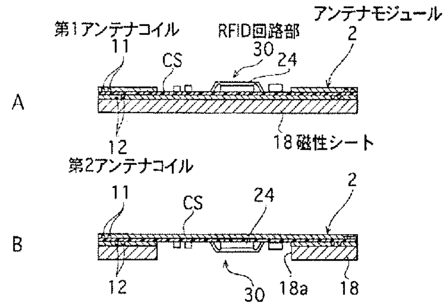

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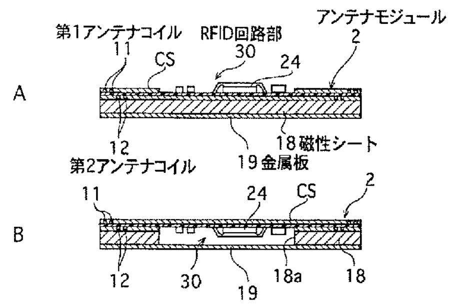

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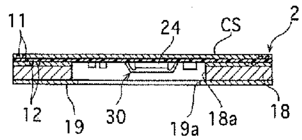

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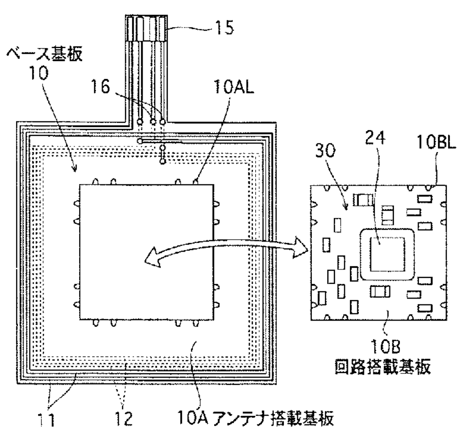

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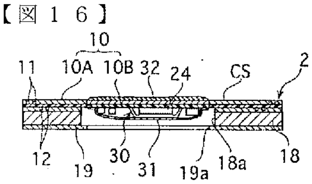

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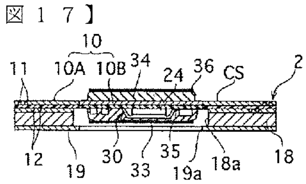
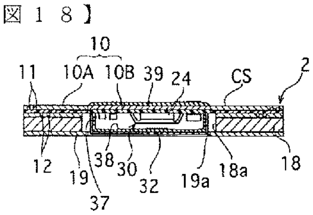


【図１８】



フロントページの続き

(51)Int.Cl.[7]		F I			テーマコード（参考）
Ｈ０１Ｑ	1/24	Ｈ０１Ｑ	1/52		５Ｊ０４７
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Ｈ０１Ｑ	1/52	Ｈ０４Ｂ	1/59		
Ｈ０１Ｑ	7/00	Ｈ０４Ｂ	5/02		
Ｈ０４Ｂ	1/59	Ｇ０６Ｋ	19/00	Ｈ	
Ｈ０４Ｂ	5/02	Ｇ０６Ｋ	19/00	Ｋ	

Ｆターム(参考) 5J021 AA02 AB04 CA01 CA06 HA05 JA07
5J046 AA02 AA07 AA12 AA19 AB11 PA07 UA02 UA04
5J047 AA02 AA07 AA12 AA19 AB11 FC01 FC02 FC06
5K012 AB05 AC06 AC08 AC10 BA02

Espacenet

Bibliographic data: JPH10282232 (A) — 1998-10-23

RADIO COMMUNICATION SYSTEM

Inventor(s): ISHIBASHI TAKANOBU ± (ISHIBASHI TAKANOBU)

Applicant(s): TOSHIBA CORP ± (TOSHIBA CORP)

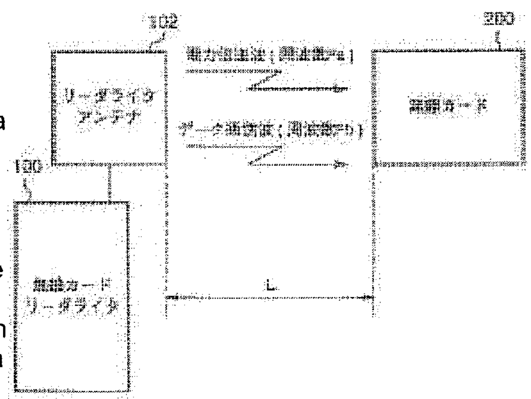
Classification: - **international:** ***G01S13/75; G01S13/76; G01S13/79;*** (IPC1-7): G01S13/75; G01S13/76; G01S13/79
- **cooperative:**

Application number: JP19970081615 19970331 Global Dossier

Priority number (s): JP19970081615 19970331

Abstract of JPH10282232 (A)

PROBLEM TO BE SOLVED: To obtain a stable system capable of demodulating data with a low error rate by transmitting data at the first communication frequency and the second communication frequency different from the first one from a radio communication device to a radio communication medium. SOLUTION: A radio card reader writer 100 operates on a clock of a frequency fp, transmits electric power to a radio card 200 by electric power transmission waves (frequency fp), and transmits data by data communication waves (frequency fd). The frequencies fp and fd are set so as to satisfy the relation fd=fp/k(1<k: integer). In addition, letting a distance of transmission be L and the velocity of light be c, fp satisfies the relation fp<<(kc/16L). By this, it is possible to operate the radio card 200 on the clock of frequency fp of the radio card reader writer 100. Therefore, as there is no need for specially incorporating a PLL circuit in the circuit in



the radio card 200, the simplification and formation into one chip of a circuit configuration become easy.

CLAIMS

[Claim(s)]

[Claim 1]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

A power supply means which supplies electric power from the aforementioned radio communication equipment with first communication frequency to the aforementioned wireless communication media, A wireless communication system providing a data sending means which transmits data with said first communication frequency and different second communication frequency from the aforementioned radio communication equipment to the aforementioned wireless communication media.

[Claim 2]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

A power supply means which supplies electric power from the aforementioned radio communication equipment with first communication frequency to the aforementioned wireless communication media, An electric power receiving means which receives electric power supplied by this power supply means, A wireless communication system possessing a data sending means which transmits data with second communication frequency which is different from said first communication frequency from the aforementioned radio communication equipment to the aforementioned wireless communication media, and a data receiving means which receives data transmitted by this data sending means.

[Claim 3]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

The first communication frequency Fa and the second communication frequency Fb fill Fa=Fb/K (1<K: positive number), and receive the aforementioned wireless communication media from the aforementioned radio communication equipment, A power supply means which supplies electric power with said first communication frequency Fa, and an electric power receiving means which receives electric power supplied by this power supply means, A wireless communication system possessing a data sending means which transmits data from the aforementioned radio communication equipment with said second communication frequency Fb to the aforementioned wireless communication media, and a data receiving means which receives data transmitted by this data sending means.

[Claim 4]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

The first communication frequency Fa and the second communication frequency Fb fill Fa=Fb/K (1<K: positive number), this first communication frequency Fa -- Fa -- < -- < (Kc/16L) -- it filling (C: the velocity-of-light [m/s] L:maximum communication range [m]), and from the aforementioned radio communication equipment to the aforementioned wireless communication media, A power supply means which supplies electric power with said first communication frequency Fa, and an electric power receiving means which receives electric power supplied by this power supply means, A wireless communication system possessing a data sending means which transmits data from the aforementioned radio communication equipment with said second communication frequency Fb to the aforementioned wireless communication media, and a data receiving means which receives data transmitted by this data sending means.

[Claim 5]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

A first encoding means that assigns first data to first communication frequency transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment, A wireless communication system possessing a second encoding means which assigns second data to said first communication frequency transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment, and different second communication frequency.

[Claim 6]Wireless communication media of a non-cell type which has a wireless communication function.

Radio communication equipment which performs transmission and reception of these wireless communication media and data while supplying electric power to these wireless communication media by a wireless communication between these wireless communication media.

In a wireless communication system provided with the above,

First communication frequency Fa_m fills $Fa_m=Fa/m$ (1<m: integer), Second communication frequency Fa_n is $Fa_n=Fa/n$ (1< n integer). n!=m is filled, a first encoding means that assigns first data to first communication frequency Fa_m transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment, A wireless communication system possessing a second encoding means which assigns second data to second communication frequency Fa_n transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.

[Claim 7]Claim 1, Claim 2 and Claim 3 characterized by comprising the following, or the wireless communication system according to claim 4.

First communication frequency Fa_m fills Fa_m=Fa/m (1<m: integer), Second communication frequency Fa_n fills Fa_n=Fa/n (a 1<n integer, n!=m), A first encoding means that assigns first data to first communication frequency Fa_m transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment

A second encoding means which assigns second data to second communication frequency Fa_n transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.

[Claim 8]The phase modulation of said first communication frequency Fa_m to which said first data was assigned, and said second communication frequency Fa_n to which said second data was assigned is carried out with the communication frequency Fa, Claim 6 transmitting this phase modulation wave by which the phase modulation was carried out from the aforementioned communication media to the aforementioned radio communication equipment, or the wireless communication system according to claim 7.

[Claim 9]The wireless communication system comprising according to claim 8:

A receiving means which receives the aforementioned phase modulation wave in receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.

A multiplication means which multiplies Dj=Bsin (omega ct+pi(j-1) /4) (j= 1, 2, 3, 4) to a phase modulation wave received by this receiving means, an integrating means which integrates with an output of this multiplication means, and a selection means which chooses a value of j from which a demodulated signal outputted from this integrating means serves as the maximum.

[Claim 10]The wireless communication system comprising according to claim 8:

A receiving means which receives the aforementioned phase modulation wave in receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.

A first multiplication means that multiplies Dj=Bsin (omega ct+pi(j_1-1) /4) (j_1=1, 2, 3, 4) to a phase modulation wave received by this receiving means, As opposed to a phase modulation wave received by first integrating means that integrates with an output of this first multiplication means, and the aforementioned receiving means, A second multiplication means which multiplies Dj=Bsin (omega ct+pi(j_2-1) /4) (j_2=1, 2, 3, 4, j_1!=j_2), A selection means which chooses a demodulated signal with a larger output among demodulated signals outputted from a second integrating means which integrates with an output of this second multiplication means, and said first integrating means and said second integrating means.

[Claim 11]The wireless communication system comprising according to claim 8:
A receiving means which receives the aforementioned phase modulation wave in receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.

Dj=Bsin (omega ct+pi(j_1-1) /4) (j_1=1, 2, 3, 4), And a selection means which chooses one side of Dj=Bsin (omega ct+pi(j_2-1) /4) (j_2=1, 2, 3, 4, j_1!=j_2), A multiplication means which multiplies a value with this selected selection means to a phase modulation wave received by the aforementioned receiving means, an integrating means which integrates with an output of this multiplication means, and a selection-control means to control selection by the aforementioned selection means so that a demodulated signal outputted from this integrating means serves as the maximum.

[Claim 12]The wireless communication system comprising according to claim 10:
A delay means which delays a demodulated signal with the aforementioned selected selection means.

A multiplication means which multiplies a demodulated signal with the aforementioned selected selection means, and a demodulated signal delayed by the aforementioned delay means, and a demodulated data creating means which integrates with and binary-izes an output of this multiplication means, and generates demodulated data.

[Claim 13]The wireless communication system comprising according to claim 11:

A delay means which delays a demodulated signal outputted from the aforementioned integrating means.
A multiplication means by which even an output multiplies ********** and a demodulated signal delayed by the aforementioned delay means from the aforementioned integrating means, and a demodulated data creating means which integrates with and binary-izes an output of this multiplication means, and generates demodulated data.

[Claim 14]Claim 1 adding a subcarrier of data-communications frequency to data transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment, Claim 2, Claim 3, or the wireless communication system according to claim 4.
[Claim 15]A receiving means which receives data in which the aforementioned subcarrier was added, and a phase synchronization means which takes phase simulation, A switching means which connects or cuts a clock generating means which generates a clock, and the aforementioned phase synchronization means and the aforementioned clock generating means, By a subcarrier added to a reception signal which possessed a reception signal received by the aforementioned receiving means and a multiplication means which multiplies an output of the aforementioned clock generating means, and an integrating means which integrates with an output of this multiplication means, and was received by the aforementioned receiving means, When a synchronization of the aforementioned phase synchronization means and this reception signal is taken and a synchronization is able to be taken, phase simulation timing is transmitted from this phase synchronization means to the aforementioned clock generating means, The wireless communication system according to claim 14 cutting connection between the aforementioned phase synchronization means and a clock generating means by the aforementioned switching means at this time.
[Claim 16]When data communications of one frame are completed, by a subcarrier which connected the aforementioned phase synchronization means and a clock generating means by the aforementioned switching means, and was again added to a reception signal received by the aforementioned receiving means, When a synchronization of the aforementioned phase synchronization means and this reception signal is taken and a synchronization is able to be taken, phase simulation timing is

transmitted from this phase synchronization means to the aforementioned clock generating means, The wireless communication system according to claim 15 cutting connection between the aforementioned phase synchronization means and a clock generating means by the aforementioned switching means at this time.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]The wireless communication media (wireless card) of the non-cell type which has a wireless communication function which can carry this invention, for example, While supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, it is related with the wireless communication system provided with these wireless communication media and the radio communication equipment (radio card reader writer) which performs transmission and reception of data.

[0002]

[Description of the Prior Art]In recent years, the wireless communication system using a wireless card and a radio card reader writer is spreading through society. For example, it is being used for the system for which the monetary value of the system of an automatic wicket, a prepaid card or a banking card, etc. is exchanged.

[0003]In the system of the automatic wicket using a wireless communication system, Transpose a ticket medium to a wireless card and it mounts the function of a radio card reader writer on an automatic ticket gate machine, Information (information on a getting-on-and-off station etc.) required for the ticket gate stored in the wireless card as a ticket medium is read with an automatic ticket gate machine by a wireless communication, and collecting processing is performed based on this read information.

[0004]Many of conventional wireless communication systems serve as frequency which differs in the data-communications frequency transmitted to a wireless card, and the data-communications frequency transmitted from a wireless card to a radio card reader writer from the radio card reader writer. It is ******** so that a power supply may be supplied from a radio card reader writer to a wireless card by the data-communications frequency transmitted from a radio card reader writer to a wireless card. That is, data-communications frequency serves as the frequency for current supply. The clock for data demodulation is reproduced from the weak data transmitted from the wireless card when restoring to the data transmitted from the wireless card in a radio card reader writer, and the recovery of data is ******** by this reproduced clock. In addition, an NRZ code, a Manchester code, etc. are used for coding of data.

[0005]

[Problem to be solved by the invention]It is necessary to read the information on a wireless card in an instant by a radio card reader writer, and to perform collecting processing promptly in the system of the automatic wicket using a wireless communication system which was described above. Therefore, in order to operate a wireless communication system in the state where it was stabilized, it becomes important to synchronize the clock of a radio card reader writer and a wireless card and to make it restore to commo data by a low error rate. It is in the power supply which operates a wireless card, and the state stabilized in the clock, and it becomes important to make supply possible easily.

[0006]However, in the above-mentioned conventional wireless communication system, there was a problem in realization of the stable radio card system plentifully triggered by the following.

[0007]In a radio card reader writer, since the clock for data demodulation is reproduced from the weak data transmitted from a wireless card when restoring to the data transmitted from the wireless card, the clock reproduced may become unstable. The more the communication range between a radio card reader writer and a wireless card becomes long especially, the more such a situation appears notably. If the clock for data demodulation becomes unstable, when the data to which it restores is coded by an NRZ code or Manchester code, there is a possibility that the data to which it restores may be reversed.

[0008]The object of this invention is to accomplish in view of a situation which was described above, and to provide the stable radio card system which can restore to data by a low error rate.

[0009]

[Means for solving problem]In order to solve an aforementioned problem and to achieve the object, the wireless communication system of this invention is constituted as follows.

[0010](1) Invention of the Claim 1 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, A power supply means which supplies electric power from the aforementioned radio communication equipment with first communication frequency to the aforementioned wireless communication media.
A data sending means which transmits data from the aforementioned radio communication equipment with above-mentioned first communication frequency and different second communication frequency to the aforementioned wireless communication media.

[0011](2) Invention of the Claim 2 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, A power supply means which supplies electric power from the aforementioned radio communication equipment with first communication frequency to the aforementioned wireless communication media.
An electric power receiving means which receives electric power supplied by this power supply means.
A data receiving means which receives data transmitted by a data sending means which transmits data with above-mentioned first communication frequency and different second communication frequency to the aforementioned wireless communication media, and this data sending means from the aforementioned radio communication equipment.

[0012](3) Invention of the Claim 3 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, A power supply means to which the first communication frequency Fa and the second communication frequency Fb fill Fa=Fb/K (1<K: positive number), and supply electric power from the aforementioned radio communication equipment with the above-mentioned first communication frequency Fa to the aforementioned wireless communication media.
An electric power receiving means which receives electric power supplied by this power supply means.
A data sending means which transmits data from the aforementioned radio communication equipment with the above-mentioned second communication frequency Fb to the aforementioned wireless communication media, and a data receiving means which receives data transmitted by this data sending means.

[0013](4) Invention of the Claim 4 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, The first communication frequency Fa and the second communication frequency Fb fill Fa=Fb/K (1<K: positive number), this first communication frequency Fa -- Fa -- < -- < (Kc/16L) -- a power supply means which fills (C: the velocity-of-light [m/s] L:maximum communication range [m]), and supplies electric power from the aforementioned radio communication equipment with the above-mentioned first communication frequency Fa to the aforementioned wireless communication media.
An electric power receiving means which receives electric power supplied by this power

supply means.
A data sending means which transmits data from the aforementioned radio communication equipment with the above-mentioned second communication frequency Fb to the aforementioned wireless communication media, and a data receiving means which receives data transmitted by this data sending means.

[0014](5) Invention of the Claim 5 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, A first encoding means that assigns first data to first communication frequency transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.
A second encoding means which assigns second data to above-mentioned first communication frequency transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment, and different second communication frequency.

[0015](6) Invention of the Claim 6 description is provided with the following.
Wireless communication media of a non-cell type which has a wireless communication function.
In the wireless communication system provided with these wireless communication media and the radio communication equipment which performs transmission and reception of data while supplying electric power to these wireless communication media by the wireless communication between these wireless communication media, First communication frequency Fa_m fills $Fa_m=Fa/m$ (1<m: integer), A first encoding means that assigns first data to first communication frequency Fa_m that second communication frequency Fa_n fills $Fa_n=Fa/n$ (a 1<n integer, n!=m), and is transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.

A second encoding means which assigns second data to second communication frequency Fa_n transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.

[0016](7) Invention of the Claim 7 description is provided with the following.
It adds to Claim 1, Claim 2, Claim 3, or the composition according to claim 4, First communication frequency Fa_m fills Fa_m=Fa/m (1<m: integer), A first encoding means that assigns first data to first communication frequency Fa_m that second communication frequency Fa_n fills Fa_n=Fa/n (a 1<n integer, n!=m), and is transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.
A second encoding means which assigns second data to second communication frequency Fa_n transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.

[0017](8) invention of the Claim 8 description -- Claim 6 or the composition according to claim 7 -- in addition, The phase modulation of above-mentioned first communication frequency Fa_m to which the above-mentioned first data was assigned, and the above-mentioned second communication frequency Fa_n to which the above-mentioned second data was assigned is carried out with the communication frequency Fa, This phase modulation wave by which the phase modulation was carried out is transmitted from the aforementioned communication media to the aforementioned radio communication equipment.
[0018](9) Invention of the Claim 9 description is provided with the following.
A receiving means which receives the aforementioned phase modulation wave in in addition to the composition according to claim 8 receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.
A multiplication means which multiplies Dj=Bsin (omega ct+pi(j-1) /4) (j= 1, 2, 3, 4) to a phase modulation wave received by this receiving means.
An integrating means which integrates with an output of this multiplication means.
A selection means which chooses a value of j from which a demodulated signal outputted from this integrating means serves as the maximum.

[0019](10) Invention of the Claim 10 description is provided with the following.

A receiving means which receives the aforementioned phase modulation wave in in addition to the composition according to claim 8 receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.

A first multiplication means that multiplies Dj=Bsin (omega ct+pi(j_1-1) /4) (j_1=1, 2, 3, 4) to a phase modulation wave received by this receiving means.

A first integrating means that integrates with an output of this first multiplication means.

The second multiplication means which multiplies Dj=Bsin (omega ct+pi(j_2-1) /4) (j_2=1, 2, 3, 4, j_1!=j_2) to the phase modulation wave received by the aforementioned receiving means, A selection means which chooses a demodulated signal with a larger output among demodulated signals outputted from a second integrating means which integrates with an output of this second multiplication means, and above-mentioned first integrating means and above-mentioned second integrating means.

[0020](11) Invention of the Claim 11 description is provided with the following.

A receiving means which receives the aforementioned phase modulation wave in in addition to the composition according to claim 8 receiving the aforementioned phase modulation wave and restoring to this received phase modulation wave.

A selection means which chooses either Dj=Bsin (omega ct+pi(j_1-1) /4) (j_1=1, 2, 3, 4) or Dj=Bsin (omega ct+pi(j_2-1) /4) (j_2=1, 2, 3, 4, j_1!=j_2).

A multiplication means which multiplies a value with this selected selection means to a phase modulation wave received by the aforementioned receiving means.

An integrating means which integrates with an output of this multiplication means, and a selection-control means to control selection by the aforementioned selection means so that a demodulated signal outputted from this integrating means serves as the maximum.

[0021](12) Invention of the Claim 12 description is provided with the following.

A delay means which delays a demodulated signal with the aforementioned selected selection means in addition to the composition according to claim 10.

A multiplication means which multiplies a demodulated signal with the aforementioned selected selection means, and a demodulated signal delayed by the aforementioned

delay means.
A demodulated data creating means which integrates with and binary-izes an output of this multiplication means, and generates demodulated data.

[0022](13) Invention of the Claim 13 description is provided with the following.
A delay means which delays a demodulated signal outputted from the aforementioned integrating means in addition to the composition according to claim 11.
A multiplication means by which even an output multiplies ********** and a demodulated signal delayed by the aforementioned delay means from the aforementioned integrating means.
A demodulated data creating means which integrates with and binary-izes an output of this multiplication means, and generates demodulated data.

[0023](14) invention of the Claim 14 description -- Claim 1, Claim 2, Claim 3, or the composition according to claim 4 -- in addition, add the subcarrier of data-communications frequency to the data transmitted from the aforementioned wireless communication media to the aforementioned radio communication equipment.
[0024]Invention of the Claim 15 description in the composition according to claim 14 (15) In addition, the receiving means which receives the data in which the aforementioned subcarrier was added, The phase synchronization means which takes phase simulation, and the clock generating means which generates a clock, The switching means which connects or cuts the aforementioned phase synchronization means and the aforementioned clock generating means, By the subcarrier added to the reception signal which possessed the reception signal received by the aforementioned receiving means and the multiplication means which multiplies the output of the aforementioned clock generating means, and the integrating means which integrates with the output of this multiplication means, and was received by the aforementioned receiving means, When the synchronization of the aforementioned phase synchronization means and this reception signal is taken and a synchronization is able to be taken, phase simulation timing is transmitted from this phase synchronization means to the aforementioned clock generating means, and the aforementioned switching means cuts connection between the aforementioned phase synchronization means and a clock generating means at this time.

[0025](16) Invention of the Claim 16 description in the composition according to claim 15 in addition, when the data communications of one frame are completed, By the subcarrier which connected the aforementioned phase synchronization means and the clock generating means by the aforementioned switching means, and was again added to the reception signal received by the aforementioned receiving means, When the synchronization of the aforementioned phase synchronization means and this reception signal is taken and a synchronization is able to be taken, phase simulation timing is transmitted from this phase synchronization means to the aforementioned clock generating means, and the aforementioned switching means cuts connection between the aforementioned phase synchronization means and a clock generating means at this time.

[0026]

[Mode for carrying out the invention]Hereinafter, with reference to Drawings, it describes about this embodiment of the invention.

[0027]Fig.1 is the figure showing the outline of the wireless communication system of this invention.

[0028]As shown in Fig.1, the radio card reader writer 100 and the wireless card 200 which have the antenna section 102 are provided by the wireless communication system of this invention. It shall be connected with the coaxial cable or the radio card reader writer 100 and the reader/writer antenna 102 shall be unified.

[0029]The radio card reader writer 100 shall operate around the center of the clock of the frequency fp. This radio card reader writer 100 transmits data by a data-communications wave (frequency fd) while transmitting electric power by a transfer-of-power wave (frequency fp) to the wireless card 200.

[0030]These frequency fp and the frequency fd shall be set up to fill the relation of fd=fp/k (1<k: integer). furthermore -- if a communication range is set to L and the velocity of light is set to c -- fp -- fp -- < -- < (kc/16L) -- a relation shall also be filled

[0031]Thereby, it becomes possible to operate the wireless card 200 around the center of the clock frequency (frequency fp) of the radio card reader writer 100. Therefore, it becomes unnecessary to make a PLL circuit build in, and since simplification of the circuit configuration of the wireless card 200 is attained and the consumed electric current becomes low, 1 chip making becomes easy especially in the circuit in the wireless card 200.

[0032]Then, with reference to Fig.2, the outline of the circuit configuration of the radio card reader writer 100 is described. Fig.2 is the figure showing the outline of the circuit configuration of the radio card reader writer 100.

[0033]As shown in Fig.2, to the radio card reader writer 100, As the antenna section 102, the electric power driver 103, the clock generation part 104, the modulation part 105, the demodulation section 106, the transceiver change-over switch 107, the data processing part 108, and a power supply means. The data-communications antenna 110 as the antenna 109 for **********, a data sending means, and a receiving means, etc. are provided.

[0034]Two antennas, the antenna 109 for transfer of power for transfer of power and the antenna 110 for data communications for data communications, are provided by the antenna section 102. The transceiver change-over switch 107 switches a transmitting mode and receiving mode, the modulation part 105 and the antenna 110 for data communications are connected at the time of a transmitting mode, and the demodulation section 106 and the antenna 110 for data communications are connected at the time of receiving mode.

[0035]At the time of transfer of power, the clock of a transfer-of-power wave is generated by the clock generation part 104, it is amplified by the electric power driver 103, and the antenna 109 for transfer of power emanates in the air. At this time, the frequency of the transfer-of-power wave emitted in the air is the frequency fp.

[0036]In data transmission, a clock required for modulation data is generated by the clock generation part 104, this generated clock is supplied to the data processing part 108, and data is generated in the data processing part 108. The generated data is sent to the modulation part 105, and is modulated by the modulation clock supplied from the clock generation part 104. Thus, the modulated modulation data passes along the transceiver change-over switch 107 set as the transmitting mode, and is emitted in the air from the antenna 110 for data communications. At this time, the frequency of the data-communications wave emitted in the air is the frequency fd.

[0037]In data receiving, the modulated wave received from the antenna 110 for data communications passes along the transceiver change-over switch 107 set as receiving mode, and is input into the demodulation section 106. In the demodulation section 106, a recovery is performed by the demodulation clock supplied from the clock generation part 104, the demodulated data to which it restored is input into the data processing part 108, and data processing is performed.

[0038]Then, with reference to Fig.3, the outline of the circuit configuration of the wireless card 200 is described. Fig.3 is the figure showing the outline of the circuit configuration of the wireless card 200.

[0039]As shown in Fig.3, the rectification part 203, the electric power generation part 204, the clock generation part 205, the transceiver change-over switch 207, the 1st, the modulation part 208 as a second encoding means, the demodulation section 209, the data processing part 210, the antenna section 211, etc. are provided by the wireless card 200.

[0040]Two antennas, the electric power receiving antenna 202 as an electric power receiving means and the antenna 206 for data communications as a data receiving means, are provided by the antenna section 211. The transceiver change-over switch 207 switches a transmitting mode and receiving mode, the modulation part 208 and the antenna 206 for data communications are connected at the time of a transmitting mode, and the demodulation section 209 and the antenna 206 for data communications are connected at the time of receiving mode.

[0041]The transfer-of-power wave (frequency fp) transmitted from the radio card reader writer 100 is received by the antenna 206 for data communications, and is input into the rectification part 203 via the transceiver change-over switch 207 set as receiving mode. The transfer-of-power wave rectified by the rectification part 203 is input into the electric power generation part 204, and is incorporated as electric power. The transfer-of-power wave rectified by this rectification part 203 is input also into the clock generation part 205. In the clock generation part 205, the system clock of the wireless card 200 is generated from a transfer-of-power wave. Therefore, the wireless card 200 operates with the electric power generated by the electric power generation part 204, and the clock generated by the clock generation part 205. On the other hand, in data transmission, a clock required for modulation data is generated by the clock generation part 205, this generated clock is supplied to the data processing part 310, and data is generated in the data processing part 310. The generated data is sent to the modulation part 208, and is modulated by the modulation clock supplied from the clock generation part 205. Thus, the modulated modulation data passes along the transceiver change-over switch 207 set as the transmitting mode, and is emitted in the air by the antenna 206 for data communications. At this time, the frequency of the data-communications wave emitted in the air turns into the frequency fd.

[0042]In data receiving, the modulated wave received from the antenna 206 for data communications passes along the transceiver change-over switch 207 set as receiving mode, and is input into the demodulation section 209. In the demodulation section 209, a recovery is performed by the demodulation clock supplied from the clock generation part 205, the demodulated data to which it restored is input into the data processing part 210, and data processing is performed.

[0043]Then, with reference to Fig.4 and Fig.5, it describes about the antenna in the antenna section of the radio card reader writer 100 and the wireless card 200. outline **** of an antenna [in / in Fig.4 / the antenna section of the radio card reader writer 100 and the wireless card 200] -- it is the figure showing the 1. outline **** of an antenna [in / in Fig.5 / the antenna section of the radio card reader writer 100 and the wireless card 200] -- it is the figure showing the 2. As shown in Fig.4, the periphery antenna 301 and the inner circumference antenna 302 are provided, the periphery antenna 301 is assigned to the antenna for transfer of power, or the antenna for data communications, and the inner circumference antenna 302 is assigned to the antenna for data communications, or the antenna for transfer of power at the antenna sections 102 and 211.

[0044]As shown in Fig.5, the periphery antenna 311 and the inner circumference antenna 312 are provided, the periphery antenna 311 is assigned to the antenna for transfer of power, or the antenna for data communications, and the inner circumference antenna 312 is assigned to the antenna for data communications, or the antenna for transfer of power at the antenna sections 102 and 211.

[0045]The above-mentioned composition of an antenna section is an example, and it is possible to pile up a part of antenna 109 for transfer of power or 202, and the antenna 110 for data communications or 206, or to detach mutual distance, and to build the optimal transmitting and receiving environment.

[0046]Then, with reference to Fig.6, it describes about the coding and modulation of data in the wireless card 200. Fig.6 is a wave form chart for describing the coding and modulation of data in the wireless card 200.

[0047]According to this embodiment, in coding of the send data transmitted from the wireless card 200, $fd_n=fd/n$ (1<n: an integer, n!=m) shall be assigned to the frequency of $fd_m=fd/m$ (1<m: integer), and data "0" to data "1."

[0048]For example, if m= 8 and n= 12, the data s1 shown in Fig.6 turns into the coded data s2 by coding. With the modulation clock s3, the phase modulation of the coded data s2 is carried out, and it serves as the modulating signal s4. The radio card reader writer 100 restores to the waveform of the modulating signal s4 transmitted from the wireless card 200, and it is necessary to obtain the data s1.

[0049]Then, with reference to Fig.7, it describes about the recovery of the data in the radio card reader writer 100. Fig.7 is a wave form chart for describing the recovery of the data in the radio card reader writer 100.

[0050]Temporarily, the frequency fp of a transfer-of-power wave and the frequency fd of a data-communications cycle shall fill the relation between fd=fp/4 (k= 4). The master clock (frequency fp) s21, the modulation clock (frequency fp/4) s22, the data code s23, and the modulating signal s24 are shown in Fig.7. This modulating signal s24 is transmitted from the wireless card 200. That is, the radio card reader writer 100 receives this modulating signal s24, and restores to this received modulating signal s24.

[0051]Since it is the requisite that it is satisfied with this embodiment of fp<<kc/16L as mentioned above, it is thought that the phase of the master clock on the radio card reader writer 100 side and the master clock on the wireless card 200 side is substantially equal. However, if delay and the phase of a circuit are taken into consideration, it is not the same at all. Here, the state where delay and a phase were corrected is considered. About these delay and phases, it shall describe later. Since the demodulation clock on the radio card reader writer 100 side is 4 dividing of a master clock, four kinds of phase states of a demodulation clock are considered to received data {Dj=Bsin (omega ct+pi(j-1) /4) (j= 1, 2, 3, 4)}. The 1st phase states are the modulation clock s22 on the wireless card 200 side, and a waveform completely in phase. The 2nd phase states are the waveforms of the demodulation clock s25 shifted pi/4 to the modulation clock s22. The 3rd is a waveform of the demodulation clock s27 with which phase states deviated pi/2 to the modulation clock s22. The 4th phase states are the waveforms shifted 3pi/4 to the modulation clock s22.

[0052]Using each demodulation clock, the case which restores to the modulating signal s24 is considered. If the modulating signal s24 gets over with the modulation clock s22, naturally the data code s23 will be obtained as a demodulation output. If the modulating signal s24 gets over with the demodulation clock s25, the multiplication output s26 of the output which multiplied the modulating signal s24 and the demodulation clock s25 will be obtained as a demodulation output. However, this multiplication output s25 is data on the wireless card 200 side, and completely different data. If the modulating signal s24 gets over with the demodulation clock s27, the output multiplication output s28 which multiplied the modulating signal s24 and the demodulation clock s27 will be obtained as a demodulation output. This multiplication output s28 is the data which reversed the data code s23.

[0053]In this embodiment, since data coding which was described by Fig.6 is performed, "0" of data and "1" can be judged by a frequency component. Therefore, the multiplication output s28 is the same as that of the data code s23 in data. That is, when the demodulation clock of multiplication output s25 state is used, it is saying that demodulated data is not obtained.

[0054]Then, with reference to Fig.8, it describes about the demodulation section 106 of the radio card reader writer 100, and the demodulation section 209 of the wireless card 200. Fig.8 is the figure showing 1 of ********** of the demodulation section 106 of the radio card reader writer 100, and the demodulation section 209 of the wireless card 200.

[0055]As described by Fig.2 and Fig.3, the modulated wave received by the antenna 110 for data receiving or 206 is input into the demodulation section 106 or 209 via the transceiver change-over switch 107 set as receiving mode, or 207. The modulation input into this demodulation section 106 or 209 passes the matching network 402, the filter 403, and the amplifier 404, and is amplified even to the level to which it can restore.

[0056]On the other hand, in the clock generation part 405, a demodulation clock which serves as phase relation of the multiplication output s25 described by Fig.7 and the multiplication output s27 is generated (here, the multiplication output s25 and the multiplication output s27 shall be generated). The multiplication output s25 generated by the clock generation part 405 is input into the 1st multiplier, and the multiplication output s27 is input into the 2nd multiplier 407. The modulating signal outputted from the amplifier 404 is input into these 1st multipliers 406 and the 2nd multiplier 407. That is, the multiplication output s25 and the modulating signal outputted from the amplifier 404 are multiplied by the 1st multiplier 406. The multiplication output s27 and the modulating signal outputted from the amplifier 404 are multiplied by the 2nd multiplier 407.

[0057]The output of the 1st multiplier 406 is input into the 1st integrator 408, and the output of the 2nd multiplier 407 is input into the 2nd integrator 409. The suitable constant for each is set to these 1st integrators 408 and the 2nd integrator 409, and a difference arises from these 1st integrators 408 and the 2nd integrator 409 to an output level. The difference of this output level is judged by the level determination part 410. Based on the level decision signal outputted from this level determination part 410, the circuit changeover switch 411 as a selection means is switched.

[0058]That is, when judged with the output of the 1st integrator 408 being larger than the output of the 2nd integrator 409 by the level determination part 410, The circuit changeover switch 411 is switched by the level decision signal outputted from the level determination part 410 at this time, and the 1st integrator 408 and the operation circuit 600 mentioned below are connected. On the contrary, when judged with the output of the 2nd integrator 409 being larger than the output of the 1st integrator 408 by the level determination part 410, The circuit changeover switch 411 is switched by the level decision signal outputted from the level determination part 410 at this time, and the 2nd integrator 409 and the operation circuit 600 mentioned below are connected.

[0059]Thus, in the radio card reader writer 100, it can restore to the modulating signal transmitted from the wireless card 200, and can acquire the signal by which data coding was carried out. Although described in this embodiment about the case which chooses and uses the demodulation clock s25 shifted pi/4 and the demodulation clock s27 shifted pi/4 (= pi/2), it may be made to use pi, pi/4, 2pi/4 (= pi/2), and the demodulation clock shifted 3pi/4, choosing.

[0060]Then, with reference to Fig.9, it describes about the demodulation section 106 of the radio card reader writer 100, and the demodulation section 209 of the wireless card 200. Fig.9 is the figure showing 2 of ********** of the demodulation section 106 of the radio card reader writer 100, and the demodulation section 209 of the wireless card 200.

[0061]As described by Fig.2 and Fig.3, the modulated wave received by the antenna 110 for data receiving or 206 is input into the demodulation section 106 or 209 via the transceiver change-over switch 107 set as receiving mode, or 207. The modulation input into this demodulation section 106 or 209 passes the matching network 502, the filter 503, and the amplifier 504, and is amplified even to the level to which it can restore.

[0062]On the other hand, in the clock generation part 505, a demodulation clock which serves as phase relation of the multiplication output s25 described by Fig.7 and the multiplication output s27 is generated (here, the multiplication output s25 and the multiplication output s27 shall be generated). The multiplication output s25 and the multiplication output s27 which were generated by the clock generation part 405 are input into the multiplier 506 according to the change of the clock change-over switch 507 as a selection means. That is, the clock change-over switch 507 switches the multiplication output s25 and the multiplication output s27 which are input into the multiplier 506. The control signal which controls the change of this clock change-over switch 507 presupposes that the clock change-over switch 507 is supplied a certain cycle. The modulating signal outputted from the amplifier 504 is input into the multiplier 506. That is, the multiplication output s25 or the multiplication output s27, and the modulating signal outputted from the amplifier 404 are multiplied by the multiplier 506.

[0063]The output of the multiplier 506 is input into the integrator 508. The output level of this integrator 508 is judged by the level determination part 509 as a selection-control means, and the clock change-over switch 507 is switched based on the level decision signal outputted from this level determination part 509.

[0064]That is, the output level of the integrator 508 when the multiplication output s25 is supplied to the multiplier 506 in the level determination part 509, When judged with it being larger than the output level of the integrator 508 when the multiplication output s27 is supplied to the multiplier 506, Change fixing of the circuit changeover switch 411 is carried out by the level decision signal outputted from the level determination part 410 at this time, and the multiplication output s25 comes to be supplied to the multiplier 506. On the contrary. In the level determination part 509, the output level of the integrator 508 when the multiplication output s27 is supplied to the multiplier 506, When judged with it being larger than the output level of the integrator 508 when the multiplication output s25 is supplied to the multiplier 506, Change fixing of the circuit changeover switch 411 is carried out by the level decision signal outputted from the level determination part 410 at this time, and the multiplication output s27 comes to be supplied to the multiplier 506. The output of the integrator 508 is input into the operation circuit 600 mentioned below.

[0065]Thus, in the radio card reader writer 100, it can restore to the modulating signal transmitted from the wireless card 200, and can acquire the signal by which data coding was carried out. Although described in this embodiment about the case which chooses and uses the demodulation clock s25 shifted pi/4 and the demodulation clock s27 shifted pi/4 (= pi/2), it may be made to use pi, pi/4, 2pi/4 (= pi/2), and the demodulation clock shifted 3pi/4, choosing.

[0066]Then, with reference to Fig.10, it describes about the waveform of the signal by which data coding was carried out by the radio card reader writer 100. Fig.10 is a wave form chart for describing the waveform of the signal by which data coding was carried out by the radio card reader writer 100.

[0067]In Fig.10, By the decoding parts 106 and 209 shown in the data s31, Fig.8, and Fig.9 on the wireless card 200 side. The demodulated data code s32 to which it restored, the 1-bit delay output s33 by which 1 bit of this demodulated data code s32 was delayed, the demodulated data code s32, the multiplication output s34 of a 1-bit delay output, the integrated output s35 of the multiplication output s34, and the binary-ized output s36 of the integrated output s35 are shown. Therefore, if the above-mentioned process is followed, restoring to the data of the wireless card 200 is possible.

[0068]Then, with reference to Fig.11, it describes about the operation circuit 600 which performs waveform operation shown in Fig.10. Fig.11 is the figure showing the schematic structure of the operation circuit 600.

[0069]The demodulated data code outputted to the 1 bit delay circuit 601 as a delay means shown in Fig.11 from the integrator 508 shown in the circuit changeover switch 411 shown in Fig.8 or Fig.9 is input. The output of this 1 bit delay circuit 601 is input into the multiplier 602. The direct entry of the demodulated data code input into the 1 bit delay circuit 601 is carried out to this multiplier 602. That is, this multiplier 602 multiplies the demodulated data code delayed 1 bit and the demodulated data code which is not delayed.

[0070]The output of this multiplier 602 is input into the integrator 603, and the output of this integrator is input into the binarization circuit 604 as a demodulated data creating means. Decoding of data coding is attained by reversing the output of this binarization circuit 604.

[0071]Then, with reference to Fig.12, it describes about the outline of the data configuration transmitted from the wireless card 200. Fig.12 is the figure showing the outline of the data configuration transmitted from the wireless card 200.

[0072]As shown in Fig.12, the demodulation clock synchronous data D1 and the data D2 are contained in the data transmitted from the wireless card 200. The demodulation clock synchronous data D1 is a synchronized signal required for clock selection. Generally, it is a subcarrier which has not required modulation. The data D2 is data according to a predetermined protocol.

[0073]Then, with reference to Fig.13, it describes about the demodulation clock generated by the demodulation section (it describes in Fig.14) which uses a phase synchronization circuit. Fig.13 is a wave form chart for describing the demodulation clock generated by the demodulation section which uses a phase synchronization circuit. The received waveforms s51, the phase synchronization circuit clock s52, the lock signal s53, the end-of-data signal s54, the phase simulation circuit changeover switch s55, and the demodulation clock s56 are shown in Fig.13.

[0074]At the head of the data of the received waveforms s51, as described by Fig.12, the subcarrier is added. The phase synchronization circuit clock s52 is a clock of the phase synchronization circuit mentioned below. When this phase synchronization circuit is able to take the received waveforms s51 and a synchronization, it generates the lock signal s53. When one frame of data is completed, the data processing part 108 or 210 uses the lock signal s53 and the end-of-data signal s54 for the waveform of the end-of-data signal s54, and it generates the phase simulation circuit changeover switch s55 which controls operation of a phase synchronization circuit. Here, the synchronization of the demodulation clock s56 is united by the signal of the lock signal s53. If the phase simulation circuit changeover switch s55 is set to "0", a phase synchronization circuit will be separated from a clock generation part, and the demodulation clock s56 will continue being generated with the above-mentioned synchronized signal. The phase simulation circuit changeover switch s55 is set to "1" by the signal of the end-of-data signal s54, and a phase synchronization circuit is again connected to a clock generation part.

[0075]Then, with reference to Fig.14, it describes about the demodulation section which uses a phase synchronization circuit. Fig.14 is the figure showing the schematic structure of the demodulation sections 106 and 209 which use a phase synchronization circuit.

[0076]As described by Fig.2 and Fig.3, the modulated wave received by the antenna 110 for data receiving or 206 is input into the demodulation section 106 or 209 via the transceiver change-over switch 107 set as receiving mode, or 207. The modulation input into this demodulation section 106 or 209 passes the matching network 702, the filter 703, and the amplifier 704, and is amplified even to the level to which it can restore.

[0077]On the other hand, the phase synchronization circuit 705 as a phase synchronization means generates the synchronized signal in sync with the modulating signal outputted from the amplifier 704. This generated synchronized signal passes the phase simulation circuit changeover switch 710 as a switching means, and is transmited to the clock generation part 706 as a clock generating means. The phase simulation circuit changeover switch 710 connects the clock generation part 706 and the phase synchronization circuit 705 at the time of waveform"1" of the phase simulation circuit changeover switch s55, and the clock generation part 706 and the phase synchronization circuit 705 are separated at the time of waveform"0" of the phase simulation circuit changeover switch s55.

[0078]When the demodulation clock of the modulating signal outputted from the amplifier 704 and the phase synchronization circuit 705 synchronizes, a phase simulation circuit changeover switch serves as OFF, and the synchronous clock generated by the clock generation part 706 is supplied to the multiplier 707 as a demodulation clock. The output of the multiplier 707 is input into the integrator 708, and the output of this integrator 708 serves as demodulated data. After one frame of data is completed, the phase simulation circuit changeover switch 710 is set to ON, and the modulating signal again outputted from the amplifier 704 in the phase synchronization circuit 705 and the process of taking a synchronization are turned on.

[0079]

[Effect of the Invention]According to this invention, the stable radio card system which can restore to data can be provided by a low error rate.

[0080]It is as follows when it describes specifically.

[0081]This invention sets up the transfer-of-power frequency fd and the data-communications frequency fd to fill the relation of fd=fp/k (1<k: integer), and -- to the velocity of light c and the communication range L -- fp -- < -- < (kc/16L) -- by setting up fp to become, In the wireless communication between the radio card reader writer 100 and the wireless card 200, The phase contrast of the clock on the radio card reader writer 100 side and the clock on the wireless card 200 side becomes weak, It becomes usable as a system clock of a radio card system about the data-communications frequency fp, and phase comparators, such as PLL, etc. become unnecessary and it can provide a wireless communication system easily.

[0082]When performing data coding, to data "1" The frequency [Hz] of fd_m=fd/m (1<m: integer), By assigning the frequency [Hz] of fd_n=fd/n (1<n: an integer, n!=m) to data "0", it is possible to extract data as a frequency component, when performing data demodulation -- the time of a recovery -- a demodulated signal -- "1" and "0" -- it can get over, even if reversed, and a wireless communication system with a low error rate can be provided.

[0083]Prepare the k/2 same demodulator circuit, and it receives received modulated wave R=Asinomegat, respectively -- Dj=Bsin (omega ct+pi(j-1) /4) (j= 1, 2, and --) Multiply k/2 and it receives received modulated wave R=Asinomegat in the method and the clock for a recovery of choosing the receiving circuit where the output which integrated with the output is the largest, respectively -- Dj=Bsin (omega ct+pi(j-1) /4) (j= 1, 2, and --) By preparing k/2, multiplying by a certain time slot with a reception signal sequentially, choosing a demodulation clock with the largest output that integrated with the output, considering it as the demodulation clock of data demodulation, and taking the method of restoring to data, It can provide that receiving sensitivity is high without a PLL circuit, and there is a wireless communication system which can extend a communication range because a demodulation output makes the largest output the demodulation output that it can get over with the stable clock.

[0084]By inputting into the filter of easy composition of having the constant which delayed 1 bit of written data coding as a method of converting to the data of an NRZ code, and was suitable for the data rate in the output, binary-izing the output and using it as demodulated data, That data changes with the delicate timing of a clock decreases.

[0085]When the synchronization of a phase synchronization circuit and a reception signal is taken by the subcarrier of a reception signal head and a synchronization is able to be taken, From a phase synchronization circuit, transmit phase simulation timing to a clock generation part, and further At this time. By connecting a phase synchronization circuit to a clock generation part again, when a phase synchronization circuit and a clock generation part are separated, it restores henceforth to data with the clock of a clock generation part and the data communications of one frame are completed, It becomes possible to become possible to generate a demodulation clock stably also in complicated data coding which PLL does not lock, and to perform the stable data communications.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is the figure showing the outline of the wireless communication system of this invention.

[Drawing 2]It is the figure showing the outline of the circuit configuration of the radio card reader writer shown in Fig.1.

[Drawing 3]It is the figure showing the outline of the circuit configuration of the wireless card shown in Fig.1.

[Drawing 4]outline **** of the antenna in the antenna section of a radio card reader writer and a wireless card -- it is the figure showing the 1.

[Drawing 5]outline **** of the antenna in the antenna section of a radio card reader writer and a wireless card -- it is the figure showing the 2.

[Drawing 6]It is a wave form chart for describing the coding and modulation of data in a wireless card.

[Drawing 7]It is a wave form chart for describing the recovery of the data in a radio card reader writer.

[Drawing 8]It is the figure showing 1 of ********** of the demodulation section of a radio card reader writer, and the demodulation section of a wireless card.

[Drawing 9]It is the figure showing 2 of ********** of the demodulation section of a radio card reader writer, and the demodulation section of a wireless card.

[Drawing 10]It is a wave form chart for describing the waveform of the signal by which data coding was carried out by the radio card reader writer.

[Drawing 11]It is the figure showing the schematic structure of an operation circuit.

[Drawing 12]It is the figure showing the outline of the data configuration transmitted from a wireless card.

[Drawing 13]It is a wave form chart for describing the demodulation clock generated by the demodulation section which uses a phase synchronization circuit.

[Drawing 14]It is the figure showing the schematic structure of the demodulation section which uses a phase synchronization circuit.

[Explanations of letters or numerals]

100 -- Radio card reader writer

102 -- Antenna section

103 -- Electric power driver

104 -- Clock generation part

105 -- Modulation part

106 -- Demodulation section

107 -- Transceiver change-over switch

108 -- Data processing part

109 -- Antenna for transfer of power

110 -- Antenna for data communications

200 -- Wireless card

202 -- Electric power receiving antenna

203 -- Rectification part

204 -- Electric power generation part

205 -- Clock generation part

206 -- Antenna for data communications

207 -- Transceiver change-over switch

208 -- Modulation part

209 -- Demodulation section

210 -- Data processing part

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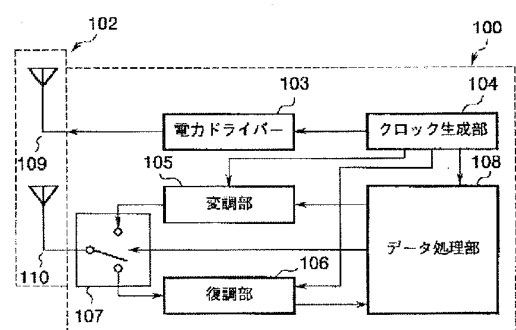
(54)【発明の名称】　無線通信システム

(57)【要約】
【課題】低い誤り率でデータの復調が可能な安定した無線カードシステムを提供すること。
【解決手段】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、前記無線通信装置から前記無線通信媒体に対して、第１の通信周波数により電力を供給する電力供給手段（１０９）と、前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数と異なる第２の通信周波数によりデータを送信するデータ送信手段（１１０）とを具備している。



【特許請求の範囲】

【請求項１】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
前記無線通信装置から前記無線通信媒体に対して、第１の通信周波数により電力を供給する電力供給手段と、
前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数と異なる第２の通信周波数によりデータを送信するデータ送信手段と、
を具備したことを特徴とする無線通信システム。

【請求項２】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
前記無線通信装置から前記無線通信媒体に対して、第１の通信周波数により電力を供給する電力供給手段と、
この電力供給手段により供給される電力を受け取る電力受取手段と、
前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数と異なる第２の通信周波数によりデータを送信するデータ送信手段と、
このデータ送信手段により送信されるデータを受け取るデータ受取手段と、
を具備したことを特徴とする無線通信システム。

【請求項３】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
第１の通信周波数Ｆａ及び第２の通信周波数Ｆｂが、Ｆａ＝Ｆｂ／Ｋ（１＜Ｋ：正数）を満たし、
前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数Ｆａにより電力を供給する電力供給手段と、
この電力供給手段により供給される電力を受け取る電力受取手段と、
前記無線通信装置から前記無線通信媒体に対して、前記第２の通信周波数Ｆｂによりデータを送信するデータ送信手段と、
このデータ送信手段により送信されるデータを受け取るデータ受取手段と、
を具備したことを特徴とする無線通信システム。

【請求項４】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
第１の通信周波数Ｆａ及び第２の通信周波数Ｆｂが、Ｆａ＝Ｆｂ／Ｋ（１＜Ｋ：正数）を満たし、
この第１の通信周波数Ｆａが、Ｆａ＜＜（Ｋｃ／１６Ｌ）を満たし（Ｃ：光速［ｍ／ｓ］、Ｌ：最大通信距離［ｍ］）、
前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数Ｆａにより電力を供給する電力供給手段と、
この電力供給手段により供給される電力を受け取る電力受取手段と、
前記無線通信装置から前記無線通信媒体に対して、前記第２の通信周波数Ｆｂによりデータを送信するデータ送信手段と、
このデータ送信手段により送信されるデータを受け取るデータ受取手段と、
を具備したことを特徴とする無線通信システム。

【請求項５】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数に第１のデータを割当てる第１の符号化手段と、
前記無線通信媒体から前記無線通信装置に対して送信される前記第１の通信周波数と異なる第２の通信周波数に第２のデータを割当てる第２の符号化手段と、
を具備したことを特徴とする無線通信システム。

【請求項６】無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、
第１の通信周波数Fa_mがFa_m＝Ｆａ／ｍ（１＜ｍ：整数）を満たし、
第２の通信周波数Fa_nがFa_n＝Ｆａ／ｎ（１＜ｎ整数、ｎ≠ｍ）を満たし、　前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数Fa_mに第１のデータを割当てる第１の符号化手段と、
前記無線通信媒体から前記無線通信装置に対して送信される第２の通信周波数Fa_nに第２のデータを割当てる第２の符号化手段と、
を具備したことを特徴とする無線通信システム。

【請求項７】第１の通信周波数Fa_mがFa_m＝Ｆａ／ｍ（１＜ｍ：整数）を満たし、
第２の通信周波数Fa_nがFa_n＝Ｆａ／ｎ（１＜ｎ整数、ｎ≠ｍ）を満たし、　前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数Fa_mに第１のデータを割当てる第１の符号化手段と、
前記無線通信媒体から前記無線通信装置に対して送信さ

れる第２の通信周波数Ｆａ$_{n}$に第２のデータを割当てる第２の符号化手段と、
を具備したことを特徴とする請求項１、請求項２、請求項３、又は請求項４に記載の無線通信システム。
【請求項８】前記第１のデータが割当てられた前記第１の通信周波数Ｆａ$_{m}$、及び前記第２のデータが割当てられた前記第２の通信周波数Ｆａ$_{n}$を、通信周波数Ｆａにより位相変調して、この位相変調された位相変調波を前記通信媒体から前記無線通信装置に対して送信することを特徴とする請求項６、又は請求項７に記載の無線通信システム。
【請求項９】前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、前記位相変調波を受信する受信手段と、
この受信手段により受信された位相変調波に対して、$Dj=B\sin(\omega ct+\pi(j-1)/4)$（ｊ＝１、２、３、４）を乗算する乗算手段と、
この乗算手段の出力を積分する積分手段と、
この積分手段から出力される復調信号が最大となるｊの値を選択する選択手段と、
を具備したことを特徴とする請求項８に記載の無線通信システム。
【請求項１０】前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、
前記位相変調波を受信する受信手段と、
この受信手段により受信された位相変調波に対して、$Dj=B\sin(\omega ct+\pi(j_1-1)/4)$（$j_1$＝１、２、３、４）を乗算する第１の乗算手段と、 この第１の乗算手段の出力を積分する第１の積分手段と、
前記受信手段により受信された位相変調波に対して、$Dj=B\sin(\omega ct+\pi(j_2-1)/4)$（$j_2$＝１、２、３、４、$j_1 \neq j_2$）を乗算する第２の乗算手段と、
この第２の乗算手段の出力を積分する第２の積分手段と、
前記第１の積分手段及び前記第２の積分手段から出力される復調信号のうち、出力が大きい方の復調信号を選択する選択手段と、
を具備したことを特徴とする請求項８に記載の無線通信システム。
【請求項１１】前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、前記位相変調波を受信する受信手段と、
$Dj=B\sin(\omega ct+\pi(j_1-1)/4)$（$j_1$＝１、２、３、４）、及び$Dj=B\sin(\omega ct+\pi(j_2-1)/4)$（$j_2$＝１、２、３、４、$j_1 \neq j_2$）のうちの一方を選択する選択手段と、
この選択手段により選択された値を、前記受信手段により受信された位相変調波に対して乗算する乗算手段と、
この乗算手段の出力を積分する積分手段と、
この積分手段から出力される復調信号が最大となるように、前記選択手段による選択を制御する選択制御手段と、
を具備したことを特徴とする請求項８に記載の無線通信システム。
【請求項１２】前記選択手段により選択された復調信号を遅延させる遅延手段と、
前記選択手段により選択された復調信号、及び前記遅延手段により遅延された復調信号を乗算する乗算手段と、
この乗算手段の出力を積分して２値化し復調データを生成する復調データ生成手段と、
を具備したことを特徴とする請求項１０に記載の無線通信システム。
【請求項１３】前記積分手段から出力される復調信号を遅延させる遅延手段と、
前記積分手段から出力さえる復調信号、及び前記遅延手段により遅延された復調信号を乗算する乗算手段と、
この乗算手段の出力を積分して２値化し復調データを生成する復調データ生成手段と、
を具備したことを特徴とする請求項１１に記載の無線通信システム。
【請求項１４】前記無線通信媒体から前記無線通信装置に対して送信されるデータにデータ通信周波数の搬送波を付加したことを特徴とする請求項１、請求項２、請求項３、又は請求項４に記載の無線通信システム。
【請求項１５】前記搬送波が付加されたデータを受信する受信手段と、
位相同期を取る位相同期手段と、
クロックを生成するクロック生成手段と、
前記位相同期手段と前記クロック生成手段とを接続または切断するスイッチング手段と、
前記受信手段により受信された受信信号、及び前記クロック生成手段の出力を乗算する乗算手段と、
この乗算手段の出力を積分する積分手段と、
を具備し、
前記受信手段により受信された受信信号に付加された搬送波により、前記位相同期手段とこの受信信号の同期を取り、同期が取れたときこの位相同期手段から前記クロック生成手段に対して位相同期タイミングを送信し、このとき前記スイッチング手段により前記位相同期手段とクロック生成手段との接続を切断することを特徴とする請求項１４に記載の無線通信システム。
【請求項１６】１フレームのデータ通信が終了した時点で、前記スイッチング手段により前記位相同期手段とクロック生成手段とを接続し、再度、前記受信手段により受信された受信信号に付加された搬送波により、前記位相同期手段とこの受信信号の同期を取り、同期が取れたときこの位相同期手段から前記クロック生成手段に対して位相同期タイミングを送信し、このとき前記スイッチング手段により前記位相同期手段とクロック生成手段と

の接続を切断することを特徴とする請求項１５に記載の無線通信システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、例えば、携帯可能な無線通信機能を有する無電池式の無線通信媒体（無線カード）と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置（無線カードリーダライタ）とを備えた無線通信システムに関する。

【０００２】

【従来の技術】近年、無線カード及び無線カードリーダライタを利用した無線通信システムが、社会に普及しつつある。例えば、自動改札のシステムや、プリペイドカード又は銀行カード等の金銭的価値を交換するシステムに利用されつつある。

【０００３】無線通信システムを利用した自動改札のシステムでは、乗車券媒体を無線カードに置換えて、自動改札装置に無線カードリーダライタの機能を搭載して、乗車券媒体としての無線カードに格納されている改札に必要な情報（乗降駅などの情報）を無線通信により自動改札装置で読み取り、この読み取られた情報を基にして改札処理を行うというものである。

【０００４】従来の無線通信システムの多くは、無線カードリーダライタから無線カードに対して送信されるデータ通信周波数と、無線カードから無線カードリーダライタに対して送信されるデータ通信周波数とが異なる周波数となっている。また、無線カードリーダライタから無線カードに対して送信されるデータ通信周波数により、無線カードリーダライタから無線カードに対して電源が供給されるようになている。つまり、データ通信周波数が、電源供給用周波数を兼ねている。さらに、無線カードリーダライタにおいて、無線カードから送信されたデータを復調する場合には、無線カードから送信された微弱なデータからデータ復調用のクロックが再生され、この再生されたクロックによりデータの復調が行わてる。その他、データの符号化にはＮＲＺ符号、マンチェスター符号等が使用されている。

【０００５】

【発明が解決しようとする課題】上記したような無線通信システムを利用した自動改札のシステムでは、無線カードリーダライタで無線カードの情報を瞬時に読み取り、改札処理を迅速に行う必要がある。そのため、無線通信システムを安定した状態で動作させる為に、無線カードリーダライタと無線カードのクロックを同期させること、及び低い誤り率で通信データを復調させることが重要となる。また、無線カードを動作させる電源とクロックを安定した状態で、かつ容易に供給可能とすることが重要となる。

【０００６】ところが、上記した従来の無線通信システムでは、下記のようなことから、安定した無線カードシステムの実現には多々問題があった。

【０００７】無線カードリーダライタにおいて、無線カードから送信されたデータを復調する場合には、無線カードから送信される微弱なデータからデータ復調用のクロックが再生されるため、再生されるクロックが不安定となることがある。特に、無線カードリーダライタと無線カードとの間の通信距離が長くなればなるほど、このような状況は顕著に現れる。データ復調用のクロックが不安定となれば、復調されるデータがＮＲＺ符号、又はマンチェスター符号等により符号化されている場合、復調されるデータが反転してしまうおそれがある。

【０００８】この発明の目的は、上記したような事情に鑑み成されたものであって、低い誤り率でデータの復調が可能な安定した無線カードシステムを提供することにある。

【０００９】

【課題を解決するための手段】上記課題を解決し目的を達成するために、この発明の無線通信システムは、以下のように構成されている。

【００１０】（１）請求項１記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、前記無線通信装置から前記無線通信媒体に対して、第１の通信周波数により電力を供給する電力供給手段と、前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数と異なる第２の通信周波数によりデータを送信するデータ送信手段とを具備している。

【００１１】（２）請求項２記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、前記無線通信装置から前記無線通信媒体に対して、第１の通信周波数により電力を供給する電力供給手段と、この電力供給手段により供給される電力を受け取る電力受取手段と、前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数と異なる第２の通信周波数によりデータを送信するデータ送信手段と、このデータ送信手段により送信されるデータを受け取るデータ受取手段とを具備している。

【００１２】（３）請求項３記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにお

いて、第１の通信周波数Ｆａ及び第２の通信周波数Ｆｂが、Ｆａ＝Ｆｂ／Ｋ（１＜Ｋ：正数）を満たし、前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数Ｆａにより電力を供給する電力供給手段と、この電力供給手段により供給される電力を受け取る電力受取手段と、前記無線通信装置から前記無線通信媒体に対して、前記第２の通信周波数Ｆｂによりデータを送信するデータ送信手段と、このデータ送信手段により送信されるデータを受け取るデータ受取手段とを具備している。

【００１３】（４）請求項４記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、第１の通信周波数Ｆａ及び第２の通信周波数Ｆｂが、Ｆａ＝Ｆｂ／Ｋ（１＜Ｋ：正数）を満たし、この第１の通信周波数Ｆａが、Ｆａ＜＜（Ｋｃ／１６Ｌ）を満たし（Ｃ：光速［ｍ／ｓ］、Ｌ：最大通信距離［ｍ］）、前記無線通信装置から前記無線通信媒体に対して、前記第１の通信周波数Ｆａにより電力を供給する電力供給手段と、この電力供給手段により供給される電力を受け取る電力受取手段と、前記無線通信装置から前記無線通信媒体に対して、前記第２の通信周波数Ｆｂによりデータを送信するデータ送信手段と、このデータ送信手段により送信されるデータを受け取るデータ受取手段とを具備している。

【００１４】（５）請求項５記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数に第１のデータを割当てる第１の符号化手段と、前記無線通信媒体から前記無線通信装置に対して送信される前記第１の通信周波数と異なる第２の通信周波数に第２のデータを割当てる第２の符号化手段とを具備している。

【００１５】（６）請求項６記載の発明は、無線通信機能を有する無電池式の無線通信媒体と、この無線通信媒体との間の無線通信によりこの無線通信媒体に対して電力を供給するとともにこの無線通信媒体とデータの送受信を行う無線通信装置とを備えた無線通信システムにおいて、第１の通信周波数Fa_mがFa_m＝Ｆａ／ｍ（１＜ｍ：整数）を満たし、第２の通信周波数Fa_nがFa_n＝Ｆａ／ｎ（１＜ｎ整数、ｎ≠ｍ）を満たし、前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数Fa_mに第１のデータを割当てる第１の符号化手段と、前記無線通信媒体から前記無線通信装置に対して送信される第２の通信周波数Fa_nに第２のデータを割当てる第２の符号化手段とを具備している。

【００１６】（７）請求項７記載の発明は、請求項１、請求項２、請求項３、又は請求項４記載の構成に加えて、第１の通信周波数Fa_mがFa_m＝Ｆａ／ｍ（１＜ｍ：整数）を満たし、第２の通信周波数Fa_nがFa_n＝Ｆａ／ｎ（１＜ｎ整数、ｎ≠ｍ）を満たし、前記無線通信媒体から前記無線通信装置に対して送信される第１の通信周波数Fa_mに第１のデータを割当てる第１の符号化手段と、前記無線通信媒体から前記無線通信装置に対して送信される第２の通信周波数Fa_nに第２のデータを割当てる第２の符号化手段とを具備している。

【００１７】（８）請求項８記載の発明は、請求項６、又は請求項７記載の構成に加えて、前記第１のデータが割当てられた前記第１の通信周波数Fa_m、及び前記第２のデータが割当てられた前記第２の通信周波数Fa_nを、通信周波数Ｆａにより位相変調して、この位相変調された位相変調波を前記通信媒体から前記無線通信装置に対して送信する。

【００１８】（９）請求項９記載の発明は、請求項８記載の構成に加えて、前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、前記位相変調波を受信する受信手段と、この受信手段により受信された位相変調波に対して、$Dj = B\sin(\omega ct + \pi(j-1)/4)$（ｊ＝１、２、３、４）を乗算する乗算手段と、この乗算手段の出力を積分する積分手段と、この積分手段から出力される復調信号が最大となるｊの値を選択する選択手段とを具備している。

【００１９】（１０）請求項１０記載の発明は、請求項８記載の構成に加えて、前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、前記位相変調波を受信する受信手段と、この受信手段により受信された位相変調波に対して、$Dj = B\sin(\omega ct + \pi(j_1-1)/4)$（$j_1$＝１、２、３、４）を乗算する第１の乗算手段と、この第１の乗算手段の出力を積分する第１の積分手段と、前記受信手段により受信された位相変調波に対して、$Dj = B\sin(\omega ct + \pi(j_2-1)/4)$（$j_2$＝１、２、３、４、$j_1 \neq j_2$）を乗算する第２の乗算手段と、この第２の乗算手段の出力を積分する第２の積分手段と、前記第１の積分手段及び前記第２の積分手段から出力される復調信号のうち、出力が大きい方の復調信号を選択する選択手段とを具備している。

【００２０】（１１）請求項１１記載の発明は、請求項８記載の構成に加えて、前記位相変調波を受信して、この受信された位相変調波を復調するにあたり、前記位相変調波を受信する受信手段と、$Dj = B\sin(\omega ct + \pi(j_1-1)/4)$（$j_1$＝１、２、３、４）、及び$Dj = B\sin(\omega ct + \pi(j_2-1)/4)$（$j_2$＝１、２、３、４、$j_1 \neq j_2$）のうちの一方を選択する選択手段と、この選択手段により選択された値を、

前記受信手段により受信された位相変調波に対して乗算する乗算手段と、この乗算手段の出力を積分する積分手段と、この積分手段から出力される復調信号が最大となるように、前記選択手段による選択を制御する選択制御手段とを具備している。

【００２１】（１２）請求項１２記載の発明は、請求項１０記載の構成に加えて、前記選択手段により選択された復調信号を遅延させる遅延手段と、前記選択手段により選択された復調信号、及び前記遅延手段により遅延された復調信号を乗算する乗算手段と、この乗算手段の出力を積分して２値化し復調データを生成する復調データ生成手段とを具備している。

【００２２】（１３）請求項１３記載の発明は、請求項１１記載の構成に加えて、前記積分手段から出力される復調信号を遅延させる遅延手段と、前記積分手段から出力さえる復調信号、及び前記遅延手段により遅延された復調信号を乗算する乗算手段と、この乗算手段の出力を積分して２値化し復調データを生成する復調データ生成手段とを具備している。

【００２３】（１４）請求項１４記載の発明は、請求項１、請求項２、請求項３、又は請求項４に記載の構成に加えて、前記無線通信媒体から前記無線通信装置に対して送信されるデータにデータ通信周波数の搬送波を付加する。

【００２４】（１５）請求項１５記載の発明は、請求項１４記載の構成に加えて、前記搬送波が付加されたデータを受信する受信手段と、位相同期を取る位相同期手段と、クロックを生成するクロック生成手段と、前記位相同期手段と前記クロック生成手段とを接続または切断するスイッチング手段と、前記受信手段により受信された受信信号、及び前記クロック生成手段の出力を乗算する乗算手段と、この乗算手段の出力を積分する積分手段とを具備し、前記受信手段により受信された受信信号に付加された搬送波により、前記位相同期手段とこの受信信号の同期を取り、同期が取れたときこの位相同期手段から前記クロック生成手段に対して位相同期タイミングを送信し、このとき前記スイッチング手段により前記位相同期手段とクロック生成手段との接続を切断する。

【００２５】（１６）請求項１６記載の発明は、請求項１５記載の構成に加えて、１フレームのデータ通信が終了した時点で、前記スイッチング手段により前記位相同期手段とクロック生成手段とを接続し、再度、前記受信手段により受信された受信信号に付加された搬送波により、前記位相同期手段とこの受信信号の同期を取り、同期が取れたときこの位相同期手段から前記クロック生成手段に対して位相同期タイミングを送信し、このとき前記スイッチング手段により前記位相同期手段とクロック生成手段との接続を切断する。

【００２６】

【発明の実施の形態】以下、この発明の実施の形態について図面を参照して説明する。

【００２７】図１は、この発明の無線通信システムの概略を示す図である。

【００２８】図１に示すように、この発明の無線通信システムには、アンテナ部１０２を有する無線カードリーダライタ１００及び無線カード２００が設けられている。無線カードリーダライタ１００とリーダライタアンテナ１０２とは、同軸ケーブルで接続されているか、もしくは一体化されているものとする。

【００２９】無線カードリーダライタ１００は、周波数ｆｐのクロックを中心として動作するものとする。この無線カードリーダライタ１００は無線カード２００に対して、電力伝送波（周波数ｆｐ）により電力を伝送するとともに、データ通信波（周波数ｆｄ）によりデータを送信する。

【００３０】これら周波数ｆｐと周波数ｆｄは、ｆｄ＝ｆｐ／ｋ（１＜ｋ：整数）の関係を満たすように設定されるものとする。さらに、通信距離をＬ、光速をｃとすると、ｆｐはｆｐ＜＜（ｋｃ／１６Ｌ）の関係をも満たすものとする。

【００３１】これにより無線カードリーダライタ１００のクロック周波数（周波数ｆｐ）を中心として、無線カード２００を動作させることが可能となる。従って、無線カード２００内の回路には、特にＰＬＬ回路を内蔵させる必要がなくなり、無線カード２００の回路構成の簡略化が可能となり消費電流が低くなる為、１チップ化が容易になる。

【００３２】続いて、図２を参照して、無線カードリーダライタ１００の回路構成の概略を説明する。図２は、無線カードリーダライタ１００の回路構成の概略を示す図である。

【００３３】図２に示すように、無線カードリーダライタ１００には、アンテナ部１０２、電力ドライバー１０３、クロック生成部１０４、変調部１０５、復調部１０６、送受信切換スイッチ１０７、データ処理部１０８、電力供給手段としての電力伝送用アンテナ１０９、及びデータ送信手段及び受信手段としてのデータ通信アンテナ１１０等が設けられている。

【００３４】また、アンテナ部１０２には、電力伝送用の電力伝送用アンテナ１０９、及びデータ通信用のデータ通信用アンテナ１１０の２つのアンテナが設けられている。送受信切換スイッチ１０７は、送信モード及び受信モードを切換えるものであり、送信モード時には変調部１０５とデータ通信用アンテナ１１０とが接続され、受信モード時には復調部１０６とデータ通信用アンテナ１１０とが接続されるようになっている。

【００３５】電力伝送時には、クロック生成部１０４により電力伝送波のクロックが生成され、電力ドライバ１０３により増幅され、電力伝送用アンテナ１０９により空中に放射される。このとき、空中に放出される電力伝

送波の周波数が、周波数ｆｐである。

【００３６】データ送信においては、クロック生成部１０４により変調データに必要なクロックが生成され、この生成されたクロックがデータ処理部１０８に供給され、データ処理部１０８においてデータが生成される。生成されたデータは変調部１０５に送られ、クロック生成部１０４から供給される変調クロックにより変調される。このようにして変調された変調データは送信モードに設定された送受信切換スイッチ１０７を通り、データ通信用アンテナ１１０から空中に放射される。このとき、空中に放出されるデータ通信波の周波数が、周波数ｆｄである。

【００３７】データ受信においては、データ通信用アンテナ１１０から受信された変調波が、受信モードに設定された送受信切換スイッチ１０７を通り、復調部１０６に入力される。復調部１０６では、クロック生成部１０４から供給される復調クロックにより復調が行われ、復調された復調データはデータ処理部１０８に入力され、データ処理が行われる。

【００３８】続いて、図３を参照して、無線カード２００の回路構成の概略を説明する。図３は、無線カード２００の回路構成の概略を示す図である。

【００３９】図３に示すように、無線カード２００には、整流部２０３、電力生成部２０４、クロック生成部２０５、送受信切換スイッチ２０７、第１及び第２の符号化手段としての変調部２０８、復調部２０９、データ処理部２１０、及びアンテナ部２１１等が設けられている。

【００４０】また、アンテナ部２１１には、電力受取手段としての電力受信用アンテナ２０２、及びデータ受取手段としてのデータ通信用アンテナ２０６の２つのアンテナが設けられている。送受信切換スイッチ２０７は、送信モード及び受信モードを切換えるものであり、送信モード時には変調部２０８とデータ通信用アンテナ２０６とが接続され、受信モード時には復調部２０９とデータ通信用アンテナ２０６とが接続されるようになっている。

【００４１】無線カードリーダライタ１００から送信された電力伝送波（周波数ｆｐ）は、データ通信用アンテナ２０６で受信され、受信モードに設定された送受信切換スイッチ２０７を介して整流部２０３に入力される。整流部２０３により整流された電力伝送波は、電力生成部２０４に入力され電力として取込まれる。さらに、この整流部２０３で整流された電力伝送波は、クロック生成部２０５にも入力される。クロック生成部２０５では、電力伝送波から無線カード２００のシステムクロックが生成される。従って、無線カード２００は、電力生成部２０４で生成された電力、及びクロック生成部２０５で生成されたクロックにより動作する。一方、データ送信においては、クロック生成部２０５により変調データに必要なクロックが生成され、この生成されたクロックがデータ処理部３１０に供給され、データ処理部３１０においてデータが生成される。生成されたデータは変調部２０８に送られ、クロック生成部２０５から供給される変調クロックにより変調される。このようにして変調された変調データは送信モードに設定された送受信切換スイッチ２０７を通り、データ通信用アンテナ２０６により空中に放射される。このとき、空中に放出されるデータ通信波の周波数は、周波数ｆｄとなる。

【００４２】データ受信においては、データ通信用アンテナ２０６から受信された変調波が受信モードに設定された送受信切換スイッチ２０７を通り、復調部２０９に入力される。復調部２０９では、クロック生成部２０５から供給される復調クロックにより復調が行われ、復調された復調データはデータ処理部２１０に入力され、データ処理が行われる。

【００４３】続いて、図４及び図５を参照して、無線カードリーダライタ１００及び無線カード２００のアンテナ部におけるアンテナについて説明する。図４は、無線カードリーダライタ１００及び無線カード２００のアンテナ部におけるアンテナの概略構造その１を示す図である。図５は、無線カードリーダライタ１００及び無線カード２００のアンテナ部におけるアンテナの概略構造その２を示す図である。図４に示すように、アンテナ部１０２及び２１１に、外周アンテナ３０１及び内周アンテナ３０２を設け、外周アンテナ３０１を電力伝送用アンテナ又はデータ通信用アンテナに割当て、内周アンテナ３０２をデータ通信用アンテナ又は電力伝送用アンテナに割当てる。

【００４４】また、図５に示すように、アンテナ部１０２及び２１１に、外周アンテナ３１１及び内周アンテナ３１２を設け、外周アンテナ３１１を電力伝送用アンテナ又はデータ通信用アンテナに割当て、内周アンテナ３１２をデータ通信用アンテナ又は電力伝送用アンテナに割当てる。

【００４５】なお、上記したアンテナ部の構成は一例であり、電力伝送用アンテナ１０９又は２０２と、データ通信用アンテナ１１０又は２０６との一部を重ねたり、互いの距離を離したりして、最適な送受信環境を構築することが可能である。

【００４６】続いて、図６を参照して、無線カード２００におけるデータの符号化及び変調について説明する。図６は、無線カード２００におけるデータの符号化及び変調を説明するための波形図である。

【００４７】この実施形態では、無線カード２００から送信される送信データの符号化において、データ“１”に対して$fd_m = fd/m$（$1<m$：整数）の周波数、データ“０”に対して$fd_n = fd/n$（$1<n$：整数、$n \neq m$）を割り当てるものとする。

【００４８】例えば、ｍ＝８、ｎ＝１２とすると、図６

に示すデータｓ１は、符号化により符号化データｓ２となる。さらに、変調クロックｓ３により、符号化データｓ２が位相変調され、変調信号ｓ４となる。無線カードリーダライタ１００は無線カード２００から送信される変調信号ｓ４の波形を復調し、データｓ１を得ることが必要となる。

【００４９】続いて、図７を参照して、無線カードリーダライタ１００におけるデータの復調について説明する。図７は、無線カードリーダライタ１００におけるデータの復調を説明するための波形図である。

【００５０】仮に、電力伝送波の周波数ｆｐとデータ通信周波の周波数ｆｄとが、ｆｄ＝ｆｐ／４（ｋ＝４）の関係を満たすものとする。図７には、マスタークロック（周波数ｆｐ）ｓ２１、変調クロック（周波数ｆｐ／４）ｓ２２、データ符号ｓ２３、変調信号ｓ２４が示されている。この変調信号ｓ２４は、無線カード２００から送信されるものである。つまり、無線カードリーダライタ１００はこの変調信号ｓ２４を受信し、この受信された変調信号ｓ２４の復調を行う。

【００５１】前述したように、この実施形態ではｆｐ＜＜ｋｃ／１６Ｌが満足されることが前提となっているので、無線カードリーダライタ１００側のマスタークロックと、無線カード２００側のマスタクロックの位相はほぼ等しいと考えられる。但し、回路の遅延や位相を考慮すると全く同一ではない。ここでは遅延や位相を補正した状態を考える。これらの遅延や位相に関しては後で説明を行うものとする。無線カードリーダライタ１００側の復調クロックはマスタクロックの４分周であるため、復調クロックの位相状態は受信データに対して４通り考えられる｛Ｄｊ＝Ｂｓｉｎ（ωｃｔ＋π（ｊ－１）／４）（ｊ＝１、２、３、４）｝。１つ目の位相状態は、無線カード２００側の変調クロックｓ２２と全く同位相の波形である。２つ目の位相状態は、変調クロックｓ２２に対してπ／４ずれた復調クロックｓ２５の波形である。３つ目は位相状態は、変調クロックｓ２２に対してπ／２ずれた復調クロックｓ２７の波形である。４つ目の位相状態は、変調クロックｓ２２に対して３π／４ずれた波形である。

【００５２】夫々の復調クロックを使用して、変調信号ｓ２４を復調するケースを考える。変調信号ｓ２４が変調クロックｓ２２により復調されると、当然、データ符号ｓ２３が復調出力として得られる。変調信号ｓ２４が復調クロックｓ２５により復調されると、変調信号ｓ２４及び復調クロックｓ２５を乗算した出力の乗算出力ｓ２６が復調出力として得られる。ところが、この乗算出力ｓ２５は、無線カード２００側のデータと全く異なるデータである。変調信号ｓ２４が復調クロックｓ２７で復調されると、変調信号ｓ２４及び復調クロックｓ２７を乗算した出力乗算出力ｓ２８が復調出力として得られる。この乗算出力ｓ２８は、データ符号ｓ２３を反転したデータである。

【００５３】また、この実施形態では、図６で説明したようなデータ符号化が行われているので、データの“０”、“１”は周波数成分によって判定可能である。よって、乗算出力ｓ２８は、データ的にはデータ符号ｓ２３と同一である。即ち、乗算出力ｓ２５状態の復調クロックを使用すると復調データが得られないと言うことである。

【００５４】続いて、図８を参照して、無線カードリーダライタ１００の復調部１０６、及び無線カード２００の復調部２０９について説明する。図８は、無線カードリーダライタ１００の復調部１０６、及び無線カード２００の復調部２０９の概略構成その１を示す図である。

【００５５】図２及び図３で説明したように、データ受信用アンテナ１１０又は２０６で受信された変調波は、受信モードに設定された送受信切換スイッチ１０７又は２０７を介して、復調部１０６又は２０９に入力される。この復調部１０６又は２０９に入力された変調は、マッチング回路４０２、フィルタ４０３、アンプ４０４を通過し、復調可能なレベルまで増幅される。

【００５６】一方、クロック生成部４０５では、図７で説明した乗算出力ｓ２５及び乗算出力ｓ２７の位相関係となるような復調クロックが生成される（ここでは乗算出力ｓ２５及び乗算出力ｓ２７が生成されるものとする）。クロック生成部４０５で生成された乗算出力ｓ２５は第１乗算器に入力され、乗算出力ｓ２７は第２乗算器４０７に入力される。また、これら第１乗算器４０６及び第２乗算器４０７には、アンプ４０４から出力される変調信号が入力される。つまり、第１乗算器４０６では、乗算出力ｓ２５とアンプ４０４から出力される変調信号とが乗算される。第２乗算器４０７では、乗算出力ｓ２７とアンプ４０４から出力される変調信号とが乗算される。

【００５７】第１乗算器４０６の出力は第１積分器４０８に入力され、第２乗算器４０７の出力は第２積分器４０９に入力される。また、これら第１積分器４０８及び第２積分器４０９には夫々に適切な定数が設定されており、これら第１積分器４０８及び第２積分器４０９からの出力レベルには差が生じる。この出力レベルの差はレベル判定部４１０により判定される。このレベル判定部４１０から出力されるレベル判定信号に基づき選択手段としての回路切換スイッチ４１１が切換えられる。

【００５８】つまり、レベル判定部４１０により第１積分器４０８の出力が第２積分器４０９の出力より大きいと判定された場合、このときレベル判定部４１０から出力されるレベル判定信号により回路切換スイッチ４１１が切換えられ、第１積分器４０８と後述する動作回路６００とが接続される。逆に、レベル判定部４１０により第２積分器４０９の出力が第１積分器４０８の出力より大きいと判定された場合、このときレベル判定部４１０

から出力されるレベル判定信号により回路切換スイッチ４１１が切換えられ、第２積分器４０９と後述する動作回路６００とが接続される。

【００５９】このようにして、無線カードリーダライタ１００では、無線カード２００から送信される変調信号を復調し、データ符号化された信号を得ることができる。また、この実施形態では、π／４ずれた復調クロックｓ２５及びπ／４（＝π／２）ずれた復調クロックｓ２７を選択して使用するケースについて説明したが、π、π／4、２π／４（＝π／２）、及び３π／４ずれた復調クロックを選択して使用するようにしてもよい。

【００６０】続いて、図９を参照して、無線カードリーダライタ１００の復調部１０６、及び無線カード２００の復調部２０９について説明する。図９は、無線カードリーダライタ１００の復調部１０６、及び無線カード２００の復調部２０９の概略構成その２を示す図である。

【００６１】図２及び図３で説明したように、データ受信用アンテナ１１０又は２０６で受信された変調波は、受信モードに設定された送受信切換スイッチ１０７又は２０７を介して、復調部１０６又は２０９に入力される。この復調部１０６又は２０９に入力された変調は、マッチング回路５０２、フィルタ５０３、アンプ５０４を通過し、復調可能なレベルまで増幅される。

【００６２】一方、クロック生成部５０５では、図７で説明した乗算出力ｓ２５及び乗算出力ｓ２７の位相関係となるような復調クロックが生成される（ここでは乗算出力ｓ２５及び乗算出力ｓ２７が生成されるものとする）。クロック生成部４０５で生成された乗算出力ｓ２５及び乗算出力ｓ２７は、選択手段としてのクロック切換スイッチ５０７の切換に応じて乗算器５０６に入力される。つまり、クロック切換スイッチ５０７は、乗算器５０６に入力される乗算出力ｓ２５と乗算出力ｓ２７とを切換えるものである。また、このクロック切換スイッチ５０７の切換えを制御する制御信号は、ある周期でクロック切換スイッチ５０７に供給されるようになっているものとする。さらに、乗算器５０６には、アンプ５０４から出力される変調信号が入力される。つまり、乗算器５０６では、乗算出力ｓ２５又は乗算出力ｓ２７と、アンプ４０４から出力される変調信号とが乗算される。

【００６３】乗算器５０６の出力は積分器５０８に入力される。また、この積分器５０８の出力レベルは選択制御手段としてのレベル判定部５０９により判定されるようになっており、このレベル判定部５０９から出力されるレベル判定信号に基づきクロック切換スイッチ５０７が切換えられる。

【００６４】つまり、レベル判定部５０９において、乗算出力ｓ２５が乗算器５０６に供給されているときの積分器５０８の出力レベルが、乗算出力ｓ２７が乗算器５０６に供給されているときの積分器５０８の出力レベルより大きいと判定された場合、このときレベル判定部４１０から出力されるレベル判定信号により回路切換スイッチ４１１が切換固定され、乗算出力ｓ２５が乗算器５０６に供給されるようになる。逆に。レベル判定部５０９において、乗算出力ｓ２７が乗算器５０６に供給されているときの積分器５０８の出力レベルが、乗算出力ｓ２５が乗算器５０６に供給されているときの積分器５０８の出力レベルより大きいと判定された場合、このときレベル判定部４１０から出力されるレベル判定信号により回路切換スイッチ４１１が切換固定され、乗算出力ｓ２７が乗算器５０６に供給されるようになる。なお、積分器５０８の出力は、後述する動作回路６００へ入力される。

【００６５】このようにして、無線カードリーダライタ１００では、無線カード２００から送信される変調信号を復調し、データ符号化された信号を得ることができる。また、この実施形態では、π／４ずれた復調クロックｓ２５及びπ／４（＝π／２）ずれた復調クロックｓ２７を選択して使用するケースについて説明したが、π、π／４、２π／４（＝π／２）、及び３π／４ずれた復調クロックを選択して使用するようにしてもよい。

【００６６】続いて、図１０を参照して、無線カードリーダライタ１００でデータ符号化された信号の波形について説明する。図１０は、無線カードリーダライタ１００でデータ符号化された信号の波形を説明するための波形図である。

【００６７】図１０には、無線カード２００側のデータｓ３１、図８及び図９に示す復号部１０６及び２０９により復調された復調データ符号ｓ３２、この復調データ符号ｓ３２が１ビット遅延された１ビット遅延出力ｓ３３、復調データ符号ｓ３２及び１ビット遅延出力の乗算出力ｓ３４、乗算出力ｓ３４の積分出力ｓ３５、積分出力ｓ３５の２値化出力ｓ３６が示されている。従って、上記プロセスをたどると、無線カード２００のデータを復調することが可能である。

【００６８】続いて、図１１を参照して、図１０に示す波形動作を実行する動作回路６００について説明する。図１１は、動作回路６００の概略構成を示す図である。

【００６９】図１１に示す遅延手段としての１ビット遅延回路６０１には、図８に示す回路切換スイッチ４１１又は図９に示す積分器５０８から出力される復調データ符号が入力される。この１ビット遅延回路６０１の出力は乗算器６０２に入力される。また、この乗算器６０２には、１ビット遅延回路６０１に入力される復調データ符号が直接入力される。つまり、この乗算器６０２は、１ビット遅延された復調データ符号と、遅延されない復調データ符号とを乗算する。

【００７０】また、この乗算器６０２の出力は積分器６０３に入力され、この積分器の出力は復調データ生成手段としての２値化回路６０４に入力されるようになっている。さらに、この２値化回路６０４の出力を反転する

ことにより、データ符号化が復号可能となる。

【００７１】続いて、図１２を参照して、無線カード２００から送信されるデータ構成の概略について説明する。図１２は、無線カード２００から送信されるデータ構成の概略を示す図である。

【００７２】図１２に示すように、無線カード２００から送信されるデータには、復調クロック同期データＤ１、及びデータＤ２が含まれている。復調クロック同期データＤ１は、クロック選択に必要な同期信号である。一般的には、変調のかかっていない搬送波である。データＤ２は、所定のプロトコルに従ったデータである。

【００７３】続いて、図１３を参照して、位相同期回路を使用した復調部（図１４において説明する）で生成される復調クロックについて説明する。図１３は、位相同期回路を使用した復調部で生成される復調クロックを説明するための波形図である。図１３には、受信波形ｓ５１、位相同期回路クロックｓ５２、ロック信号ｓ５３、データ終了信号ｓ５４、位相同期回路切換スイッチｓ５５、復調クロックｓ５６が示されている。

【００７４】受信波形ｓ５１のデータの先頭には、図１２で説明したように搬送波が付加されている。位相同期回路クロックｓ５２は、後述する位相同期回路のクロックである。この位相同期回路は、受信波形ｓ５１と同期がとれた時点で、ロック信号ｓ５３を生成する。また、データの１フレームが終了した時、データ終了信号ｓ５４の波形をデータ処理部１０８又は２１０がロック信号ｓ５３とデータ終了信号ｓ５４とを使用し、位相同期回路の動作を制御する位相同期回路切換スイッチｓ５５を生成する。ここで、ロック信号ｓ５３の信号で復調クロックｓ５６の同期をあわせる。位相同期回路切換スイッチｓ５５が“０”になると位相同期回路はクロック生成部から切り離され、復調クロックｓ５６は上記同期信号で発生し続ける。データ終了信号ｓ５４の信号で位相同期回路切換スイッチｓ５５が“１”となり再び位相同期回路はクロック生成部に接続される。

【００７５】続いて、図１４を参照して、位相同期回路を使用した復調部について説明する。図１４は、位相同期回路を使用した復調部１０６及び２０９の概略構成を示す図である。

【００７６】図２及び図３で説明したように、データ受信用アンテナ１１０又は２０６で受信された変調波は、受信モードに設定された送受信切換スイッチ１０７又は２０７を介して、復調部１０６又は２０９に入力される。この復調部１０６又は２０９に入力された変調は、マッチング回路７０２、フィルタ７０３、アンプ７０４を通過し、復調可能なレベルまで増幅される。

【００７７】一方、位相同期手段としての位相同期回路７０５は、アンプ７０４から出力される変調信号に同期した同期信号を生成する。この生成された同期信号は、スイッチング手段としての位相同期回路切換スイッチ７１０を通過してクロック生成手段としてのクロック生成部７０６に伝送される。位相同期回路切換スイッチ７１０は、位相同期回路切換スイッチｓ５５の波形“１”の時には、クロック生成部７０６と位相同期回路７０５とを接続し、位相同期回路切換スイッチｓ５５の波形“０”の時には、クロック生成部７０６と位相同期回路７０５とが切り離される。

【００７８】アンプ７０４から出力される変調信号と位相同期回路７０５の復調クロックが同期した時点で位相同期回路切換スイッチはＯＦＦとなり、クロック生成部７０６で生成された同期クロックが復調クロックとして乗算器７０７に供給される。乗算器７０７の出力は、積分器７０８に入力され、この積分器７０８の出力が復調データとなる。データの１フレームが終了すると、位相同期回路切換スイッチ７１０はＯＮとなり、再び位相同期回路７０５でアンプ７０４から出力される変調信号と同期を取るプロセスに入る。

【００７９】

【発明の効果】この発明によれば、低い誤り率でデータの復調が可能な安定した無線カードシステムを提供することができる。

【００８０】具体的に説明すると、以下の通りである。

【００８１】この発明は、電力伝送周波数ｆｄとデータ通信周波数ｆｄをｆｄ＝ｆｐ／ｋ（１＜ｋ：整数）の関係を満たすように設定し、かつ光速ｃ、通信距離Ｌに対し、ｆｐ＜＜（ｋｃ／１６Ｌ）となるようにｆｐを設定することによって、無線カードリーダライタ１００と無線カード２００との間の無線通信において、無線カードリーダライタ１００側のクロックと無線カード２００側のクロックの位相差が微弱になり、データ通信周波数ｆｐを無線カードシステムのシステムクロックとして使用可能となり、ＰＬＬ等の位相比較器等が必要なくなり、容易に無線通信システムを提供することができる。

【００８２】また、データ符号化を行う際に、データ“１”に対してfd_m＝ｆｄ／ｍ（１＜ｍ：整数）の周波数［Ｈｚ］、データ“０”に対してfd_n＝ｆｄ／ｎ（１＜ｎ：整数、ｎ≠ｍ）の周波数［Ｈｚ］を割り当てることによって、データ復調を行う時にデータを周波数成分として取り出すことが可能であり、復調時に復調信号が“１”“０”反転していても復調可能であり、誤り率の低い無線通信システムを提供することができる。

【００８３】また、同一の復調回路をｋ／２個準備し、受信変調波Ｒ＝Ａｓｉｎωｔに対して、それぞれＤｊ＝Ｂｓｉｎ（ωｃｔ＋π（ｊ－１）／４）（ｊ＝１、２、…、ｋ／２）を乗算し、その出力を積分した出力が最も大きい受信回路を選択することの方法や、復調用クロックを受信変調波Ｒ＝Ａｓｉｎωｔに対して、それぞれＤｊ＝Ｂｓｉｎ（ωｃｔ＋π（ｊ－１）／４）（ｊ＝１、２、…、ｋ／２）を準備し、あるタイムスロットで順次受信信号と乗算を行い、その出力を積分した出力が最も

大きい復調クロックを選択しデータ復調の復調クロックとし、データを復調する方法を取ることにより、安定したクロックで復調可能であり、また復調出力が最も大きい出力をその復調出力にすることで、ＰＬＬ回路無しで受信感度が高く、通信距離の延長が可能な無線通信システムが提供できる。

【００８４】また、上記データ符号化をＮＲＺ符号のデータに変換する方法として、１ビット遅延させその出力をデータレートに適した定数を持つ簡単な構成のフィルターに入力し、その出力を２値化し復調データとすることにより、クロックの微妙なタイミングによりデータが変化することが少なくなる。

【００８５】また、受信信号先頭の搬送波で位相同期回路と受信信号の同期を取り、同期がとれたとき、位相同期回路からクロック生成部に位相同期タイミングを送信し、さらにこのとき、位相同期回路とクロック生成部を分離し、以後はクロック生成部のクロックでデータを復調し、１フレームのデータ通信が終了した時点で再び位相同期回路をクロック生成部に接続することにより、ＰＬＬがロックしないような複雑なデータ符号化においても安定的に復調クロックを生成することが可能となり、安定したデータ通信を行うことが可能となる。

【図面の簡単な説明】

【図１】この発明の無線通信システムの概略を示す図である。

【図２】図１に示す無線カードリーダライタの回路構成の概略を示す図である。

【図３】図１に示す無線カードの回路構成の概略を示す図である。

【図４】無線カードリーダライタ及び無線カードのアンテナ部におけるアンテナの概略構造その１を示す図である。

【図５】無線カードリーダライタ及び無線カードのアンテナ部におけるアンテナの概略構造その２を示す図である。

【図６】無線カードにおけるデータの符号化及び変調を説明するための波形図である。＊

＊【図７】無線カードリーダライタにおけるデータの復調を説明するための波形図である。

【図８】無線カードリーダライタの復調部及び無線カードの復調部の概略構成その１を示す図である。

【図９】無線カードリーダライタの復調部及び無線カードの復調部の概略構成その２を示す図である。

【図１０】無線カードリーダライタでデータ符号化された信号の波形を説明するための波形図である。

【図１１】動作回路の概略構成を示す図である。

【図１２】無線カードから送信されるデータ構成の概略を示す図である。

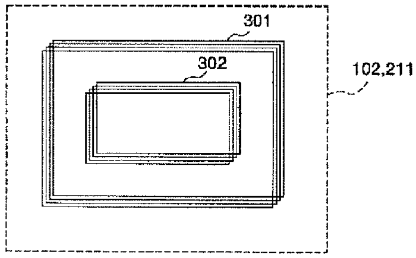
【図１３】位相同期回路を使用した復調部で生成される復調クロックを説明するための波形図である。

【図１４】位相同期回路を使用した復調部の概略構成を示す図である。

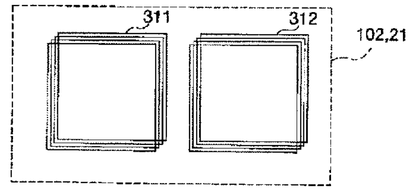
【符号の説明】

１００…無線カードリーダライタ
１０２…アンテナ部
１０３…電力ドライバー
１０４…クロック生成部
１０５…変調部
１０６…復調部
１０７…送受信切換スイッチ
１０８…データ処理部
１０９…電力伝送用アンテナ
１１０…データ通信用アンテナ
２００…無線カード
２０２…電力受信用アンテナ
２０３…整流部
２０４…電力生成部
２０５…クロック生成部
２０６…データ通信用アンテナ
２０７…送受信切換スイッチ
２０８…変調部
２０９…復調部
２１０…データ処理部

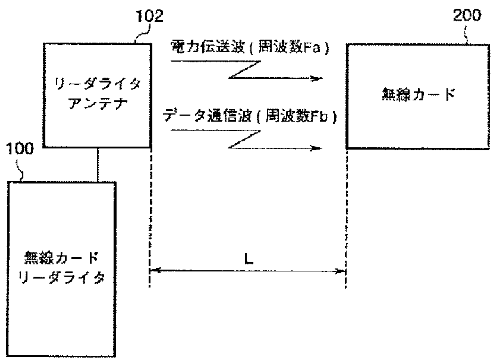
【図４】



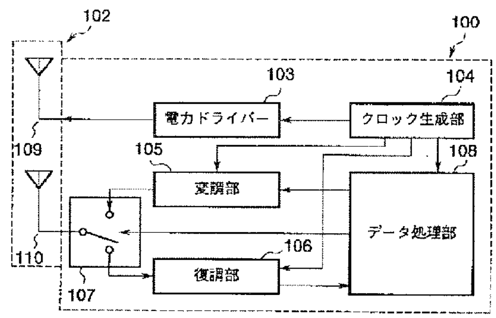
【図５】



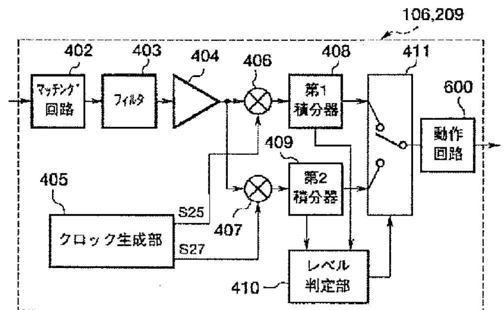
【図１】



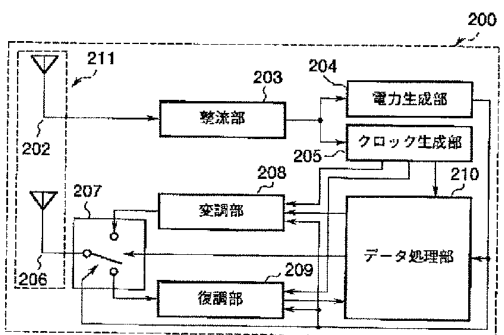
【図２】



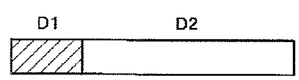
【図８】



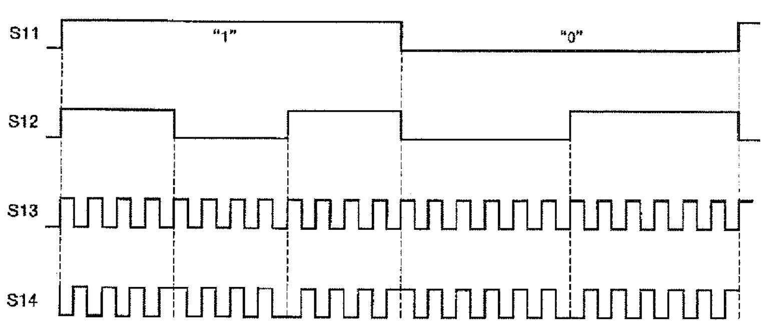
【図３】



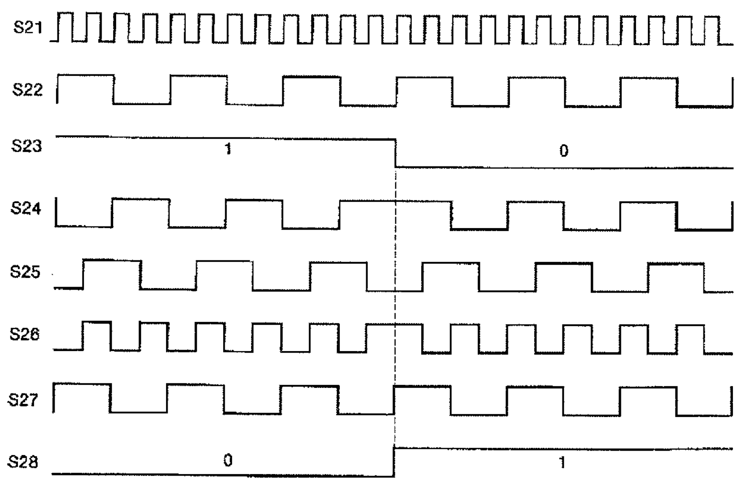
【図１２】



【図６】



【図７】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S23
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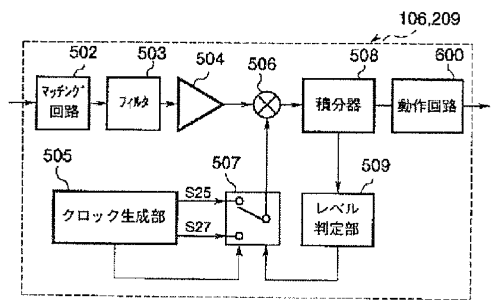
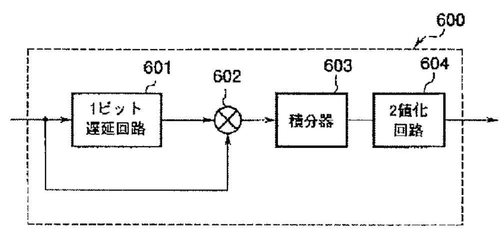
S24
S25
S26
S27
S28
0
1

【図９】


106,209
502
503
504
506
508
600
マッチング回路
フィルタ
積分器
動作回路
505
507
509
S25
S27
クロック生成部
レベル判定部

【図１１】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601
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604
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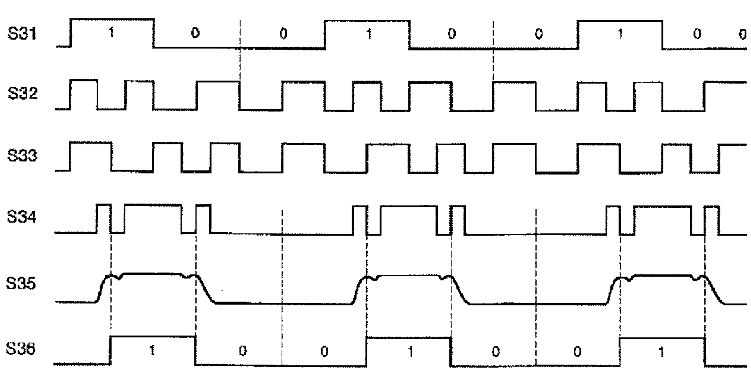
積分器
2値化回路

【図１０】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S33
S34
S35
S36
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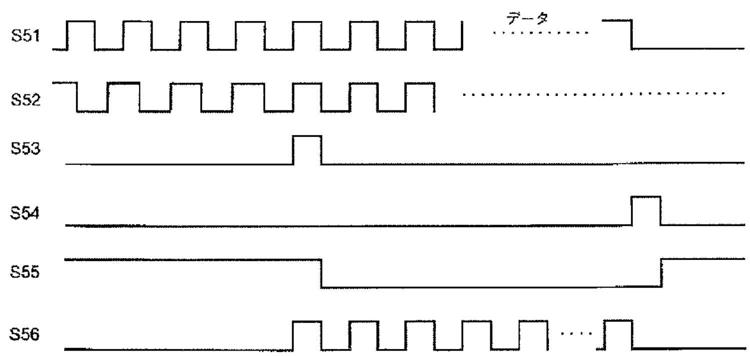
【図１３】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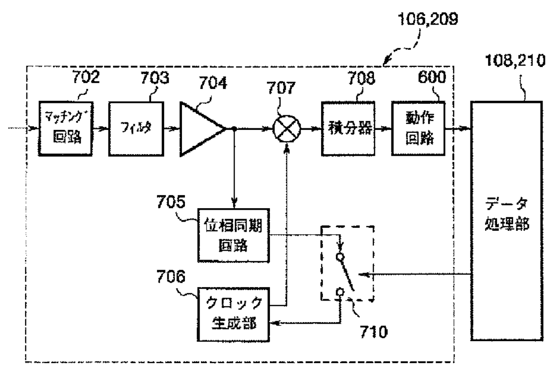
データ
S52
S53
S54
S55
S56

【図１４】


106,209
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マッチング回路
フィルタ
積分器
動作回路
データ処理部
705
位相同期回路
706
クロック生成部
710

Electronic Acknowledgement Receipt

EFS ID:	29119405
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Natalie Stevenson
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	04-MAY-2017
Filing Date:	29-OCT-2012
Time Stamp:	16:14:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Other Reference-Patent/App/Search documents	R1.pdf	89786 227ec014380969d8746fbc01236b035c48def0e5	no	2

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on May 4, 2017.

/NATALIE STEVENSON/

Natalie Stevenson

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached. However, Applicants have not submitted a copy of the published U.S. Patent Application cited on attached Form PTO/SB/08 pursuant to 37 CFR 1.98(a)(2)(ii).

Applicants note that Japanese Publication Nos. 2004364199 and H10282232, cited as F1 and F2, respectively, on the attached form PTO/SB/08 were written in a foreign language; however, English language Abstracts are provided herewith. Applicants have also included U.S. Publication No. 2007/0095913, cited as U1 on the attached form PTO/SB/08, which is a patent family member of F1 and is believed to be an English language equivalent thereof. Applicants

J:\SUN\LGI\420\IDS-Refs\05-04-17\SIDS8.doc/njs respectfully request that the references be made of record and considered in the examination of the subject application.

The undersigned hereby certifies that each item of information contained in this Supplemental Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Supplemental Information Disclosure Statement. Applicants are attaching a copy of the Japanese Office Action.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

/JEFF LLOYD/

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Gainesville, FL 32614-2950

JL/njs

Attachments: Form PTO/SB/08; copies of references cited.

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27 MARCH 2017

Jeff Lloyd, Patent Attorney, Reg. No. 35,589

AMENDMENT UNDER 37 C.F.R. §1.111
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Confirm. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Mail Stop **Amendment**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. §1.111

Sir:

In response to the Office Action dated December 27, 2016, please amend the application identified above as follows:

J:\SUN\LGI\420\Amd-Resp\Response3.doc/con/lcf

In the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Currently Amended) A wireless power receiver comprising:

a substrate ~~having~~ comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; ~~and~~

a coil unit disposed on the substrate, the coil unit comprising ~~including~~ a first connection terminal, a second connection terminal, and a coil~~,~~; and

a short-range communication antenna disposed on the substrate and surrounding the coil;

wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate,

wherein the conductive pattern ~~includes~~ comprises a conductive line wound at least two times and the conductive pattern has a spiral shape,

wherein the first connection terminal is located at one end of the coil and the second connection terminal is ~~provided~~ located at the other end of the coil,

wherein the coil unit overlaps the receiving space in a ~~vertical~~ first direction perpendicular to an upper surface of the substrate~~;~~,

wherein the connecting unit is disposed in the receiving space and connected to the coil unit, ~~and~~

wherein the connecting unit overlaps the receiving space in a second direction parallel to the upper surface of the substrate, and

wherein the connecting unit ~~includes~~comprises:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit.

2. (Canceled)

3. (Previously Presented) The wireless power receiver of claim 1, wherein the shape of the receiving space corresponds to a shape of the connecting unit.

4-6. (Canceled)

7. (Currently Amended) The wireless power receiver of ~~claim 6~~claim 1, wherein the short-range communication antenna has a rectangular configuration formed by winding one conductive line several times.

8. (Canceled)

9. (Currently Amended) The wireless power receiver of ~~claim 6~~claim 1, wherein the connecting unit is connected to the short-range communication antenna.

10. (Canceled)

11. (Previously Presented) The wireless power receiver of claim 1, wherein the conductive pattern is a conductive layer.

12. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises a pattern groove for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove.

13. (Currently Amended) The wireless power receiver of ~~claim 12~~claim 1, wherein the coil has a thickness smaller than a thickness of the substrate and wherein an upper portion of the coil is exposed out of the substrate.

14-18. (Canceled)

19. (Previously Presented) A wireless portable terminal, comprising the wireless power receiver of claim 1.

20. (Canceled)

21. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate comprises magnetic material.

22. (Canceled)

23. (Currently Amended) A wireless power receiver comprising:

a substrate ~~having~~ comprising a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and

a coil unit ~~including~~ comprising a first connection terminal, a second connection terminal, and a coil~~,~~; and

a short-range communication antenna disposed on the substrate and surrounding the coil;

wherein the coil is configured to wirelessly receive power,

wherein the coil is formed as a conductive pattern on or within the substrate,

wherein the conductive pattern ~~includes~~ comprises a conductive line wound at least two times and the conductive pattern has a spiral shape,

wherein the first connection terminal is located at one end of the coil and the second connection terminal is ~~provided~~ located at the other end of the coil~~;~~,

wherein the connecting unit is disposed in the receiving space and connected to the coil unit,

wherein the connecting unit overlaps the receiving space in a direction parallel to the upper surface of the substrate, and

wherein the connecting unit ~~includes~~comprises:

a third connection terminal connected to the first connection terminal of the coil unit; and

a fourth connection terminal connected to the second connection terminal of the coil unit; and

wherein the coil unit is disposed on ~~a top surface of~~ the substrate and the connecting unit.

24. (Canceled)

25. (Previously Presented) The wireless power receiver of claim 1, wherein the substrate is flexible.

26-29. (Canceled)

30. (Currently Amended) The wireless power receiver of claim 1, wherein the one end of the coil is at an ~~inside~~ outside portion of the conductive pattern and the other end of the coil is at an ~~outside~~ inside portion of the conductive pattern.

31. (Canceled)

32. (Currently Amended) The wireless power receiver of ~~claim 1~~claim 23, wherein the connecting unit is configured such that it is separable from the receiving space.

33. (New) The wireless power receiver of claim 23, wherein the predetermined shape of the receiving space corresponds to a shape of the connecting unit.

34. (New) The wireless power receiver of claim 23, wherein the short-range communication antenna has a rectangular configuration formed by winding one conductive line several times.

35. (New) The wireless power receiver of claim 23, wherein the connecting unit is connected to the short-range communication antenna.

36. (New) The wireless power receiver of claim 23, wherein the substrate comprises a pattern groove for receiving a part of the coil, and wherein the part of the coil is disposed in the pattern groove.

37. (New) A wireless portable terminal, comprising the wireless power receiver of claim 23.

38. (New) The wireless power receiver of claim 23, wherein the substrate comprises magnetic material.

39. (New) The wireless power receiver of claim 23, wherein the substrate is flexible.

Remarks

Claims 1, 3, 6, 7, 9, 11-13, 19, and 21-32 are pending in the subject application. By this Amendment, claims 1, 7, 9, 13, 23, 30, and 32 are amended; claims 6, 22, 24, 26-29, and 31 are canceled; and new claims 33-39 are added. No new matter is introduced. Support for the amendments and new claims can be found throughout the original specification (see, for example; page 6, lines 26-27; page 15, lines 4-8; page 21, lines 22-24; page 24, lines 1-2; Figure 11; and original claim 6). Upon entry of these amendments, claims 1, 3, 7, 9, 11-13, 19, 21, 23, 25, 30, and 32-39 will be before the Examiner for further consideration.

The amendments set forth herein should not be interpreted to indicate that Applicants have agreed with or acquiesced to the rejections set forth in the outstanding Office Action. The amendments to the claims have been made in an effort to lend greater clarity to the claimed subject matter and to expedite prosecution. Favorable consideration of the claims now presented, in view of the remarks and amendments set forth herein, is respectfully requested.

Rejection of claims 1, 3, 11-13, 19, 21-23, and 27-32 under 35 U.S.C. §102

Claims 1, 2, 11-13, 19, 21-23, and 27-32 have been rejected under pre-AIA 35 U.S.C. §102(e) as being anticipated by Kuk (U.S. Patent Application Publication No. 2013/0106198). Applicants respectfully request reconsideration.

Though Applicants do not necessarily agree that Kuk anticipated these claims as previously presented, this issue need not be addressed because Kuk is not available as prior art. According to pre-AIA 35 U.S.C. §102(e), "an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language" (emphasis added). In this case, the international application of which Kuk is a national stage application – PCT/KR2011/004561 – did not publish in English, so the filing date of Kuk for §102 purposes is January 3, 2013, which is after both the March 23, 2012 priority date and the October 29, 2012 filing date of the subject application. Thus, **Kuk is not available as prior art under any subsection of pre-AIA 35 U.S.C. §102**.

In addition, though it is not necessary to address this rejection in view of the above, Applicants note that, in an effort solely to expedite prosecution, each of independent claims 1 and 23 has been amended to recite a limitation similar to that previously presented in claim 6, which was indicated in the Action as containing allowable subject matter, as well as additional limitations (see also, *e.g.*, Figure 11 of the original specification). Accordingly, Applicants respectfully request withdrawal of the rejection of claims 1, 3, 11-13, 19, 21-23, and 27-32 under 35 U.S.C. §102.

Rejection of claim 25 under 35 U.S.C. §103(a)

Claim 25 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Kuk. Applicants respectfully request reconsideration.

As discussed above, Kuk is not available as prior art. Accordingly, Applicants respectfully request withdrawal of the rejection of claim 25 under 35 U.S.C. §103(a).

Objection to claims 6, 7, 9, 24, and 26

Claims 6, 7, 9, 24, and 26 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants thank the Examiner for the indication of allowable subject matter. As discussed above, though it is not necessary to address the prior art rejections because Kuk is not available as prior art, in an effort solely to expedite prosecution, each of independent claims 1 and 23 has been amended to recite a limitation similar to that previously presented in claim 6. Accordingly, Applicants respectfully request reconsideration and withdrawal of the objection to claims 6, 7, 9, 24, and 26.

New claims 33-39

Applicants submit that new claims 33-39 are also allowable over the cited art. The features of these claims, which find support throughout the original specification, are not taught or suggested in the cited reference (see, *e.g.*; page 6, lines 26-27; page 15, lines 4-8; page 21, lines 22-24; page 24, lines 1-2).

In view of the foregoing remarks and amendments to the claims, Applicants believe that the claims as currently pending are in condition for allowance, and such action is respectfully requested.

Applicants invite the Examiner to call the undersigned if clarification is needed on any of this response, or if the Examiner believes a telephonic interview would expedite the prosecution of the subject application to completion.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

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Electronic Acknowledgement Receipt

EFS ID:	28749495
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/MORGAN LAMPP
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	27-MAR-2017
Filing Date:	29-OCT-2012
Time Stamp:	17:06:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response3.pdf	465392 c91d78ddf229c5cd328c50959e251981187 1f2b4	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	9
Warnings:			
Information:			
	Total Files Size (in bytes):	465392	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/663,012	Filing Date 10/29/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/27/2017	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
DORIS BURNS

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/663,012	10/29/2012	Jeong Wook AN	SUN.LGI.420	3575

23557 7590 12/27/2016
SALIWANCHIK, LLOYD & EISENSCHENK
A PROFESSIONAL ASSOCIATION
PO Box 142950
GAINESVILLE, FL 32614

EXAMINER	
EVANS, JAMES P	

ART UNIT	PAPER NUMBER
2836	

NOTIFICATION DATE	DELIVERY MODE
12/27/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

euspto@slepatents.com

Office Action Summary	Application No. 13/663,012	Applicant(s) AN ET AL.	
	Examiner JAMES EVANS	Art Unit 2836	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _10/27/2016_.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) _1-32_ is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6)☐ Claim(s) ____ is/are allowed.

7)☒ Claim(s) _1,3,11-13,19,21-23,25 and 27-32_ is/are rejected.

8)☒ Claim(s) _6,7,9,24 and 26_ is/are objected to.

9)☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on _10/29/2012_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☒ All b)☐ Some** c)☐ None of the:

1.☒ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. ____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ .

4) ☐ Other: ____.

DETAILED ACTION

Response to Amendment

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114.

Applicant's submission filed 10/27/2016 along with the request has been entered. Allowability of claims 1, 3, 11-13, 19, 21-23, 25, and 27-32 are withdrawn in light of new prior art submitted 7/7/2016. New grounds for rejection are set forth below.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1, 3, 11-13, 19, 21-23, and 27-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Kuk (US 2013/0106198).

Regarding claim 1, Kuk teaches (e.g., Fig. 3-5) a wireless power receiver (Fig 2: power supplying device 100, which inherently receives power from a magnetic field to which it is exposed) comprising:

a substrate (e.g., Fig. 5: circuit board 130 and/or core 120) having a receiving space (e.g., Fig. 5: 130b, circuit board 130: upwards-facing flat surface of the circuit board over which the coils 110 are positioned, and/or the bottom surface of 130, and/or the through-holes therein; core 120: upwards-facing flat surface of the core over which the coils 110 are positioned and/or the through-holes therein) of a predetermined shaped formed therein (e.g., Fig. 4, 5; Paragraph [0069], last sentence: the four connection parts 138 *(which comprise the connecting unit as described next)* enclose the through-holes 137 and therefore are on both sides of the circuit board, thus the receiving spaces on these surfaces have a predetermined shape for the connecting unit, in that the substrate's receiving space is determined by the size and position of the coils to be connected via the connecting unit; and/or the through-holes within 120 and 130 form a receiving space to accommodate the connecting unit described below, thus the receiving spaces on these through-holes have a predetermined shape for the connecting unit ; ***i.e., substrate (130 and/or core 120) has a receiving space of a predetermined shape formed therein***) for a connecting unit (e.g., Fig. 4, Paragraph [0069], last sentence: the four connection parts 138 connected to the four free ends of coils 110***: i.e., these four parts 138 form a connecting unit***); and

a coil unit (e.g., coil 110, including coils 11 and 112) including a first connection terminal (e.g., first end of the coil 111), a second connection terminal (e.g., second end of the coil 111), and a coil, wherein the coil is configured to wirelessly receive power (inherent operation of the coil, as discussed earlier), wherein the coil is formed as a conductive pattern (coil is inherently conductive, and forms a spiral pattern as shown in Figures 3 and 5) on or within the substrate (e.g., Fig. 5: coil unit 110 is positioned on substrate 130 and/or core 120, with portion 111 directly on the substrate 130 and with portion 112 directly on core 120),

wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape (e.g., Fig. 5: coil 110 is a conductive (inherent, as discussed earlier) line wound more than two times and has a spiral shape somewhat flattened into an oval);

wherein the first connection terminal is located at one end of the coil (e.g., Fig. 5: first end of the coil 111 or 112) and the second connection terminal is provided at the other end of the coil (e.g., second end of the coil 111 or 112),

wherein the coil unit overlaps the receiving space in a vertical direction perpendicular to an upper surface of the substrate (e.g., Fig. 5: coil unit 110 overlaps the receiving space in a vertical direction perpendicular to an upper surface of the substrate because the coils are positioned directly above area 130b of the substrate, as described above);

wherein the connecting unit (e.g., Fig. 4, Paragraph [0069]: the four connection parts 138) is disposed in the receiving space (parts 138 are in the receiving space) and connected to the coil unit, wherein the connecting unit includes:

a third connection terminal connected to the first connection terminal of the coil unit (e.g., Fig. 4: connection part connected to first end of one of the two coils 111 or 112); and

a fourth connection terminal connected to the second connection terminal of the coil unit (e.g., Fig. 4: connection part connected to other end of one of the two coils 111 or 112).

Regarding claim 3, Kuk teaches (e.g., Fig. 5) the wireless power receiver of claim 1, wherein the shape of the receiving space (e.g., Fig. 5: 130b, circuit board 130: upwards-facing flat surface of the circuit board over which the coils 110 are positioned, and/or the rear side; core 120: upwards-facing flat surface of the core over which the coils 110 are positioned; and/or the through-holes within 120 and 130 form a receiving space to accommodate the connecting unit described below, thus the receiving spaces on these through-holes have a predetermined shape for the connecting unit) corresponds to a shape (e.g., the shapes correspond in that they are rectangles of the same size; and/or the through-holes within 120 and 130 form a receiving space which corresponds to the shape of the connecting unit) of the connecting unit (e.g., Fig. 4, the four connection parts 138).

Regarding claim 11, Kuk teaches (e.g., Fig. 5) the wireless power receiver of claim 1, wherein the conductive pattern is a conductive layer (e.g., Paragraph [0086]: coil 110 which is wound, has at least single conductive layer).

Regarding claim 12, Kuk teaches (e.g., Fig. 6-7) the wireless power receiver of claim 1, wherein the substrate comprises a pattern groove (e.g., grooves 120a) for receiving a part of the coil and wherein the part of the coil is disposed in the pattern groove (e.g., Fig. 7: bottom part of coil 111 is disposed in grooves 120a).

Regarding claim 13, Kuk teaches (e.g., Fig. 7) the wireless power receiver of claim 12, wherein the coil has a thickness smaller than a thickness of the substrate (e.g., coil 111 thickness is less than thickness of 120') and wherein an upper portion of the coil is exposed out of the substrate (e.g., coil 111 upper portion of the coil is exposed out of the substrate 120').

Regarding claim 19, Kuk teaches a wireless portable terminal, comprising the wireless power receiver of claim 1 (e.g., Paragraph [0042]: the entire circuit of Figures 2-5 may comprise a portable electronic device …may include but are not limited to cellular phones, … or the like.. ***(i.e., a wireless portable terminal)***).

Regarding claim 21, Kuk teaches the wireless power receiver of claim 1, wherein the substrate comprises magnetic material (e.g., Paragraph [0091], second sentence: powder may comprise a material allowing the core 120 or 120' to have magnetism.)

Regarding claim 22, Kuk teaches the wireless power receiver of claim 1, further comprising a wireless power receiving circuit connected to the connecting unit (e.g., Fig. 2).

Regarding claim 23, Kuk teaches (e.g., Fig. 3-7) a wireless power receiver comprising:

a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the conductive pattern includes a line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil; wherein the connecting unit Is disposed in the receiving space and connected to the coil unit, wherein the connecting unit includes: a third connection terminal connected to the first connection terminal of the coil unit; a fourth connection terminal connected to the second connection terminal of the coil unit (e.g., all preceding limitations disclosed in the rejection of Claim 1, supra);

wherein the coil unit is disposed on a top surface of the substrate (e.g., Fig. 7: coil 111 is disposed in grooves 120a on the top surface of the core 120) and the connecting unit (e.g., Fig. 7: coil 111 is disposed the top surface of the connecting parts 138).

Regarding claim 27, Kuk teaches a wireless portable terminal, comprising the wireless power receiver of claim 3 (e.g., Paragraph [0042]: the entire circuit of Figures 2-5 may comprise a portable electronic device …may include but are not limited to cellular phones, … or the like.. ***(i.e., a wireless portable terminal)***).

Regarding claim 28, Kuk teaches the wireless portable terminal of claim 19, which is a smartphone (e.g., Paragraph [0042]: the entire circuit of Figures 2-5 may comprise a portable electronic device …may include but are not limited to cellular phones, … or the like.. ***(i.e., a smartphone)***).

Regarding claim 29, Kuk teaches the wireless portable terminal of claim 27, which is a smartphone (e.g., Paragraph [0042]: the entire circuit of Figures 2-5 may comprise a portable electronic device …may include but are not limited to cellular phones, … or the like.. ***(i.e., a smartphone)***).

Regarding claim 30, Kuk teaches (e.g., Fig. 5) the wireless power receiver of claim 1, wherein the one end of the coil (e.g., 111', 112') is at an inside portion of the conductive pattern and the other end of the coil is at an outside portion of the conductive pattern (e.g., outside portion near perimeter of assembly).

Regarding claim 31, Kuk teaches (e.g., Fig. 3-7) a wireless power receiver comprising: a substrate having a receiving space of a predetermined shape formed therein for a connecting unit configured to connect to a wireless power receiving circuit; and a coil unit including a first connection terminal, a second connection terminal, and a coil, wherein the coil is configured to wirelessly receive power, wherein the coil is formed as a conductive pattern on or within the substrate, wherein the conductive pattern includes a conductive line wound at least two times and the conductive pattern has a spiral shape, wherein the first connection terminal is located at one end of the coil and the second connection terminal is provided at the other end of the coil; wherein the connecting unit is disposed in the receiving space and connected to the coil unit, wherein the connecting unit includes: a third connection terminal connected to the first connection terminal of the coil unit; and a fourth connection terminal connected to the second connection terminal of the coil unit (e.g., all preceding limitations disclosed in the rejection of Claim 1, supra); and

wherein the conductive line of the conductive pattern crosses over the receiving space (e.g., Fig. 5: coil 110 crosses over the receiving space on substrate 130 and core 120).

Regarding Claim 32, although Kuk does not explicitly disclose wherein the connecting unit is configured such that it is separable from the receiving space, it is inherent that the terminals 138 are separable from the printed circuit board (PCB), for example, by way of desoldering the terminals and removing them. NOTE: “separable” is not mentioned in the specification.

Claim Rejections - 35 USC § 103

4. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kuk (US 2013/0106198).

Regarding Claim 25, Kuk teaches the wireless portable terminal of claim 1, but does not disclose wherein the substrate is flexible. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to make the core 120 and/or the substrate 130 flexible, because this would allow the assembled unit to flex, thus resisting breakage and increasing reliability, of which fact the examiner takes official notice.

Allowable Subject Matter

5. Claims 6, 7, 9, 24, and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claim 6 and dependent claims 7, 9, 24 and 26 would be allowable because none of the prior art of record discloses or suggests the wireless power receiver of claim 1, further comprising a short-range communication antenna formed on the substrate and surrounding the coil.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES P. EVANS whose telephone number is (571) 270-0639. The examiner can normally be reached on Monday-Friday 8 AM-5pm ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jared Fureman can be reached on 571-272-2391. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JAMES P EVANS/
Examiner, Art Unit 2836

/JUNG KIM/
Primary Examiner, Art Unit 2842

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13663012	AN ET AL.
	Examiner	**Art Unit**
	JAMES P EVANS	2836

CPC- SEARCHED

Symbol	Date	Examiner
H04B5/0037	1/29/2015	JPE
H04B5/0081	1/29/2015	JPE
H01F41/14	1/29/2015	JPE
H01F38/14	8/13/2015	JPE
Re-searched all symbols above	1/19/2016	JPE
Re-searched all symbols above	5/7/2016	JPE
Reviewed against new art	12/8/2016	JPE

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
307	104	1/29/2015	JPE
713	300	8/13/2015	JPE
Re-searched all above	Re-searched all subclasses above	1/19/2016	JPE
Re-searched all classes above	Re-searched all subclasses above	5/7/2016	JPE

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Search	1/21/2015	JPE
Keyword search	1/20/2015	JPE
IP.com search	1/20/2015	JPE
and all docs cited in European search report	1/20/2015	JPE
Search with SSE (Michael Obinna)	1/26/2015	JPE
Consulted Jared Fureman (SPE)	1/29/2015	JPE

/JAMES P EVANS/
Examiner.Art Unit 2836

SEARCH NOTES

Search Notes	Date	Examiner
Consulted Primary Dan Cavallari	8/13/2015	JPE
Consulted Primary Alex Gilman in Connectors	8/13/2015	JPE
Consulted Primary Carlos Amaya	8/14/2015	JPE
Consulted Primary Bob Deberadinis	8/17/2015	JPE
Searched amended claims	1/19/2016	JPE
Consulted Primary Ken Wells	1/19/2016	JPE
Added IDS docs, reviewed them, and performed augmented searches	5/7/2016	JPE
Consulted Primary Ken Wells	5/7/2016	JPE
Consulted Primary John Kim and SPE Jared Fureman	10/5/2016	JPE

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04B	5/0037	1/19/2016	JPE
Re-searched above	Re-searched above	5/7/2016	JPE

/JAMES P EVANS/ Examiner.Art Unit 2836	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"20130106198".pn.	US-PGPUB; USPAT	OR	ON	2016/12/08 12:10
L2	82	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$).did. or (US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/12/08 12:11

S1	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2015/01/20 10:41
S2	8	("20050046573" | "20080122570" | "20080154178" | "20080197957" | "20090058358" | "20100277004" | "20120057322" | "6008622").PN.	US-PGPUB; USPAT	OR	ON	2015/01/20 10:51
S3	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:23
S4	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 11:34
S5	175746	(coil$1 or winding$1) WITH (power or energy or current) WITH (terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S6	5375	(substrate or base or core or "ferrite magnet layer") WITH (space or shape or shaped) WITH (connector or "connecting unit") WITH (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S7	158	S6 AND S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:06
S8	398217	(coil$1 or winding$1) SAME (power or energy or current) SAME(terminal$1 or electrode$1 or lead$1 or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S9	27303	(substrate or base or core or "ferrite magnet layer") SAME (space or shape or shaped) SAME (connector or "connecting unit") SAME (terminal or lead or "connecting land")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 12:23
S10	1934	S9 SAME S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2015/01/20 12:24

			IBM_TDB			
S11	392	WO adj "2008053599" WO adj "2013174340" EP adj "1870984" WO adj "2012169728" WO adj "2006127829" EP adj "0037921" WO adj "2005034152" WO adj "1992014254" WO adj "2006134712" WO adj "2007007516" WO adj "2007055265" "20030006657" EP adj "2642632" EP adj "2202499" EP adj "2642632" CN adj "1110225" "3634878" "3848208" "20130249302" WO adj "2006047953" CN adj "1151100" WO adj "2013149781" CN adj "103326473" JP adj "2012235630" "5724018" CN adj "100466382" CN adj "101071909" EP adj "2367263" WO adj "2011147451" WO adj "2014183352" EP adj "1487087" WO adj "2004045050" WO adj "2009070705" JP adj "2013138404" WO adj "2004030845" EP adj "2309620" JP adj "2005065018" JP adj "2004023961" JP adj "2010110168" EP adj "2256751" WO adj "2009155030" EP adj "2642591" WO adj "2012015839" EP adj "2814047" JP adj "2004072867" "2091798" WO adj "1993013532" WO adj "2008135507" "3660791" WO adj "2006101049" WO adj "2002046653" WO adj "2007049788" JP adj "2001144642" "3146419" EP adj "1868280" EP adj "1883998" JP adj "2014023281" "3792410" CN adj "201340774" "20060278387" CN adj "1855761" JP adj "2013157917" EP adj "1717967" CN adj "101189692" CN adj "102056328" "3848205" WO adj "2013022255" JP adj "2014027102" EP adj "1821556" "3767102" EP adj "2375531" JP adj "2008017141" WO adj "2005034307" JP adj "2010093386" EP adj "2629361" WO adj "2005030528" CN adj "1941230" "3163840" "3863040"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:52
S12	299	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 13:58
S13	3	EP adj "2642632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 14:51
S14	22	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-	US-PGPUB; USPAT; FPRS; JPO;	OR	ON	2015/01/20 15:01

		20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$ or US-20130249302-$).did.	DERWENT			
S15	22	((substrate or base or core or "ferrite magnet layer")(space or shape or shaped) (connector or "connecting unit") (terminal or lead or "connecting land")or (coil or winding) or power or energy or current or terminal or relectrode) AND S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 15:01
S16	2	"20080164840"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/20 17:13
S17	6	"39593692".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/20 17:15
S18	2	"20120044114"	US-PGPUB; USPAT	OR	ON	2015/01/20 17:26
S19	3	(("Jeong Wook") near2 (AN)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:52
S20	2	(("Jeong Wook") near2 (AN)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:54
S21	8	(("Jung Oh") near2 (LEE)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:55
S22	1	(("Jung Oh") near2 (LEE)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 08:57
S23	3	(("Sung Hyun") near2 (LEEM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 08:58
S24	0	(("Sung Hyun") near2 (LEEM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:04
S25	7	(("Yang Hyun") near2 (KIM)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/01/21 09:05
S26	3	(("Yang Hyun") near2 (KIM)).INV.	EPO; JPO; DERWENT	OR	ON	2015/01/21 09:19
S27	5	"47598569".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/23 11:34
S28	24	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	ON	2015/01/26 13:45

		or US-20120044114-$ or US-20140167521-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$).did. or (WO-2013120710-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$).did. or (WO-2013065245-$ or CN-203326731-$).did.				
S29	2993903	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:02
S30	1440492	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:07
S31	3326212	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:10
S32	2674608	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:19
S33	2115289	(connect$3 or link$3 or coupl$3 or join$3) near3 (terminal or node or lead or electrode or contact)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:22
S34	80414	S29 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:28
S35	2254	S34 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:29
S36	328	S35 SAME S32	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S37	52	S36 SAME S33	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:30
S38	133047	S29 SAME S31	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S39	2254	S38 SAME S30	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 14:31
S40	5809	S30 near3 S31	US-PGPUB;	ADJ	ON	2015/01/26

			USPAT; USOCR			14:32
S43	27	jp and "2006042519"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 12:52
S44	0	jp and "04-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:35
S45	4911	jp and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:36
S46	0	jp and "rotary transformer" and "flexible substrate (35)"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S47	20	jp and "rotary transformer" and "flexible substrate"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:37
S51	2	"4-51115"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:42
S52	61	"hitachi ferrite" and "rotary transformer"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:49
S53	17	"hitachi ferrite" and "rotary transformer" and grooves	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/27 14:52
S57	4554	"satoshi" AND "shinji"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2015/01/28 09:15

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S58	100	murata AND S57	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 09:15
S59	2	JP2010022098A	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/28 10:40
S60	38	"6008622"	US-PGPUB; USPAT	OR	ON	2015/01/28 17:01
S61	1	"6008622" and Norio	US-PGPUB; USPAT	OR	ON	2015/01/28 17:02
S62	1	"17402302".FMID.	US-PGPUB; USPAT; FPRS	OR	ON	2015/01/28 17:03
S63	336	H04B5/0037	US-PGPUB; USPAT	OR	ON	2015/01/28 17:30
S64	42	H04B5/0081	US-PGPUB; USPAT	OR	ON	2015/01/28 17:31
S65	38	H01F41/14	US-PGPUB; USPAT	OR	ON	2015/01/28 17:32
S66	1111	H02J17/00	US-PGPUB; USPAT	OR	ON	2015/01/28 17:55
S67	32971	H02J17/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/28 17:55
S68	6341	H01F41/14	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:19
S69	20594	H01Q7/00	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:27
S70	1439	H04B5/0081	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:29
S71	21809	S70 OR S69	US-PGPUB;	OR	ON	2015/01/29

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			08:29
S72	394	S71 and ("rectang$4" OR "square")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/01/29 08:38
S73	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/05/19 08:45
S74	18	S73 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/05/19 08:48
S92	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:16
S93	771	S92 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:16
S94	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/08/11 17:18

		H04B5/00.ipc.) AND @ad<"20120719"	DERWENT; IBM_TDB			
S95	771	S94 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S96	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S95	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:18
S97	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S98	771	S97 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S99	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S98	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:20
S100	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S101	771	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S102	305	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S101	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:23
S103	72	((coil or winding or antenna or resonator or "receiving element") WITH conductive WITH (layer or	US-PGPUB; USPAT; USOCR;	OR	ON	2015/08/11 17:23

		pattern)) AND S102	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S104	934	S100 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:29
S105	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S106	934	S105 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S107	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S106	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:32
S108	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/11 17:35
S109	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35

S110	934	S109 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S111	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S110	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S112	0	S111 AND S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:35
S113	165	S111 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 17:41
S114	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S115	372	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (space or shape or shaped) AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:09
S116	0	S115 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:10
S117	389	S114 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:11

S118	0	S117 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:11
S119	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S108) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:13
S120	27	S119 and S108	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/11 18:14
S121	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 13:32
S122	136746	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S121) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:32
S123	27	S122 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:32
S124	11	S121 NOT S123	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2015/08/12 13:32

			EPO; JPO; DERWENT; IBM_TDB			
S125	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S126	934	S125 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S127	0	S126 and S121	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:46
S128	136730	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.) AND @ad<"20120719"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S129	389	S128 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 13:56
S130	337	((coil$1 or winding$1) SAME (power or energy or current) SAME (terminal$1 or electrode$1 or lead$1 or "connecting land")) AND S126	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:11
S131	160	S130 and spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:11
S132	165	S130 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:13

S133	160	S132 AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:13
S134	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 14:34
S135	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 14:36
S136	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S135) AND S134	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 14:36
S139	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 15:22

S140	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 15:22
S141	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S140) AND S139	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S142	253	S141 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 15:22
S144	5387	((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/12 16:04
S145	38	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/12 16:04

		or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S146	385	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc. S145) AND S144	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S147	253	S146 and ((space or notch or cutout or "cut-out") SAME(connector|connect$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S148	198	S147 and ((first near3 (connector|connect$3|terminal) SAME (second near3 (connector|connect$3|terminal))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 16:04
S149	28	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal))))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:00
S150	1	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121029"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:02
S151	2	S147 and ((first ADJ (connector|connect$3|terminal) SAME (second ADJ (connector|connect$3|terminal)))) AND @ad<"20121030"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:02
S152	6	S147 and ((first NEAR2 (connector|connect$3|terminal) SAME (second NEAR2 (connector|connect$3|terminal)))) AND @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/12 17:11
S153	0	((substrate or base or core or "ferrite magnet layer") AND (connector or	JPO	ADJ	ON	2015/08/13 11:35

		"connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)				
S154	11	((substrate or base or core or "ferrite magnet layer") AND (receiv$3 or transceiv$3 or antenna or transponder)) AND spiral AND (pattern$3 or etch$3 or depos$3 or deposit$3 or plat$3 or PCB or print$3) AND (coil or winding or resonator or antenna) AND (wire$1less$2 or "wire less" or inductive or contact$1less$2 or "contact less" or "non contact" or connectionless)	JPO	ADJ	ON	2015/08/13 11:35
S155	9194	H01F38/14.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 11:59
S156	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 12:04
S157	164	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") AND (receiv$3 or transceiv$3 or antenna$2 or transponder)) AND ((coil or winding or antenna or resonator or "receiving element") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 12:05
S158	40	S156 AND ((substrate or base or core or "ferrite magnet layer") AND (connector or "connecting unit") AND (terminal or lead or "connecting land") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 12:06
S161	477	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND (coil$1 or winding$1 or resonator or secondary or inductor)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:10
S162	293	S156 AND (substrate "PCB" semiconductor silicon) AND (terminal port connector connection) AND	US-PGPUB; USPAT; USOCR;	OR	ON	2015/08/13 13:11

		(space or notch or cutout or "cut-out")	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S164	30	S156 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 13:18
S165	8	"8,092,251"	USPAT	OR	ON	2015/08/13 19:28
S166	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/13 19:33
S167	5888	H01F38/14.cpc. and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/13 19:34
S168	30	S167 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:34
S169	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$	US-PGPUB; USPAT; USOCR; FPRS; JPO;	OR	ON	2015/08/13 19:35

		or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	DERWENT			
S170	5	S169 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:35
S171	21496	713/3??.ccls.	US-PGPUB; USPAT	OR	ON	2015/08/13 19:52
S172	10	S171 AND ((substrate "PCB" semiconductor silicon) SAME (space or notch or cutout or "cut-out")) AND (terminal port connector connection) AND (notch or cutout or "cut-out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/13 19:53
S173	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/08/17 08:34

		8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S174	21	S173 and flexible	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 08:34
S175	21	S173 and flexible and ((uniform$2 or consistent$2 or consistency or perfect$3 or balanc$3 or equaliz$3 or overcom$3 or eliminat$3 or advantag$6 or benefit$4 or beneficially or allow$3 or effect$3 or less or great$3 or better$3 or more or most or improv$5 or simplify$3 or well or simplification or fewer or fewest or least or better or best or superior or increas$3 or decreas$3 or enhanc$5 or lower$3 or lessen$3 or short$5 or higher or highest or lighter or lightest or brighter or brightest or cheap$3 or fast$3 or long$3 or lengthen$3 or shorten$3 or extend$3 or wide$2 or prolong$3 or prevent$3 or eliminat$5 or mitigat$3 or without or effective$4 or efficien$3 or reduc$4 or compact$3 or small$3 or enhanc$3 or boost$3 or simple$2 or simplify$3 or easy or ease$2 or easi$3 or inhibit$3 or $savin$1 or environment$4 or $1friendly or sav$3 or safe$2 or protect$3 or possible or possibilit$3 or mak$3 or possible or possibilit$3 or solv$2 or fix$2 or solution or maximum or maximiz$5 or accomplish$4 or minimiz$5 or minimum or optimiz$5 or low$1cost or reliable or reliably or avoid$3 or excellent or (very ADJ high) or (very ADJ low) or stable or stabili$6 or portable or modular or slow$3 or speed$3 or hasten$3 or strenghthen$3 or resilien$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 09:46
S176	1	S173 and "modular power transmitting system"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:02
S177	358681	(coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT;	OR	ON	2015/08/17 11:17

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S178	5890	H01F38/14.cpc. and @ad< "20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/08/17 11:18
S179	380	S178 AND (coil|winding) SAME (groove$1|recess$2|indentation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:18
S180	180	S178 AND (coil|winding) SAME (groove$1|recess$2|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:19
S181	94	S178 AND (coil|winding) SAME (groove$1|indentation) SAME (core|substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/08/17 11:22
S182	3191265	(wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or remote$2 or ((free or without or lack$3 or no or less) near2 (contact$3 or connect$3)) or (RF or R F or radio$1frequenc$3 or radio frequency) near3 (transmission or network$3 or LAN or control$3) or connectionless)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S183	1498071	(receiv$3 or accept$3 or obtain$3 or recover$3 or receipt or retriev$3 or acquir$3 or acquisition) near3 (spac$3 or hole or opening or slot or gap or notch or port)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S184	3523990	(predetermin$5 or predefined or set or prescribed or fixed or preselect$3 or establish$3 or prestablish$3 or standard or desired or reference or known or specific$4 or select$4 or fixed or defin$4 or precis$3 or certain or preset or particular) near3 (size or shape or dimension or design or pattern or cutout or configuration or layout)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14
S185	2858589	(coil or transmit$4 or transmission or receiv$3 or transceiv$3 or antenna$2 or transponder) near3 (unit or module or circuit or assembly or device)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/10/13 09:14

S186	7009	S182 AND S183 AND S184 and S185 and spiral	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:14
S187	2229	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (layer or pattern or PCB or printed or etch$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:19
S188	437	S186 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:21
S189	171977	(H04B5/0037.cpc. H04B5/0081.cpc. H01F41/14.cpc. H01F38/14.cpc. 307/104.ccls. 29/602.1.ccls. H02J7/02.ipc. G06K19/07.ipc. H02J5/00.ipc. B60L11/18.ipc. H02J17/00.ipc. H04B5/00.ipc.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S190	15	S188 AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:23
S191	17651	S182 AND S183 AND S184 and S185 and (radial (helically or helix) Near3 (flat planar))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:37
S192	681	S191 AND ((substrate or base or core or "ferrite magnet layer") WITH (conduct$3 NEAR2(layer or pattern or PCB or printed or etch$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:38
S193	6	S192 AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 09:39
S194	25	(coil WITH overlap$4 NEAR4 connect$3) AND S189	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2015/10/13 09:44

			DERWENT; IBM_TDB			
S195	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2015/10/13 13:43
S196	15	S195 and overlap$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/13 13:43
S197	1	"20120248981"	US-PGPUB	OR	ON	2015/10/13 13:44
S198	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 10:30
S202	51	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/16 10:52

		20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S207	546319	S198 AND (((receiv$3 or accept$3 or receipt or retriev$3 or acquir$3 or acquisition or fit$4 or accommodat$3) near3 (spac$3 or hole or opening or slot$3 or gap or notch$2 or port or area or shaped or cut-out or configured or size or shape or dimension or design or pattern or cutout or "cut out" or configuration or layout)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:03
S208	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:11
S209	1657391	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S210	1130997	S209 AND (space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/16 11:17
S211	723742	(coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:28
S212	32986	S211 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/01/16 11:36

			IBM_TDB			
S213	7222	S212 AND S210	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/16 11:38
S214	723868	(coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S215	32995	S214 SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S216	51	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/19 09:22
S217	6	S215 AND S216	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 09:22
S218	1658038	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire	US-PGPUB; USPAT; USOCR;	ADJ	ON	2016/01/19 09:55

		less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S219	287249	S218 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/01/19 09:55
S220	3911	S215 AND S219	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:08
S221	253	S220 AND (third ADJ2 (terminal electrode end terminus "connecting land" end contact pin)) AND (fourth ADJ2 (terminal electrode end terminus "connecting land" end contact pin))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:15
S222	167	S221 and @ad<"20120323"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 10:23
S223	33	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 13:51
S224	62	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 14:23
S225	6	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (cross$3 across)) NEAR3 (space gap)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:13
S226	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (overlap$4)) NEAR3 (space gap)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/01/19 15:18

			DERWENT; IBM_TDB			
S227	2	S221 AND ((coil loop inductor inductance pattern conductive) NEAR3 (top)) NEAR3 (substrate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/19 15:29
S228	57	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/19 16:47
S237	49	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140167521-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140333253-$ or US-20140306656-$ or US-20130069445-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20130069444-$ or US-20090284341-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/20 09:57

		8653927-$ or US-7392013-$ or US-8092251-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.				
S238	57	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/01/20 09:57
S239	12	S238 NOT S237	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/20 09:57
S240	1	S238 AND Kato	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/20 10:07
S241	17	("20050072595" | "20050116874" | "20060166506" | "20070020932" | "20070254432" | "20070279002" | "20080129439" | "20080200210" |	US-PGPUB; USPAT	OR	ON	2016/05/06 15:59

		"20080266748" | "20100289341" | "20100308187" | "20110127070" | "20110267248" | "20110285494" | "20120019075" | "20120049986" | "20140091614").PN.				
S242	74	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-20110127070-$ or US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/05/06 16:01
S243	1713929	(receiv$3 or reception or pick-up or pickup or "pick up" or secondary or target) SAME ((wire$1less$2 or wire less or inductive or contact$1less$2 or contact less or non contact$3 or (RF or R F or radio$1frequenc$3 or radio frequency)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/06 16:03
S245	1	WO ADJ "2012150293"	US-PGPUB; USPAT; DERWENT	OR	ON	2016/05/06 16:16
S246	0	"2005116874".PN.	US-PGPUB; USPAT	OR	ON	2016/05/06 16:21

S247	1	"20050116874".PN.	US-PGPUB; USPAT	OR	ON	2016/05/06 16:21
S248	1	"20140091640".pn.	US-PGPUB	ADJ	ON	2016/05/06 16:35
S249	76	(US-20130249302-$ or US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20140152245-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$).did. or (US-20110127070-$ or US-20050072595-$ or US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/05/06 16:36
S250	47	S249 AND S243	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/06 16:36
S251	31	S250 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/05/06 16:39

		patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or base))	DERWENT; IBM_TDB			
S252	723389	((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:02
S253	2787	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)) SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second 2nd another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:19
S254	901	S253 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 17:50
S255	648	S254 AND ((space or spacing or hole or opening or slot or slotted or gap or notch or notched or recess or recessed or shape or shaped or cut-out or design or designed or pattern or patterned or cutout or "cut out" or configured or configuration or layout or "lay out" or lay-out or "laid out") WITH (substrate or board or printed-circuit-board or PCB or base))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/05/07 17:51
S256	245	S255 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern)) WITH ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:06
S257	45	S256 AND ((coil inductor inductance winding antenna) WITH (third 3rd) ADJ2 (terminal electrode end terminus "connecting land" end) WITH (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:14
S258	349	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) NEAR5 substrate) SAME ((terminal electrode end terminus "connecting land" end) NEAR3 (second 2nd another other))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 18:36
S259	92	S258 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/05/07 18:44

		notched)) OR (connect$3 coupl$3) WITH (under beneath below))	EPO; JPO; DERWENT; IBM_TDB			
S260	272	S252 AND ((coil inductor inductance winding antenna) WITH (conductive conducting copper etch$3 PCB printed layer pattern) NEAR5 substrate) SAME ((second 2nd) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:00
S261	27	S260 AND ((coil inductor inductance winding antenna) WITH (third 3rd) ADJ2 (terminal electrode end terminus "connecting land" end) WITH (fourth 4th) ADJ2 (terminal electrode end terminus "connecting land" end))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:01
S262	11	S261 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:01
S263	9	S261 AND (((coil loop winding antenna inductor inductance inductive pattern conductive) NEAR5 (overlap$4 cross$3) NEAR5 (space gap hole notch notched)) OR (connect$3 coupl$3) WITH (under beneath below)) AND ((wire$1less$2 or wire ADJ less or inductive or contact$1less$2 or (contact adj3 less) or (non adj3 contact$3)) NEAR3 (power energy transmission transmit$4) NEAR3 (receiv$3 reception))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/07 19:04
S288	81	(US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$ or US-20050072595-$).did. or (US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/10/04 09:21

		20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or (US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S290	1	S288 and kuk.inv.	US-PGPUB; USPAT	OR	ON	2016/10/04 09:32
S292	81	(US-20050046573-$ or US-20080122570-$ or US-20080154178-$ or US-20100277004-$ or US-20120057322-$ or US-20080197957-$ or US-20090058358-$ or US-20080164840-$ or US-20120044114-$ or US-20130157565-$ or US-20140346890-$ or US-20130106198-$ or US-20140306656-$ or US-20140175895-$ or US-20120187767-$ or US-20110101788-$ or US-20130200716-$ or US-20090284341-$ or US-20130126622-$ or US-20120248981-$ or US-20140226293-$ or US-20150109167-$ or US-20090115681-$ or US-20130271328-$ or US-20110127070-$ or US-20050072595-$).did. or (US-20120049986-$ or US-20120019075-$ or US-20050116874-$ or US-20140091614-$ or US-20110285494-$ or US-20080266748-$ or US-20080200210-$ or US-20100308187-$ or US-20070020932-$ or US-20080129439-$ or US-20060166506-$ or US-20100289341-$ or US-20070279002-$ or US-20110267248-$ or US-20070254432-$ or US-20140091640-$ or US-20030141590-$ or US-20070007661-$ or US-20160118711-$ or US-20070095913-$).did. or (US-6008622-$ or US-5572180-$ or US-3936931-$ or US-5294749-$ or US-6876287-$ or US-5175525-$ or US-8922321-$ or US-8653927-$ or US-7392013-$ or US-8092251-$ or US-8947189-$ or US-4947180-$ or US-7259672-$).did. or	US-PGPUB; USPAT; USOCR; FPRS; JPO; DERWENT	OR	ON	2016/10/04 13:42

		(US-3153139-$).did. or (WO-2013120710-$ or WO-2010133995-$ or JP-H0732100-$ or GB-981380-$ or WO-2012008693-$).did. or (JP-2013157917-$ or JP-2013138404-$ or JP-2012235630-$ or JP-2006042519-$ or JP-2012010533-$ or JP-2012191134-$ or JP-2011109546-$ or JP-2007159326-$).did. or (WO-2013065245-$ or CN-203326731-$ or JP-2010022098-$ or WO-2012150293-$).did.				
S293	1	"20130249302"	US-PGPUB; USPAT	OR	ON	2016/10/04 13:46
S294	38	S292 and ((coil WITH conductive OR conducting) OR etch$3 OR plating or deposed or deposition or depositing)	US-PGPUB; USPAT	OR	ON	2016/10/04 13:57
S295	41	S292 and (coil WITH conductive OR conducting or conductor)	US-PGPUB; USPAT	OR	ON	2016/10/04 14:03
S296	41	S292 and ((coil or inductor) WITH conductive OR conducting or conductor)	US-PGPUB; USPAT	OR	ON	2016/10/04 14:04

12/8/2016 6:54:48 PM
C:\Users\jevans2\Documents\EAST\Workspaces\13663012.wsp

PTO/SB/08A (08-03)
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Substitute for form 1449A/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	**Application Number**	13/663,012
	Filing Date	October 29, 2012
	First Named Inventor	James P. Evans
(use as many sheets as necessary)	**Art Unit**	2836
	Examiner Name	Jeong Wook An
Sheet 1 of 1	**Attorney Docket Number**	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	2009/0029185-A1	01-29-2009	Lee *et al.*	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2009033106-A	02-12-2009	Taida Electronic Ind. Co., Ltd.	ALL	
	F2	JP-2012019302-A	01-26-2012	NEC Tokin Corp.	ALL	
	F3	JP-2004110854-A	04-08-2004	Yokowo Co., Ltd.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	~~R1~~	~~Office Action dated August 10, 2015 in Japanese Application No. 2015-172306.~~	
	R1	Office Action dated August 10, 2016 in Japanese Application No. 2015-172306	

Examiner Signature	/JAMES P EVANS/	Date Considered	09/08/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

J:\SUN\LGI\420\IDS-Refs\08-16-16\PTO-SB-08(7).doc/jmc

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13663012
Filing Date	2012-10-29
First Named Inventor	Jeong Wook An
Art Unit	2836
Examiner Name	James P. Evans
Attorney Docket Number	SUN.LGI.420

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20130106198	A1	2013-05-02	Kuk et al.	ALL

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	M424550	TW	U1	2012-03-11	TDK Taiwan Corporation	ALL	
	2	2012008693	WO	A2	2012-01-19	Hanrim Postech Co., Ltd. et al.	ALL	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number		13663012
	Filing Date		2012-10-29
	First Named Inventor	Jeong Wook An	
	Art Unit		2836
	Examiner Name	James P. Evans	
	Attorney Docket Number		SUN.LGI.420

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Office Action dated August 24, 2016 in Taiwanese Application No. 103130766.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/JAMES P EVANS/	Date Considered	09/08/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	13663012
	Filing Date	2012-10-29
	First Named Inventor	Jeong Wook An
	Art Unit	2836
	Examiner Name	James P. Evans
	Attorney Docket Number	SUN.LGI.420

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JEFF LLOYD/	Date (YYYY-MM-DD)	2016-09-07
Name/Print	Jeff Lloyd	Registration Number	35589

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.P.E/

Document code: WFEE

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Sales Receipt for Accounting Date: 09/09/2016

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		01 FC : 1806		180.00 DA		

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 10/28/2016

DMARTINO ADJ #00000001 Mailroom Dt: 09/08/2016
Seq No: 5 Sales Acctg Dt: 09/09/2016 190065 13663012
01 FC : 1806 180.00 CR

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/663,012	Filing Date	2012-10-29	Docket Number (if applicable)	SUN.LGI.420	Art Unit	2836
First Named Inventor	Jeong Wook An			Examiner Name	James P. Evans		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on ________
- ☐ Other ________

☒ Enclosed

- ☐ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other ________

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months ________
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other ________

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 190065

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature
Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Signature of Registered U.S. Patent Practitioner			
Signature	/JEFF LLOYD/	Date (YYYY-MM-DD)	2016-09-07
Name	JEFF LLOYD	Registration Number	35589

Privacy Act Statement

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13663012
	Filing Date	2012-10-29
	First Named Inventor	Jeong Wook An
	Art Unit	2836
	Examiner Name	James P. Evans
	Attorney Docket Number	SUN.LGI.420

U.S.PATENTS

Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

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Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20130106198	A1	2013-05-02	Kuk et al.	ALL

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS

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Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	M424550	TW	U1	2012-03-11	TDK Taiwan Corporation	ALL	
	2	2012008693	WO	A2	2012-01-19	Hanrim Postech Co., Ltd. et al.	ALL	

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13663012
	Filing Date	2012-10-29
	First Named Inventor	Jeong Wook An
	Art Unit	2836
	Examiner Name	James P. Evans
	Attorney Docket Number	SUN.LGI.420

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Office Action dated August 24, 2016 in Taiwanese Application No. 103130766.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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	Filing Date	2012-10-29
	First Named Inventor	Jeong Wook An
	Art Unit	2836
	Examiner Name	James P. Evans
	Attorney Docket Number	SUN.LGI.420

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☒ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JEFF LLOYD/	Date (YYYY-MM-DD)	2016-09-07
Name/Print	Jeff Lloyd	Registration Number	35589

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Electronic Patent Application Fee Transmittal

Application Number:	13663012
Filing Date:	29-Oct-2012
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/Seneca Miller
Attorney Docket Number:	SUN.LGI.420

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Petition fee- 37 CFR 1.17(h) (Group III)	1464	1	140	140
RCE- 2nd and Subsequent Request	1820	1	1700	1700
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1840**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : September 7, 2016

In re Application of :

Jeong Wook AN

DECISION ON PETITION

UNDER CFR 1.313(c)(2)

Application No : 13663012

Filed : 29-Oct-2012

Attorney Docket No : SUN.LGI.420

This is an electronic decision on the petition under 37 CFR 1.313(c)(2), filed September 7, 2016 to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED.**

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid in this application cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being referred to Technology Center AU 2836 for processing of the request for continuing examination under 37 CFR 1.114 .

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	26856909
Application Number:	13663012
International Application Number:	
Confirmation Number:	3575
Title of Invention:	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME
First Named Inventor/Applicant Name:	Jeong Wook AN
Customer Number:	23557
Filer:	Jeff Lloyd/Seneca Miller
Filer Authorized By:	Jeff Lloyd
Attorney Docket Number:	SUN.LGI.420
Receipt Date:	07-SEP-2016
Filing Date:	29-OCT-2012
Time Stamp:	16:03:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1840
RAM confirmation Number	090816INTEFSW16031300
Deposit Account	4000
Authorized User	Seneca Miller

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	31582 f3d45e06d06cc52ed7e9c6175b25021913e1f16b	no	2
Warnings:					
Information:					
2	Transmittal Letter	SIDS.pdf	50651 0eb58566c0abee2fda37b7040b57088664262d5e	no	3
Warnings:					
Information:					
3	Quick Path Information Disclosure Statement	QPIDS-sb0009.pdf	73323 8390fa2a9ff93e373ad525662180c435115472e7	no	2
Warnings:					
Information:					
4	Foreign Reference	F1.pdf	14927889 2c818616b8f20b456dd417f7e55dea540857e505	no	34
Warnings:					
Information:					
5	Foreign Reference	F2.pdf	18370702 1fbc1dc88eda00a90dd12d7aec13dde9008a5938	no	20
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	R1.pdf	3435682 2e7d9166753e17e724c09d49c41d26b6555c4711	no	13
Warnings:					
Information:					

7	Request for Continued Examination (RCE)	RCE2.pdf	697600 471678f94f68a73d6340eabacc881a8f76825bb1	no	3
Warnings:					
Information:					
8	Information Disclosure Statement (IDS) Form (SB08)	PTO-SB-08.pdf	612180 cc8a95d34c2bd551183f9f324f266aa975e4ab4f	no	4
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	32450 e20a8d901a4b5f24484d287c85c38815773653c3	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	38232059	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/140 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**PETITION TO WITHDRAW AN APPLICATION FROM ISSUE AFTER PAYMENT OF THE ISSUE FEE UNDER 37 CFR 1.313(c)**
Application Number	13663012
Filing Date	29-Oct-2012
First Named Inventor	Jeong Wook AN
Art Unit	2836
Examiner Name	JAMES EVANS
Attorney Docket Number	SUN.LGI.420
Title	WIRELESS POWER RECEIVER AND METHOD OF MANUFACTURING THE SAME

An application may be withdrawn from issue for further action upon petition by the applicant. To request that the Office withdraw an application from issue, applicant must file a petition under this section including the fee set forth in § 1.17(h) and a showing of good and sufficient reasons why withdrawal of the application from issue is necessary.

APPLICANT HEREBY PETITIONS TO WITHDRAW THIS APPLICATION FROM ISSUE UNDER 37 CFR 1.313(c).

A grantable petition requires the following items:
(1) Petition fee; and
(2) One of the following reasons:
(a) Unpatentability of one or more claims, which must be accompanied by an unequivocal statement that one or more claims are unpatentable, an amendment to such claim or claims, and an explanation as to how the amendment causes such claim or claims to be patentable;
(b) Consideration of a request for continued examination in compliance with § 1.114 (for a utility or plant application only); or
(c) Express abandonment of the application. Such express abandonment may be in favor of a continuing application, but not a CPA under 37 CFR 1.53(d).

Petition Fee

○	Small Entity
○	Micro Entity
◉	Regular Undiscounted

Reason for withdrawal from issue

○ One or more claims are unpatentable

◉ Consideration of a request for continued examination (RCE) (List of Required Documents and Fees)

○ Applicant hereby expressly abandons the instant application (any attorney/agent signing for this reason must have power of attorney pursuant to 37 CFR 1.32(b)).

RCE request,submission, and fee.

☐ I certify, in accordance with 37 CFR 1.4(d)(4) that : The RCE request ,submission, and fee have already been filed in the above-identified application on

☒ Are attached.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.

○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity.

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this e-petition

Signature	/JEFF LLOYD/
Name	Jeff Lloyd
Registration Number	35589

I hereby certify that this correspondence is being electronically filed in the United States Patent and Trademark Office on September 7, 2016.

/SENECA MILLER/

____

Seneca Miller

SUPPLEMENTAL INFORMATION
DISCLOSURE STATEMENT
UNDER 37 C.F.R §§ 1.97 AND 1.98
Examining Group 2836
Patent Application
Docket No. SUN.LGI.420
Serial No. 13/663,012

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner	:	James P. Evans
Art Unit	:	2836
Applicants	:	Jeong Wook An, Jung Oh Lee, Sung Hyun Leem, Yang Hyun Kim
Serial No.	:	13/663,012
Filed	:	October 29, 2012
Conf. No.	:	3575
For	:	Wireless Power Receiver and Method of Manufacturing the Same

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 AND 1.98

Sir:

In accordance with 37 C.F.R. § 1.56, the references listed below and on the attached form PTO/SB/08 are being brought to the attention of the Examiner for consideration in connection with the examination of the patent application identified above. Copies of the cited references are attached. However, Applicants have not submitted copies of the published U.S. Patent Applications cited on attached Form PTO/SB/08 pursuant to 37 CFR 1.98(a)(2)(ii).

Applicants note that Taiwanese Publication No. M424550 and International Publication No. 2012008693, cited as F1 and F2, respectively, on the attached form PTO/SB/08 were written in foreign languages; however, English language Abstracts are provided herewith. Applicants have also included U.S. Publication No. 20130106198, cited as U1 on the attached form PTO/SB/08, which is a patent family member of F2 and is believed to be an English language equivalent thereof. Applicants respectfully request that the references be made of record and considered in the examination of the subject application.

The undersigned hereby certifies that no item of information contained in this Supplemental Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in this Supplemental Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this Supplemental Information Disclosure Statement.

This Supplemental Information Disclosure Statement is being submitted with a Quick Path Information Disclosure Statement Request along with a conditional Request for Continued Examination.

It is respectfully requested that the Examiner indicate consideration of the cited references by returning a copy of the attached form PTO/SB/08 with initials or other appropriate marks.

Applicants respectfully assert that the substantive provisions of 37 C.F.R. §§ 1.56, 1.97, and 1.98 are met by the foregoing statements.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Respectfully submitted,

/JEFF LLOYD/

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Attachments: Form PTO/SB/08; copies of references cited.

(19) Taiwan Intellectual Property Office

(12) Utility Model Publication

(11) Document No.: TW M424550U1

(45) Publication Date: March 11, 2012

(21) Application No.: 100219133

(22) Application Date: October 13, 2011

(51) IPC Classification: G06K19/07 (01. 2006) H02J17/00 (01. 2006) H04B5/00 (01. 2006)

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(72) Inventor: HSU, SHENGTAI (TW); WU, DAVID (TW); TAKAHIRO, OISHI (JP); LIN, CHIENHUNG (TW); LO, SHENGHAO (TW)

Total claims: 18 Total drawings: 6 Total pages: 18

(54) TITLE OF INVENTION

INDUCTION MODULE USED FOR NEAR FIELD COMMUNICATION AS WELL AS WIRELESS CHARGING

(57) ABSTRACT

The present invention relates to an induction module used for a near field communication (NFC) as well as a wireless charging (WLC), which includes: a first induction plate in a plate shape; and a first coil and a second coil wound in a planar shape to have an empty space at a center thereof, in which the first and second coils are mounted on the first induction plate, and the second coil is accommodated in the central empty space of the first coil while forming a concentric shape with the first coil, so that

induction modules having different kinds of frequency signals are integrated into one module, thus an area for an induction coil is reduced.

FIG. 2

30 induction module 31 induction plate 32 first coil 321 coil end

33 second coil 331 coil end 36 lead coil connector 361 metal connection terminal

SPECIFICATION

※ Application No.: 100219133

※ Application Date: October 13, 2011

※ IPC Classification: G06K19/07 (01. 2006) H02J17/00 (01. 2006) H04B5/00 (01. 2006)

1. TITLE OF INVENTION

INDUCTION MODULE USED FOR NEAR FIELD COMMUNICATION AS WELL AS WIRELESS CHARGING

2. CHINESE ABSTRACT

3. ENGLISH ABSTRACT

The present invention relates to an induction module used for a near field communication (NFC) as well as a wireless charging (WLC), which includes: a first induction plate in a plate shape; and a first coil and a second coil wound in a planar shape to have an empty space at a center thereof, in which the first and second coils are mounted on the first induction plate, and the second coil is accommodated in the central empty space of the first coil while forming a concentric shape with the first coil, so that induction modules having different kinds of frequency signals are integrated into one module, thus an area for an induction coil is reduced.

4. DESIGNATED REPRESENTATIVE DRAWING:

(1) Representative drawing: FIG. 2

(2) Brief description of elements in the representative drawing

30 induction module 31 induction plate 32 first coil 321 coil end 33 second coil 331 coil end 36 lead coil connector 361 metal connection terminal

5. SPECIFICATION

【TECHNICAL FIELD OF THE INVENTION】

[0001] The present invention relates to an induction module used for a near field communication (NFC) as well as a wireless charging (WLC), and more particularly, to an NFC module and a WLC module combined to a portable apparatus for use in an integrated structure.

【RELATED ART】

[0002] A portable electronic apparatus such as a mobile phone, a personal digital assistant (PDA), a palmtop computer, a notebook computer, and a tablet computer is conveniently used by using power of a battery thereof when there is no commercial power. In addition, the electronic apparatuses are used by charging the battery or receiving the commercial power through wired power supply equipment.

[0003] The portable apparatus using the WLC technology according to the present invention does not need to use wired power, and the power is directly transmitted to the portable apparatus for charging the battery by using an electromagnetic induction scheme. As shown in FIG. 1 which is a schematic view illustrating a transmitting structure for the WLC, the transmitting structure for the WLC includes a power transmitting module 10 and a power receiving module 20. The power transmitting (induction) module 10 includes a transmitting terminal coil 11 and a transmitting terminal core plate 12. Likewise, the power receiving (induction) module 20 includes a receiving terminal coil 21 and a receiving terminal core plate 22. When the power receiving module 20 approaches the power transmitting module 10, a current flows so that the transmitting terminal coil 11 of the power transmitting (induction) module 10 is subject to a magnetic field, thus, the receiving terminal coil 21 of the power receiving module 20 induced by the magnetic field generates a current.

[0004] In addition, to combine the NFC with the portable electronic apparatus is also considered quite important nowadays. Contactless-type point-to-point communication with the portable apparatus is performed through the NFC, such that very convenient connecting scheme is provided, accordingly, the communication is rapidly and simply performed.

[0005] The NFC technology has been developed by integrating a contactless-type radio frequency identification (RFID) with related technologies. For example, the NFC is being applied in an induction card used in an express transportation system. When the induction card approaches a toll gate for an express transportation, instant pass is possible and the induction time is much less than that of a general contactless-type IC card, which is very useful for a transportation terminal having a large quantity of loads.

[0006] For this reason, some persons having ordinary skill in the art have proposed an NFC chip built in the portable electronic apparatus such as a mobile phone. It shall be an inevitable trend to integrate a function of the NFC and the WLC into the portable electronic apparatus.

[0007] For now, however, two circuits for the NFC and the WLC are not identical to each other, but independent from each other, thus dedicated induction modules are to be used and different signals are to be received, respectively. A degree of difficulty is quite high to integrate the circuits in an inner space of the portable electronic apparatus which is gradually being weight-lightened and simplified.

[0008] An inventor of the present invention have discovered that both of the NFC and the WLC use a coil induction module because the both relate to a near field induction transmitting signal, and that the two kinds of induction modules does not need to be used at once. Therefore, the induction module used for the NFC as well as the WLC is designed for receiving a signal from the NFC and the WLC so as to automatically switch the signal by a switch circuit, thereby achieving the purpose to convertibly use the induction module.

【SUMMARY OF THE INVENTION 】

[0009] The object of the present invention is to provide an induction module used for a near field communication (NFC) as well as a wireless charging (WLC). Induction modules of the NFC and the WLC, which have mutually different frequency signals, are integrated into one, thereby reducing an area occupied by an induction coil in a portable electronic apparatus, so that the object to integrate two kinds of functions into the same portable electronic apparatus is achieved.

[0010] According to the main technical feature of the present invention, the induction module used for the NFC as well as the WLC is provided, in which the induction module includes: a first induction plate in a plate shape; and a first coil and a second coil wound in a planar shape to have an empty space at a center thereof, in which the second coil is accommodated in the central empty space of the first coil and has a concentric shape with the first coil.

【DETAILED DESCRIPTION OF THE INVENTION】

[0011] Hereinafter, the detailed description of present invention will be described with reference to accompanying drawings. It should be noted that the accompanying drawings may be used as reference and for description to express embodiments of the present invention and should not be construed as being limited thereto.

[0012] FIG. 2 shows a schematic view of a first embodiment of an induction module used for a near field communication (NFC) as well as a wireless charging (WLC) according to the present invention. FIG. 3 shows an exploded perspective view of FIG. 2. The convertible module 30 of the present invention includes a first induction plate 31, a first coil 32, and a second coil 33, in which the first induction plate 31 has a plate shape, which may be configured in the form of a rectangular, circular, or oval shape and may be arranged in various directions.

[0013] In this case, the first coil 32 is mounted on the first induction plate 31, is wound in a planar shape to have an empty space at a center thereof, and has two coil ends 321; and the second coil 33 is mounted on the first induction plate 31, is wound in a planar shape to have an empty space at a center thereof, has two coil ends 331, is accommodated in the central empty space of the first coil 32 while forming a concentric shape with the first coil 32. 7. A predetermined gap exists between the first coil 32 and the second coil 33.

[0014] Referring to the embodiment shown in FIG. 2, the first coil 32 includes an NFC induction coil and the second coil 33 includes a WLC induction coil. In addition, as shown in FIG. 4 illustrating a schematic view of a second embodiment according to the present invention, the first coil 32 includes the WLC induction coil and the second coil 33 includes the NFC induction coil.

[0015] The first coil 32 and the second coil 33 are induction coils having mutually different frequency signals. The length of the NFC induction coil is short because the frequency thereof is relatively high, and the length of the WLC induction coil is long because the frequency thereof is relatively low. As for the two induction coils, induction receiving frequency of the induction coil is automatically determined by an automatic switch circuit to be electrically connected to one of the induction coils. Since the switch circuit is not a main concept of the present invention, detail description thereof will be omitted below.

[0016] As shown FIG. 3, the convertible induction module 30 further includes an insulation bonding layer 35 mounted between the first induction plate 31 and the first and second coils 32 and 33 for bonding the first and second coils 32 and 33 on the first induction plate 31. Preferably, the insulation bonding layer 35 may be formed of a double-sided tape or an adhesive.

[0017] The convertible induction module 30 further includes a second induction plate 34 mounted on the first induction plate 31, and accommodated in the empty space at the center of the second coil 32. The insulation bonding layer 35 is disposed between the first induction plate 31 and the second induction plate 34 for bonding the second induction plate 34 on the first induction plate 31. Preferably, the first induction plate 31 together with the second induction plate 34 may be integrated in a shape of a Chinese character '凸' (not illustrated), and a protrusion thereof may be accommodated in the empty space at the center of the second coil.

[0018] Referring to FIG. 5 illustrating a schematic view of a third embodiment according to the present invention, the first coil 32 and the second coil 33 may come close to each other, so that a gap is not present therebetween.

[0019] Referring again to the first embodiment shown in FIG. 2, the two lead coil connectors 36 are disposed at an outer edge of the first induction plate 31 of the convertible induction module 30, and the two metal connection terminals 361 may be mounted on the lead coil connecters 36 and electrically connected to the two coil ends 321 of the first coil and the two coil ends 331 of the second coil, respectively.

[0020] Referring again to the second embodiment shown in FIG. 4, the one lead coil connectors 36 may be disposed at the outer edge of the first induction plate 31 of the convertible induction module 30, and a plurality of the metal connection terminals 361 may be mounted thereon to be electrically connected to the end coils the first coil 32 and/or the second coil 33, respectively. Otherwise, the lead coil connector 36 may be a metal contact piece 37. For example, the two coil ends 331 of the second coil 33 may be electrically connected to the metal contact piece 37.

[0021] Referring to the third embodiment shown in FIG. 5, a connector disposed at an outside of the first induction plate 31 is the lead coil connector 36. Or, one coil end of the first coil 32 and one coil end of the second coil 33 are electrically connected to each other so as to form a convertible coil end and be electrically connected to one of the metal connection terminals on the lead coil connector 36.

[0022] Referring to FIG. 6 illustrating a schematic view of a fourth embodiment according to the present invention, the first coil 32 and the second coil 33 are wound to form one set of coil 38, and include a first coil end 381, a second coil end 382, and a middle coil end 383. The first coil end 381 and the second coil end 382 constitute the WLC induction coil, and the middle coil end 383 and the second coil end 382 constitute the NFC induction coil.

[0023] Therefore, the disclosed technology as described aforesaid according to the present invention is very useful by providing a novel design remarkably different from designs generally known in the arts. Further, since the present disclosure has not yet published or publicly used before the application date thereof, the disclosed technology is pursuant to the requirements for the utility model, so I submit the present application of the utility model under the regulation.

【BRIEF DESCRIPTION OF THE DRAWINGS】

[0024] FIG. 1 is a schematic view showing a wireless charging structure;

[0025] FIG. 2 shows an induction module used for a near field communication (NFC) as well as a wireless charging (WLC) according to the invention;

[0026] FIG. 3 is an exploded perspective view of FIG. 2;

[0027] FIG. 4 is a schematic view showing a second embodiment of the present invention; and

[0028] FIG. 5 is a schematic view showing a third embodiment of the present invention.

[0029] FIG. 6 is a schematic view showing a fourth embodiment of the present invention.

【Description of Reference numerals】

10 power transmitting module 11 transmitting terminal coil

12 transmitting terminal core plate 20 power receiving module

21 receiving terminal coil 22 receiving terminal core plate

30 induction module 31 induction plate 32 first coil 321 coil end

33 second coil 331 coil end 34 second induction plate

35 insulation bonding layer 36 lead coil connector 361 metal connection terminal 37 metal contact piece 38 coil 381 first coil end 382 second coil end

383 middle coil end

WHAT IS CLAIMED IS:

1. An induction module used for a near field communication (NFC) as well as a wireless charging (WLC), the induction module comprising:

a first induction plate in a plate shape;

a first coil mounted on the first induction plate, wound in a planar shape to have an empty space at a center thereof, and having two coil ends; and

a second coil mounted on the first induction plate, wound in a planar shape to have an empty space at a center thereof, having two coil ends, and accommodated in the central empty space of the first coil while forming a concentric shape with the first coil.

2. The induction module according to claim 1, further comprising a second induction plate mounted on the first induction plate and accommodated in the central empty space of the second coil.

3. The induction module according to claim 1, further comprising an insulation bonding layer mounted between the first induction plate and the first and second coils for bonding the first and second coils onto the first induction plate.

4. The induction module according to claim 2, further comprising an insulation bonding layer mounted between the first induction plate and the first and second coils for bonding the first and second coils onto the first induction plate.

5. The induction module according to claim 3 or 4, wherein the insulation bonding layer

includes a double-sided tape or an adhesive.

6. The induction module according to claim 1, wherein a protrusion is accommodated in the empty space at the center of the second coil so that the first induction plate is integrated with the second coil in a shape of a Chinese character '凸'.

7. The induction module according to claim 1, wherein a predetermined gap exists between the first and second coils.

8. The induction module according to claim 1, wherein the first and second coils come close to each other without forming a gap therebetween.

9. The induction module according to claim 1, further comprising a lead coil connector mounted thereon with a plurality of metal connection terminals and electrically connected to the coil end of the first coil and/or the second coil.

10. The induction module according to claim 9, wherein two metal connection terminals from among the metal connection terminals of the lead coil connector serve as a convertible terminal.

11. The induction module according to claim 1, wherein the coil end of the first coil and the coil end of the second soil are electrically connected to each other to form a convertible coil end.

12. The induction module according to claim 9, wherein the lead coil connector is

coupled to an outer edge of the first induction plate.

13. The induction module according to claim 9, wherein the lead coil connector is installed at an outside of the first induction plate.

14. The induction module according to claim 9, wherein the two lead coil connectors are disposed at an outer edge of the first induction plate, and the two metal connection terminals are mounted on the lead coil connecters and electrically connected to the two coil ends of the first coil and the two coil ends of the second coil, respectively.

15. The induction module according to claim 1, wherein the first coil includes an NFC induction coil and the second coil includes a WLC induction coil.

16. The induction module according to claim 1, wherein the first coil includes a WLC induction coil and the second coil includes an NFC induction coil.

17. The induction module according to claim 1, wherein third and fourth coil ends of the second coil are electrically connected to metal contact pieces, respectively.

18. The induction module according to claim 1, wherein the first coil and the second coil are wound as one set and comprise the first coil end, the second coil end, and a middle coil end.

(19)中華民國智慧財產局

(12)新型說明書公告本　**(11)證書號數：TW M424550U1**

(45)公告日：中華民國 101 (2012) 年 03 月 11 日

(21)申請案號：100219133　　(22)申請日：中華民國 100 (2011) 年 10 月 13 日

(51)Int. Cl.：　***G06K19/07 (2006.01)***　***H02J17/00 (2006.01)***

H04B5/00 (2006.01)

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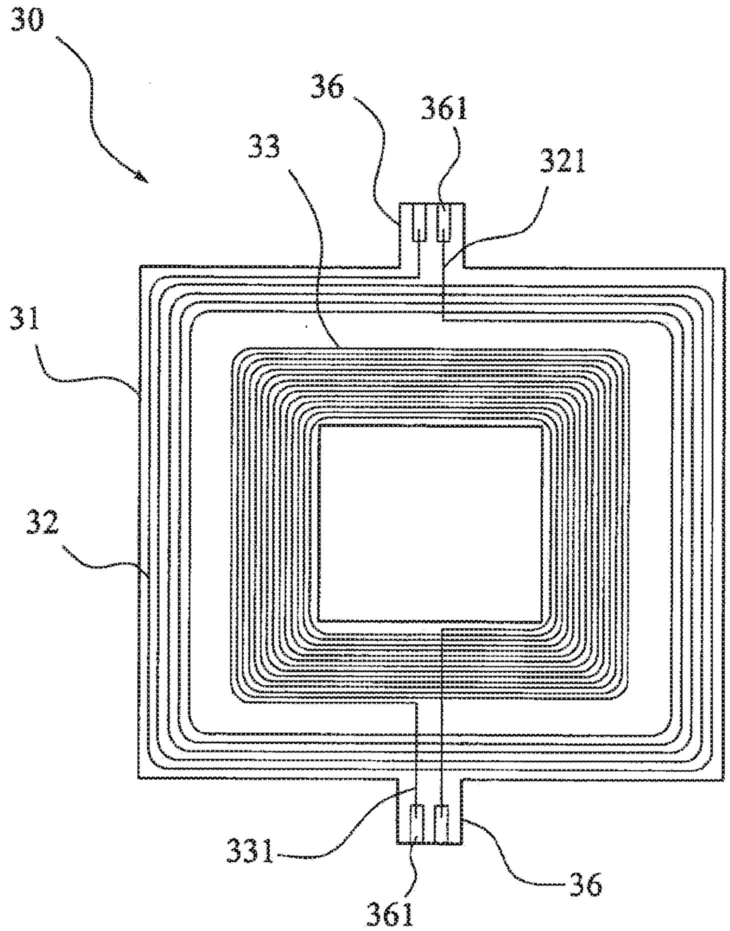
申請專利範圍項數：18 項　　圖式數：6　　共 18 頁

(54)名稱

近場通訊與無線充電共用的感應模組

(57)摘要

本創作提供一種近場通訊與無線充電共用的感應模組，至少包括：一呈平板狀第一感應板，一纏繞成中心鏤空平面狀的第一線圈及一第二線圈，該第一及第二線圈皆設置於該第一感應板上，且該第二線圈容置於該第一線圈的中心鏤空內，與該第一線圈呈同心狀，如此可將二種不同頻率信號的感應模組整合於一體，以縮小感應線圈的面積。



圖二

30・・・感應模組

31・・・感應板

32・・・第一線圈

321・・・出線端

33・・・第二線圈

331・・・出線端

36・・・引出線連接器

361・・・金屬連接端子

M424550

公告本

新型專利說明書

（本說明書格式、順序，請勿任意更動，※記號部分請勿填寫）

※申請案號：100219133

※申請日：100. 10. 13　　※IPC分類：G06K 19/07 (2006.01)
H02J 17/00 (2006.01)
H04B 5/00 (2006.01)

一、新型名稱：（中文/英文）

近場通訊與無線充電共用的感應模組

二、中文新型摘要：

本創作提供一種近場通訊與無線充電共用的感應模組，至少包括：一呈平板狀第一感應板，一纏繞成中心鏤空平面狀的第一線圈及一第二線圈，該第一及第二線圈皆設置於該第一感應板上，且該第二線圈容置於該第一線圈的中心鏤空內，與該第一線圈呈同心狀，如此可將二種不同頻率信號的感應模組整合於一體，以縮小感應線圈的面積。

三、英文新型摘要：

四、指定代表圖：

(一)本案指定代表圖為：圖二

(二)本代表圖之元件符號簡單說明：

30	感應模組
31	感應板
32	第一線圈
321	出線端
33	第二線圈
331	出線端
36	引出線連接器
361	金屬連接端子

五、新型說明：

【新型所屬之技術領域】

本創作係為一種近場通訊與無線充電共用的感應模組，特別是關於一種使用在可攜式設備上整合無線充電(Wireless Charging, WLC)感應模組與近場通訊(Near Field Communication, NFC)感應模組為一體的結構。

【先前技術】

按，於可攜式電子設備，如手機、PDA(個人數位助理器)、掌上型電腦、筆記型電腦或平板電腦...等，都是使用電池供電，以方便使用者在無市電狀態時使用，且該些電子裝置都會附帶有線的電力供應器，方便電池充電或者使用市電供電。

新型式的無線充電(WLC)技術使得可攜式設備不需要使用電力線，而可利用電磁感應的方式直接傳輸電力給該些可攜式設備對電池充電。如圖一所示，係為一無線充電傳輸的架構示意圖，包括有一電力傳送模組 10 及一電力接收模組 20，該電力傳送感應模組 10 具有一傳送端線圈 11、一傳送端鐵心板 12，而該電力接收感應模組 20 亦同樣具有一接收端線圈 21、一接收端鐵心板 22。當該電力接收模組 20 靠近該電力傳送模組 10 時，電流流經該電力傳送感應模組 10 的傳送端線圈 11 產生磁場，使得該

電力接收感應模組20的接收端線圈21感應該磁場產生電流。

另外目前在可攜式電子設備中結合近場通訊(NFC)也是相當地被受到重視，近場通訊(NFC)能夠讓可攜式設備進行非接觸式點對點通訊，提供極為便利的連接方式，可快速、簡便地進行通訊。

近場通訊(NFC)技術是由非接觸式射頻識別(RFID)及互連技術的整合演變而來，在目前近場通訊(NFC)的應用領域中就有如交通捷運系統中使用的感應卡，只要將感應卡靠近捷運查票口即可快速通關，而且感應時間比一般非接觸式晶片卡更快，這對高進出量的交通站而言相當受用。

因此有業者提出將近場通訊晶片嵌入於手機等可攜式電子設備內，也因此可攜式電子設備整合無線充電(WLC)與近場通訊(NFC)的功能將是未來不可避免的趨勢。

然而目前近場通訊(NFC)及無線充電傳輸(WLC)這二種電路完全不同，各自獨立，必需使用各自的感應模組，接收各自不同的訊號，這對可攜式電子設備越來越輕薄短小的內部空間而言，整合難度相當高。

本案創作人發現近場通訊(NFC)及無線充電傳輸(WLC)二種技術都是近距離感應傳輸訊號，因此都需使用到線圈感應模組，且該二種感應模組並不會同時使用，因此設計了一種整合近場通訊(NFC)與無線充電(WLC)共用

的感應模組，可接收來自近場通訊(NFC)與無線充電(WLC)的訊號，再藉由一組切換電路進行訊號的自動切換，達到能共用感應模組的目的。

【新型內容】

本創作之目的係在於提供一種近場通訊與無線充電共用的感應模組，將近場通訊(NFC)與無線充電(WLC)二種不同頻率信號的感應模組整合於一體，以縮小感應線圈在可攜式電子設備中所佔據的面積，以便達成將二種功能整合於同一可攜式電子設備的目的。

本創作之主要技術特徵係在於提供一種近場通訊與無線充電共用的感應模組，至少包括：一呈平板狀第一感應板；一纏繞成中心鏤空平面狀的第一線圈及一第二線圈，皆設置於該第一感應板上，該第二線圈容置於該第一線圈的中心鏤空內，且與該第一線圈呈同心狀。

【實施方式】

請參閱以下有關本創作之詳細說明與附圖，然而所附圖式僅為本創作實施例之參考與說明，並非用來對本創作加以限制者。

請參閱圖二所示，係為本創作近場通訊與無線充電共用的感應模組的第一實施例示意圖，而圖三係為圖二之立體分解示意圖，本創作的共用感應模組30至少包括有一第一感應板31、一第一線圈32及一第二線圈33，其中該

第一感應板 31 呈平板狀，可為方向、矩形、圓形或橢圓形等。

其中該第一線圈 32 纏繞成中心鏤空的平面狀，設置於該第一感應板 31 上，具有二出線端 321，而該第一線圈 33 同樣亦纏繞成中心鏤空的平面狀，設置於該第一感應板 31 上，且容置於該第一線圈 32 的中心鏤空內，與該第一線圈 32 呈同心狀，具二出線端 331，該第一線圈 32 與第二線圈 33 之間形成有一間隙存在。

如圖二所示之實施例，其中該第一線圈 32 為一近場通訊(NFC)感應線圈，而該第二線圈 33 為一無線充電(WLC)感應線圈，而如圖四所示係為本創作第二實施例示意圖，其中該第一線圈 32 則為該無線充電(WLC)感應線圈，而第二線圈 33 則為該近場通訊(NFC)感應線圈。

該第一線圈 32 及第二線圈 33 是二組不同頻率信號的感應線圈，近場通訊感應線圈頻率較高，因此線圈較短，而無線充電感應線圈的頻率較低，因此線圈較長，該二組感應線圈可藉由一自動選擇電路判斷感應線圈的感應接收頻率，而自動選擇電連接其中一組感應線圈，由於該選擇電路非本創作主張的重點，因此不再贅述。

請再參閱圖三所示，該共用感應模組 30 更包括有一不導電黏著層 35，設置於該第一感應板 31 與該第一、第二線圈 32、33 之間，用以將該第一、第二線圈 32、33 黏著於該第一感應板 31 上，較佳地該不導電黏著層 35 係可以為一雙面膠帶或黏著劑。

該共用感應模組 30 更包括有一第二感應板 34，設置於該第一感應板 31 上，且容置於第二線圈 32 的中心鏤空內，該不導電黏著層 35，同樣設置於該第一感應板 31 與第二感應板 34 之間，用以將該第二感應板 34 黏著於該第一感應板 31 上。較佳地該第一感應板 31 可與該第二感應板 34 一體成形製成凸字狀(圖中未示)，而其凸起部容置於該第二線圈的中心鏤空內。

請參閱圖五所示，係為本創作第三實施例示意圖，其中該第一線圈 32 與第二線圈 33 之間相互緊靠，而沒有間隙存在。

請再參閱圖二之第一實施例，該共用感應模組 30 之第一感應板 31 的外緣處分別設有二組引出線連接器 36，每個該引出線連接器 36 上各設有二個金屬連接端子 361，可以分別電連接該第一線圈之二出線端 321 及該第二線圈之二出線端 331。

再參閱圖四之第二實施例，該共用感應模組 30 的第一感應板 31 的外緣處僅設有一組的引出線連接器 36，其上設有複數個金屬連接端子 361，可以分別連接該第一線圈及/或第二線圈 32、33 的出線端。亦或者該引出線連接器 36 可以為金屬接觸片 37，例如可以將該第二線圈 33 之二出線端 331，各分別電連接該金屬接觸片 37。

請參閱圖五之第三實施例，其中該引出線連接器 36 係為設置在該第一感應板 31 之外的連接器，而該金屬連接端子 361 其中有二個金屬連接端子是電氣連接的一共

用端。亦或者該第一線圈32的其中之一出線端與第二線圈33的其中之一出線端，相互電氣連接成一共用出線端，再電連接至該引出線連接器36上的其中之一金屬連接端子361。

請參閱圖六所示，係為本創作之第四實施例示意圖，在本實施例中該第一線圈32與該第二線圈33係由同一組線圈38纏繞而成，包括有一第一出線端381、一第二出線端382及一中間抽頭出線端383，其中該第一出線端381與該第二出線端382形成該無線充電(WLC)感應線圈，而該第中間抽頭出線端383與該第二出線端382形成該近場通訊(NFC)感應線圈。

職是，本創作確能藉上述所揭露之技術，提供一種迥然不同於習知者的設計，堪能提高整體之使用價值，又其申請前未見於刊物或公開使用，誠已符合新型專利之要件，爰依法提出新型專利申請。

【圖式簡單說明】

圖一係為一無線充電傳輸的架構示意圖；

圖二係為本創作近場通訊與無線充電共用的感應模組；

圖三係為圖二之立體分解示意圖；

圖四係為本創作之第二實施例示意圖；及

圖五係為本創作第三實施例示意圖。

圖六係為本創作之第四實施例示意圖。

【主要元件符號說明】

10	電力傳送模組
11	傳送端線圈
12	傳送端鐵心板
20	電力接收模組
21	接收端線圈
22	接收端鐵心板
30	感應模組
31	感應板
32	第一線圈
321	出線端
33	第二線圈
331	出線端
34	第二感應板
35	不導電黏著層
36	引出線連接器
361	金屬連接端子
37	金屬接觸片
38	線圈
381	第一出線端
382	第二出線端
383	中間抽頭出線端

六、申請專利範圍：

1. 一種近場通訊與無線充電共用的感應模組，至少包括：
一第一感應板，呈平板狀；
一第一線圈，纏繞成中心鏤空的平面狀，具有二出線端，設置於該第一感應板上；及
一第二線圈，纏繞成中心鏤空的平面狀，具有二出線端，設置於該第一感應板上，且容置於該第一線圈的中心鏤空內，與該第一線圈呈同心狀。

2. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中更包括一第二感應板，設置於該第一感應板上，且容置於第二線圈的中心鏤空內。

3. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中更包括一不導電黏著層，設置於該第一感應板與該第一、第二線圈之間，用以將該第一、第二線圈黏著於該第一感應板上。

4. 如申請專利範圍第2項所述之近場通訊與無線充電共用的感應模組，其中更包括一不導電黏著層，設置於該第一感應板與第二感應板之間，用以將該第二感應板黏著於該第一感應板上。

5. 如申請專利範圍第3或4項所述之近場通訊與無線充電共用的感應模組，其中該不導電黏著層係為一雙面膠帶或黏著劑。

100年12月29日修正替換頁

6. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一感應板為一體成形的凸字狀，其凸起部容置於該第二線圈的中心鏤空內。

7. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一與第二線圈之間形成有一間隙存在。

8. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一與第二線圈之間相互緊靠而沒有間隙存在。

9. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中更包括至少一引出線連接器，其上設有複數金屬連接端子，分別電連接該第一線圈及/或第二線圈的出線端。

10. 如申請專利範圍第9項所述之近場通訊與無線充電共用的感應模組，其中該引出線連接器之金屬連接端子中，其中有二個金屬連接端子是一共用端。

11. 如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一線圈的其中之一出線端與第二線圈的其中之一出線端相互電氣連接成一共用出線端。

12. 如申請專利範圍第9項所述之近場通訊與無線充電共用的感應模組，其中該引出線連接器係連接於該第一感應板之外緣處。

13.如申請專利範圍第9項所述之近場通訊與無線充電共用的感應模組，其中該引出線連接器係為設置在該第一感應板之外的連接器。

14.如申請專利範圍第9項所述之近場通訊與無線充電共用的感應模組，其中該引出線連接器共有二個，分別配設於該第一感應板的外緣處，每個引出線連器上各設有二個金屬連接端子，分別電連接該第一線圈之二出線端及該第二線圈之二出線端。

15.如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一線圈為近場通訊(NFC)感應線圈，而該第二線圈為無線充電(WLC)感應線圈。

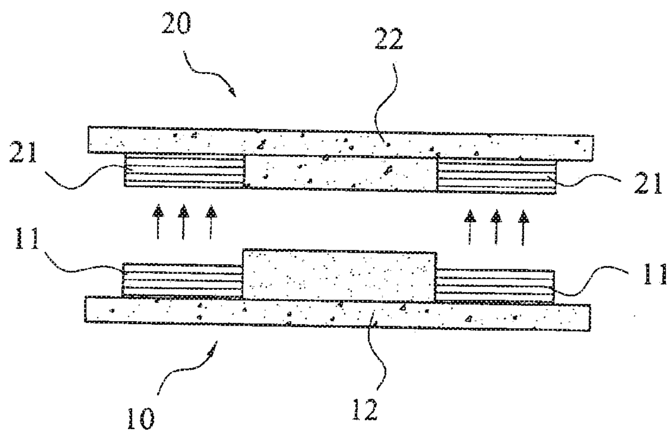
16.如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第一線圈為無線充電(WLC)感應線圈，而該第二線圈為近場通訊(NFC)感應線圈。

17.如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中該第二線圈之第三及第四出線端，各分別電連接一金屬接觸片。

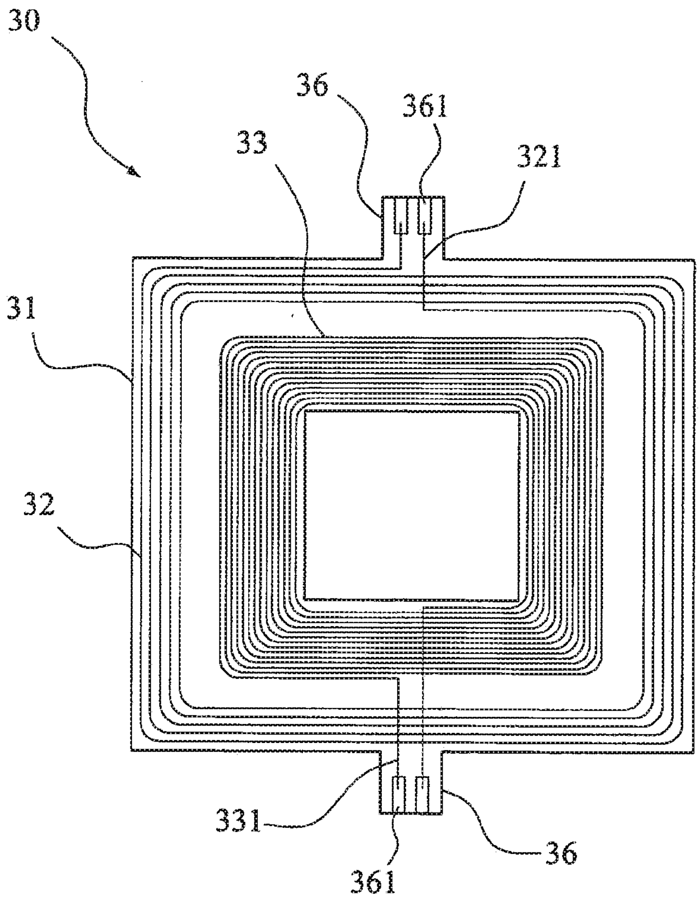
18.如申請專利範圍第1項所述之近場通訊與無線充電共用的感應模組，其中第一線圈與該第二線圈係由一組線圈纏繞而成，包含一第一出線端、一第二出線端及一中間抽頭出線端。

100. 12. 29 年 月 日 修正補充

七、圖式：



圖一



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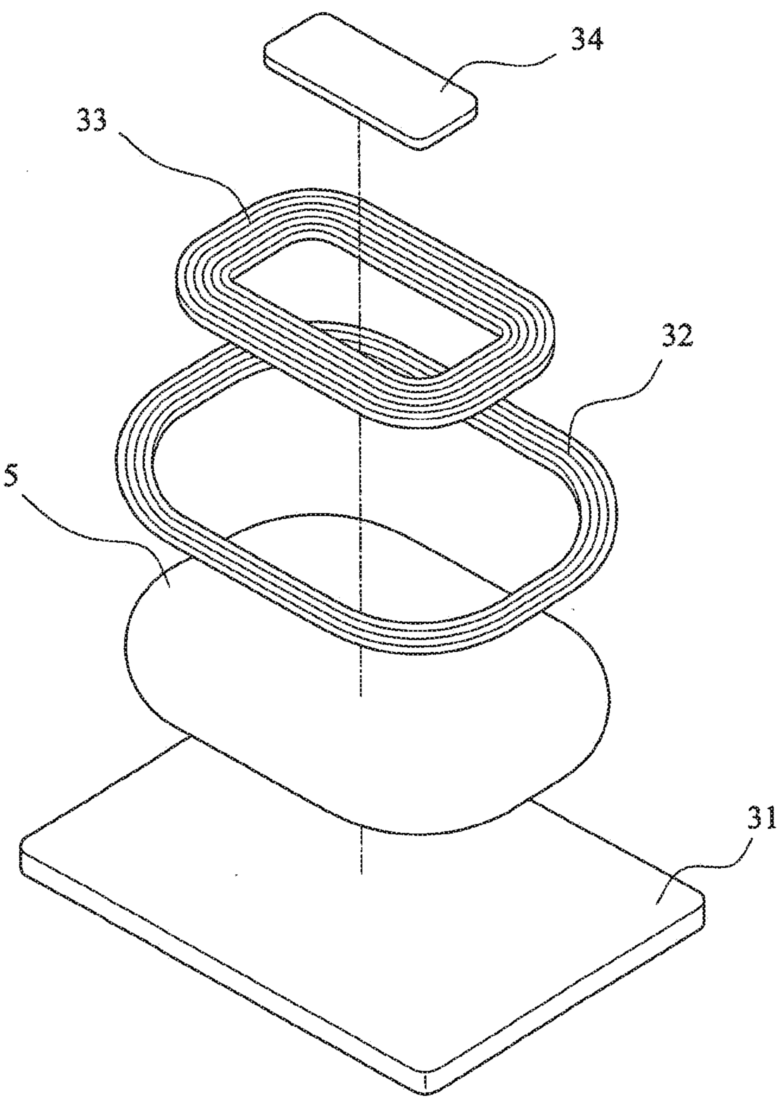

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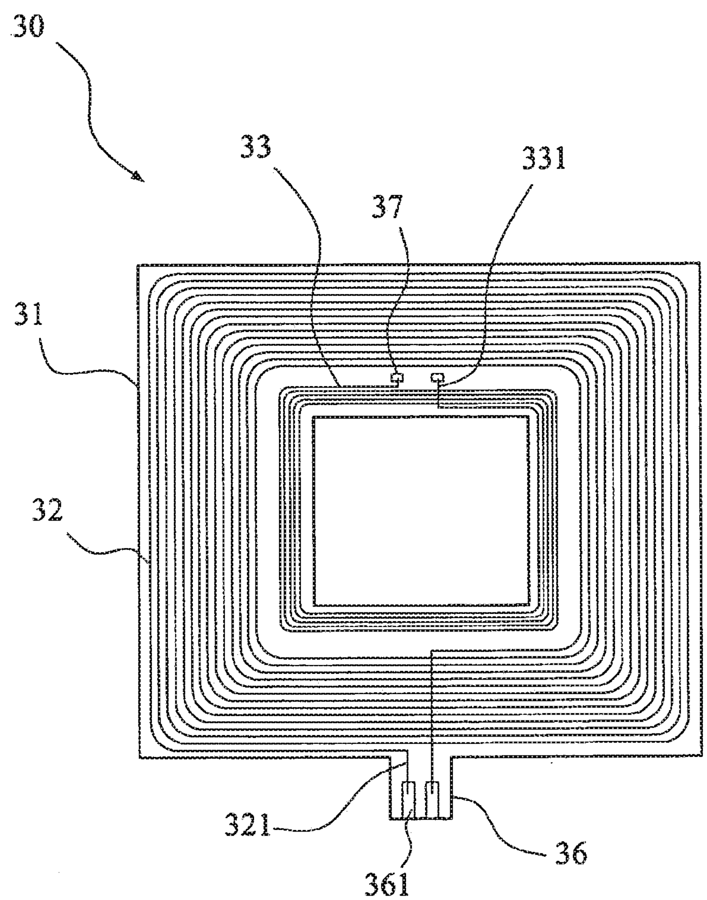
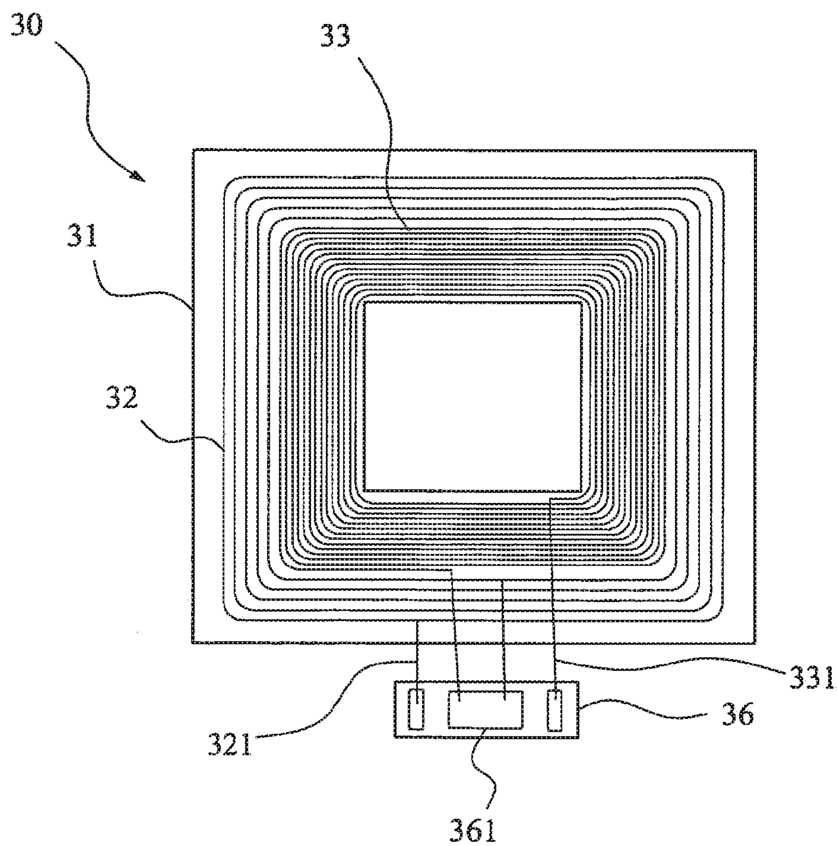
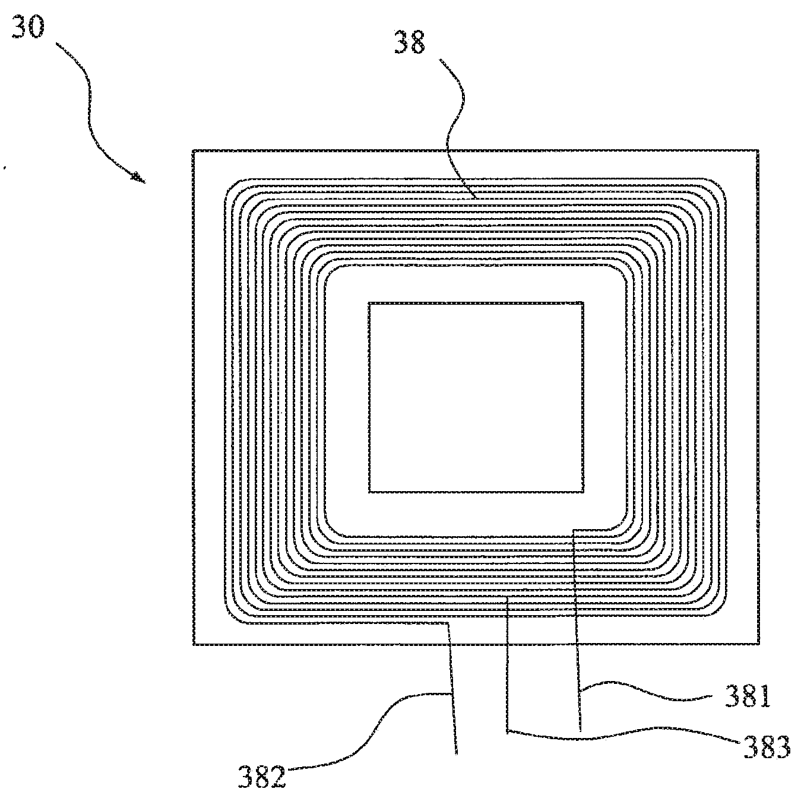


圖四



圖五



圖六

Espacenet

Bibliographic data: WO2012008693 (A2) — 2012-01-19

CORE ASSEMBLY FOR WIRELESS POWER COMMUNICATION AND POWER SUPPLY DEVICE FOR WIRELESS POWER COMMUNICATION INCLUDING SAME, AND METHOD FOR MANUFACTURING A CORE ASSEMBLY FOR WIRELESS POWER COMMUNICATION

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Classification:	**- international:*H01F27/26; H01F41/02; H02J17/00*** **- cooperative: H01F17/0006; H01F27/2871; H01F27/365; H01F38/14; H01F41/0246; H02J17/00; H02J5/005; H04B5/0037; H04B5/0075; H04B5/0087**
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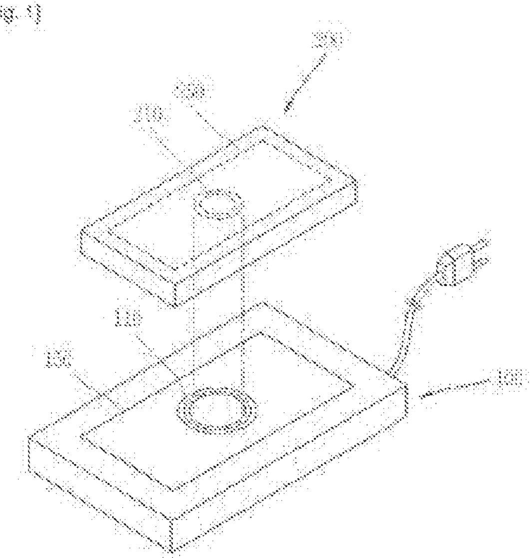
Also published as:	WO2012008693 (A3) EP2595160 (A2) US2013106198 (A1) KR20120008200 (A) KR101134625 (B1) JP2013535815 (A) CN102906828 (A) CN102906828 (B) less

Abstract of WO2012008693 (A2)

The present invention relates to a core assembly for wireless power communication and to a power supply device for wireless power communication including same, and to a method for manufacturing a core assembly for wireless power communication. The core assembly for wireless power communication includes a recess at a cylindrical surface, a plate-shaped core made of a magnetic substance, a plurality of wound coils received in the recess and disposed such that one portion of each overlaps another, and a circuit substrate connected to both ends of the coil to apply power to the coil.

[Fig. 1]



(12) 특허협력조약에 의하여 공개된 국제출원

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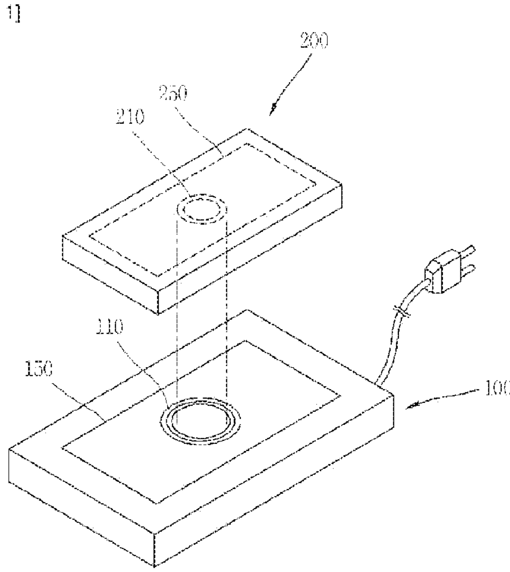
공개:

— 국제조사보고서 없이 공개하며 보고서 접수 후 이를 별도 공개함 (규칙 48.2(g))

(54) **Title**: CORE ASSEMBLY FOR WIRELESS POWER COMMUNICATION AND POWER SUPPLY DEVICE FOR WIRELESS POWER COMMUNICATION INCLUDING SAME, AND METHOD FOR MANUFACTURING A CORE ASSEMBLY FOR WIRELESS POWER COMMUNICATION

(54) **발명의 명칭** : 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법

[Fig. 1]



(57) **Abstract**: The present invention relates to a core assembly for wireless power communication and to a power supply device for wireless power communication including same, and to a method for manufacturing a core assembly for wireless power communication. The core assembly for wireless power communication includes a recess at a cylindrical surface, a plate-shaped core made of a magnetic substance, a plurality of wound coils received in the recess and disposed such that one portion of each overlaps another, and a circuit substrate connected to both ends of the coil to apply power to the coil.

(57) **요약서**: 본 발명은, 주면에 오목부가 구비되고, 자성체로 형성되는, 판상형의 코어와, 상기 오목부에 수용되며, 각각의 일 부분들이 서로 중첩되도록 배치되는, 복수의 권선형 코일과, 상기 코일 각각의 양단과 접속되어, 상기 코일에 대한 전원의 인가를 제어하는, 회로기판을 포함하는, 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법을 제공한다.

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명세서

발명의 명칭: 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법

기술분야

[1] 본 발명은 무선 전력 통신 시스템에 사용되는 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법에 관한 것이다.

[2]

배경기술

[3] 일반적으로, 이동통신단말기, PDA(Personal Digital Assistants) 등과 같은 휴대용 전자기기에는 재충전 가능한 2차 전지(Secondary Battery)가 배터리로서 장착된다. 배터리를 충전하기 위해서는, 가정용 상용 전원을 이용하여 휴대용 전자기기의 배터리에 전기 에너지를 제공하는 별도의 충전장치가 필요하다.

[4] 통상적으로, 충전장치와 배터리에는 외부에 각각 별도의 접촉 단자가 구성되어 있어서, 두 접촉 단자를 서로 접속시키는 것에 의해 충전장치와 배터리를 전기적으로 연결한다. 그러나, 이와 같이 접촉 단자가 외부에 돌출되면, 미관상 좋지 않고 접촉 단자가 외부의 이물질에 오염되어 접촉 상태가 쉽게 불량해지기도 한다. 또한, 사용자의 부주의로 배터리에 단락이 발생하거나 습기에 노출되면, 충전에너지가 쉽게 소실될 수 있다.

[5] 이러한 접촉식 충전방식의 대안으로서, 충전장치와 배터리 각각의 접촉 단자들이 서로 접촉되지 않는 방식으로 배터리가 충전되는 비접촉식(무선) 충전 시스템이 제안되고 있다.

[6]

발명의 상세한 설명

기술적 과제

[7] 본 발명의 목적은, 전력 수신 장치와의 무선 전력 전송에 장애가 될 수 있는 다크 영역(Dark area)을 효과적으로 줄일 수 있도록 코일을 배치하고, 상기 코일의 배치를 안정적으로 유지할 수 있게 하는, 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법을 제공하는 것이다.

[8]

과제 해결 수단

[9] 상기한 과제를 실현하기 위한 본 발명의 일 실시예에 따른 무선 전력 통신용 코어 어셈블리는, 주면에 오목부가 구비되고, 자성체로 형성되는, 판상형의

코어와, 상기 오목부에 수용되며, 각각의 일 부분들이 서로 중첩되도록 배치되는, 복수의 권선형 코일과, 상기 코일 각각의 양단과 접속되어, 상기 코일에 대한 전원의 인가를 제어하는, 회로기판을 포함한다.

[10] 여기서, 상기 오목부는, 제1 깊이로 형성되는 제1 오목부와, 상기 제1 오목부에 연통되도록 형성되며, 상기 제1 깊이보다 작은 제2 깊이를 가지는, 제2 오목부를 포함할 수 있다.

[11] 여기서, 상기 오목부는 폐곡선형의 윤곽을 가지도록 형성되고, 상기 제1 오목부 및 상기 제2 오목부는, 상기 오목부의 폐곡선에 내접하는 2 개의 작은 폐곡선들의 일 부분들이 서로 중첩된 형태로 리세스되어 형성될 수 있다.

[12] 여기서, 상기 작은 폐곡선들의 일 부분들이 서로 중첩된 부분은 상기 제1 깊이로 리세스될 수 있다.

[13] 여기서, 상기 폐곡선은 타원형일 수 있다.

[14] 여기서, 상기 오목부는 바닥과 측벽을 포함하고, 상기 오목부는, 상기 복수의 중첩된 코일이 전체적으로 형성하는 외주가 상기 측벽과 접촉되게 하는 사이즈로 각각 리세스될 수 있다.

[15] 여기서, 상기 코일은 각각, 타원형으로 권선될 수 있다.

[16] 여기서, 상기 복수의 코일은 서로 동일한 사이즈를 가지도록 권선될 수 있다.

[17] 여기서, 상기 코일은, 상기 코어에서 돌출되는 적어도 하나의 서포트를 포함하고, 상기 서포트는 상기 코일의 중공부에 삽입되도록 형성될 수 있다.

[18] 여기서, 상기 서포트의 단면의 적어도 일 구간은, 상기 코일의 중공부의 내주면 중 일 부분과 접하도록, 곡선형으로 형성될 수 있다.

[19] 여기서, 상기 코어는, 상기 코일 각각의 양단이 관통되도록 형성되는, 복수의 제1 관통홀을 구비하고, 상기 회로기판은, 상기 제1 관통홀에 대응하여 형성되는, 복수의 제2 관통홀을 구비할 수 있다.

[20] 여기서, 상기 복수의 제1 관통홀은, 상기 코어의 중심을 기준으로 대칭되는 적어도 한 쌍의 관통홀을 포함할 수 있다.

[21] 여기서, 상기 코일 각각의 양단이 접속되도록, 상기 회로기판의 상기 코어를 마주하는 면의 반대면에 상기 양단의 개수에 대응하여 형성되는, 복수의 접속부를 포함할 수 있다.

[22] 여기서, 상기 오목부의 저면에 상기 코일의 권선 방향을 따라 형성되어, 상기 코일의 상기 저면과 접촉하는 부분이 수납되는, 그루브를 더 포함할 수 있다.

[23] 본 발명의 다른 실시예에 따른 무선 전력 통신용 전력 공급 장치는, 위에 설명되며 충전전력 공급회로가 형성되는, 무선 전력 통신용 코어 어셈블리와, 상기 코어 어셈블리를 감싸도록 형성되는, 하우징을 포함한다.

[24] 본 발명의 또 다른 실시예에 따른 무선 전력 통신용 코어 어셈블리 제조 방법은, 자성체인 파우더에 바인더를 첨가하여 혼합물을 형성하는 단계와, 상기 혼합물을 금형에 넣고 프레싱하여, 일 면에 오목부가 형성되는 코어로 성형하는 단계와, 상기 성형된 코어를 소결하는 단계와, 상기 소결된 코어의 오목부에

권선된 복수의 코일의 일 부분들이 서로 중첩되도록 배치하는 단계와, 상기 코일 각각의 양단부를 회로기판에 접속시키는 단계를 포함할 수 있다.

[25] 여기서, 상기 파우더는 망간-아연을 포함할 수 있다.

[26] 여기서, 상기 성형된 코어를 소결하는 단계는, 소결 온도를 60 ℃ 내지 80 ℃로 유지하는 단계를 포함할 수 있다.

[27]

발명의 효과

[28] 상기와 같이 구성되는 본 발명에 관련된 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법에 의하면, 전력 수신 장치와의 무선 전력 전송에 장애가 될 수 있는 다크 영역(Dark area)을 효과적으로 줄일 수 있도록 코일을 배치하고, 상기 코일의 배치를 안정적으로 유지할 수 있게 된다.

[29]

도면의 간단한 설명

[30] 도 1은 본 발명과 관련된 무선 전력 통신 시스템의 개략적인 사시도이며,

[31] 도 2는 도 1의 무선 전력 통신시스템의 내부 기능 블록도이고,

[32] 도 3은 본 발명의 일 실시예에 따른 무선 전력 통신용 코어 어셈블리를 전면에서 바라본 조립 사시도이며,

[33] 도 4는 도 3의 어셈블리를 배면에서 바라본 조립 사시도이고,

[34] 도 5는 도 3의 어셈블리의 분해 사시도이며,

[35] 도 6은 도 3의 코어(120)의 일 변형예에 따른 코어(120')를 보인 사시도이고,

[36] 도 7은 도 6의 코어(120')에 코일(111)이 안착된 상태를 보인 부분 개념도이며,

[37] 도 8은 본 발명의 다른 실시예에 따른 무선 전력 통신용 코어 어셈블리 제조 방법을 보인 순서도이다.

[38]

발명의 실시를 위한 최선의 형태

[39] 이하, 본 발명의 바람직한 실시예에 따른 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법에 대하여 첨부한 도면을 참조하여 상세히 설명한다. 본 명세서에서는 서로 다른 실시예라도 동일·유사한 구성에 대해서는 동일·유사한 참조번호를 부여하고, 그 설명은 처음 설명으로 갈음한다.

[40] 도 1은 본 발명과 관련된 무선 전력 통신 시스템의 개략적인 사시도이다.

[41] 도면에 도시된 바와 같이, 상기 무선 전력 통신 시스템은, 전력 공급 장치(100)와, 배터리를 충전시키기 위해 전력 공급 장치(100)로부터 무접점으로 전력을 공급받는 전력 수신 장치(200)를 포함한다.

[42] 전력 공급 장치(100)는 외부 전원으로부터 전기에너지를 공급받아 전력 수신 장치(200)에 공급할 충전 전력을 생성하는 장치이다. 전력 공급 장치(100)는 전력

수신 장치(200)가 쉽게 안착 될 수 있도록 패드 형태로 형성될 수 있다. 전력 공급 장치(100)에 공급되는 외부 전원으로서는 상용 교류 전원(60Hz, 220V/100V), 또는 직류 전원이 채용될 수 있다.

[43] 전력 수신 장치(200)는, 배터리가 내장된 배터리팩이나, 배터리를 내장하고 있는 휴대용 전자기기를 포함한다. 또한, 전력 수신 장치(200)는 배터리와 접속되는 휴대용 전자기기의 일 부분이거나, 휴대용 전자기기와 별도로 배터리와 접속되는 부재일 수 있다. 휴대용 전자기기로서는, 셀룰러폰, PDA, MP3 플레이어 등을 들 수 있다. 배터리는 재충전 가능한 전지 셀로서 리튬 이온 전지나 리튬 폴리머 전지 등을 포함할 수 있다.

[44] 전력 공급 장치(100)와 전력 수신 장치(200)는 서로 대응되는 1차 코일(110) 및 2차 코일(210)을 구비할 수 있다. 1, 2차 코일(110, 210)은 유도 결합에 의해 자기적으로 상호 커플링 된다. 따라서, 2차 코일(210)이 1차 코일(110) 위에 병렬됨(juxtaposed)에 따라, 1차 코일(110)에 의해 생성되는 자기장이 2차 코일(210) 내에 유도 전류를 유기하게 된다.

[45] 전력 공급 장치(100)는 1차 코일(110)을 구동하여 자기장을 생성하기 위한 충전전력 공급회로(150)(도 2 참조)를 내장한다. 전력 수신 장치(200)는 2차 코일(210)에 의해 유기되는 유도 기전력을 이용하여 배터리를 충전시키는 충전 회로(250, 도 2 참조)를 내장한다.

[46] 이하에서, 도 2를 참조하여, 충전전력 공급회로(150)와 충전 회로(250)의 상세 구성을 살펴보기로 한다. 도 2는 도 1의 무선 전력 통신시스템의 내부 기능 블록도이다.

[47] 본 도면을 참조하면, 전력 공급 장치(100) 내에 내장되는 충전전력 공급회로(150)는, 1차 코일(110), 정류기(152), 구동회로(153), 제어기(155), 무선수신모듈(156)을 포함할 수 있다.

[48] 정류기(152)는 상용 교류 전원(151)으로부터의 교류 전압을 직류로 정류한 후, 구동 회로(153)에 전달한다. 구동 회로(153)는 정류기(152)에 의해 정류된 직류 전압을 이용하여 상용 주파수 이상의 고주파 교류 전압 펄스를 생성하고, 이를 1차 코일(110)에 인가하여 자계(Magnetic Field)를 생성한다.

[49] 구동 회로(153)는 전력 구동부(154a)와 PWM(Pulse Width Modulation, 펄스 폭 변조) 신호 발생기(154b)를 포함할 수 있다. 전력 구동부(154a)는, 소정 레벨의 직류 전압을 컨버팅하여 상용 주파수 이상의 고주파 교류 전압을 발진하는 고주파 발진회로와, 펄스폭 변조된 고주파 교류 전압 펄스를 1차 코일(110)에 인가하는 것에 의해 1차 코일(110)을 구동하는 드라이브 회로를 포함할 수 있다. 상기 PWM 신호 발생기(154b)는 상기 고주파 교류 전압을 펄스폭 변조(PWM : pulse width modulation)시킨다. 이에 의해, 전력 구동부(153)의 출력단을 통해 배출되는 출력 신호는 고주파 교류 전압 펄스가 된다. 이 고주파 교류 전압 펄스는 펄스 열(pulse train)이 되고, 이 펄스 열의 펄스폭은 제어기(155)에 의해 조절될 수 있다. 이상의 구동 회로(153)로는, 예를 들어 스위칭 모드 파워

서프라이(SMPS: switching mode power supply)가 채택될 수 있다.

[50] 제어기(155)는 무선 송,수신모듈(156, 256)을 경유하여 피드백되는 배터리의 충전상태정보에 근거하여 상기 펄스폭 변조되는 고주파 교류 전압 펄스의 펄스폭을 조절한다. 예를 들어, 제어기(155)는 충전 회로(250)로부터 피드백되는 응답신호가 충전시작신호인 경우, 1차 코일(110)의 구동 모드를 대기 모드에서 충전 모드로 전환한다. 또한, 충전 회로(250)로부터 피드백 되는 충전상태정보를 분석한 결과, 배터리가 만충전인 것으로 판단되면, 1차 코일(110)의 구동 모드를 충전 모드에서 완충 모드로 전환한다. 제어기(155)는 충전 회로(250)로부터 피드백되는 응답 신호가 없는 경우, 1차 코일(110)의 구동 모드를 대기 모드로 유지한다.

[51] 무선수신모듈(156)은 코일(110)이 충전 회로(250)의 무선송신모듈(256)로부터 전송되는 피드백 응답 신호를 수신함에 따라, 이 피드백 응답 신호를 복조하여 배터리(262)의 충전상태정보를 복원하는 복조기와 같은 수신부(156)를 포함한다. 무선수신 모듈(156)은 코일(110)과 별도로 충전 회로(250)의 무선송신모듈(256)로부터 전송되는 피드백 응답 신호를 수신하는 안테나를 포함할 수도 있다.

[52] 이상의 충전전력 공급회로(150)는 회로를 과전압으로부터 보호하기 위한 과전압 필터회로나 정류기에 의해 정류된 직류 전압을 소정 레벨의 전압으로 유지시키기 위한 정전압 회로를 더 포함할 수 있다. 상기 과전압 필터회로는 상용 교류 전원(151)과 정류기(152) 사이에 배치되고, 상기 정전압 회로는 정류기(152)와 구동 회로(153) 사이에 배치될 수 있다.

[53] 다음으로, 충전전력 공급회로(150)로부터 전력을 공급받아 배터리(262)를 충전하는 충전 회로(250)에 대해서 살펴본다. 이 충전 회로(250)는 전력 수신 장치(200)에 내장된다.

[54] 충전 회로(250)는, 2차 코일(210), 정류기(251), 정전압/정전류 회로(252), 폴링 검출기(253), 제어기(255), 무선송신모듈(256)을 포함할 수 있다.

[55] 2차 코일(210)은 1차 코일(110)에 자기적으로 결합되어 유도 기전력을 발생시킨다. 상술한 바와 같이, 1차 코일(110)에 인가되는 전력 신호가 펄스 폭 변조신호이기 때문에 2차 코일(210)에 유기되는 유기 기전력 역시 교류 전압 펄스열이다. 또한, 1차 코일(110)의 구동 모드에 따라 2차 코일(210)에 유기되는 교류 전압 펄스 역시 대기 모드, 충전 모드 및 완충 모드 중 어느 하나의 형태를 따르게 된다.

[56] 정류기(251)는 2차 코일(210)의 출력단에 연결되어 2차 코일(210)에 의해 유도된 교류 전압 펄스를 일정한 레벨의 직류로 평탄화한다. 정전압/정전류 회로(252)는 소정 레벨의 직류 전압을 이용하여 배터리(262)에 충전할 정전압과 정전류를 생성한다. 구체적으로, 배터리(262)의 초기 충전시점에서 정전류 모드를 유지하다가 배터리(262)의 충전전압이 포화상태가 되면, 정전압 모드로 전환한다.

[57] 폴링 검출기(253)는 2차 코일(210)에 의해 유도된 교류 전압 펄스의 하강 시점, 다시 말해서 폴링 시점(falling time)을 검출하는 장치이다. 폴링 검출 신호는 제어기(255)로 입력된다.

[58] 제어기(255)는 일종의 마이크로 프로세서로서 폴링 검출 신호, 충전 전류, 충전 전압 등과 같은 모니터링 신호를 입력받고, 이 모니터링 신호에 근거하여 정전압/정전류 회로(252)와 무선송신모듈(256)을 제어한다. 예를 들어, 제어기(255)는, 폴링 검출기(253)로부터 입력되는 폴링 검출 신호에 근거하여 펄스의 하강 시점을 파악하고, 충전전력 공급회로(150)에 전송할 피드백 응답 신호의 전송 시점을 펄스의 하강 시점에 동기화시킨다. 제어기(255)는 배터리(262)의 충전 전류와 충전 전압을 모니터링하고, 이 모니터링 값을 내부 메모리(미도시)에 임시 저장한다. 미도시된 상기 메모리는 모니터링된 충전 전류와 충전 전압과 같은 배터리(262) 충전상태 정보뿐만 아니라 배터리(262) 사양정보(제품 코드, 정격 등)도 함께 저장할 수 있다.

[59] 또한, 제어기(255)는 배터리(262)의 충전 상태에 따라 정전압 모드와 정전류 모드를 적절히 선택, 전환한다. 제어기(255)는, 정전압/정전류 회로(252)의 양단에 과도한 전압이 인가되는지 모니터링하며, 과도한 전압이 인가되면 충전전력의 조정요구 신호를 생성한다. 이 조정요구 신호는 무선송신모듈(256)을 거쳐 전력 공급 장치(100) 측의 충전전력 공급회로(150)로 피드백된다.

[60] 정전압/정전류 회로(252)의 양단 전압에 대한 모니터링 동작은, 정전압/정전류 회로(252)의 전단 전압과 후단 전압을 측정하여 그 차이가 기준 값을 초과하는지 여부를 검사하는 것에 의해 이루어진다. 무선송신모듈(256)은, 코일(210)이 충전전력 공급회로(150)에 전송할 피드백 응답 신호(충전시작신호, 충전상태신호, 조정요구 신호)를 송신하면, 충전상태정보와 같은 베이스밴드 신호를 변조하여 피드백 응답 신호를 생성하는 송신부(256)를 포함한다. 무선수신 모듈(256)은 코일(210)과 별도로 충전전력 공급회로(150)에 전송할 피드백 응답 신호를 송신하 안테나를 포함할 수도 있다.

[61] 정전압/정전류 회로(252)와 배터리(262) 사이에는 배터리(262)에 과전압이나 과전류의 인가를 방지하기 위한 보호 회로(PCM, Protective Circuit Module)(261)가 배치된다. 이 보호 회로(261)와 배터리(262)는 하나의 배터리 유닛(260)을 구성할 수 있다.

[62] 이하에서는, 전력 공급 장치(100)에 대하여 보다 상세하게 살펴본다.

[63] 도 3은 본 발명의 일 실시예에 따른 무선 전력 통신용 코어 어셈블리를 전면에서 바라본 조립 사시도이다.

[64] 본 발명의 일 실시예에 따른 전력 공급 장치(100)는, 본 도면 등을 참조하여 설명할 코어 어셈블리와, 상기 코어 어셈블리를 감싸서 외관을 형성하는 하우징(도 1 참조)을 포함한다.

[65] 상기 코어 어셈블리는, 복수의 코일(110)과, 판상형의 코어(12O)와,

회로기판(130)을 포함할 수 있다.

[66] 코일(110)은 2개의 자유단을 가지는 권선형으로 형성된다. 코일(110)은 또한, 복수 개로 구비된다. 복수의 코일 중에 인접한 코일(110)은 서로 간에 일 부분들이 중첩되도록 배치된다. 본 실시예에서는 2 개의 코일(110)이 일부 중첩되게 배치된 형태를 예시하고 있다.

[67] 코어(12O)는 판상형으로 형성될 수 있다. 본 실시예에서, 코어(12O)는 대체로 직육면체를 이루는 것으로 예시되어 있다. 코어(12O)의 넓은 면, 다시 말해서 주면(柱面)에는 코일(110)을 수용하기 위한 오목한 부분(122,123)가 형성된다. 코어(12O)는 자성체로 형성되어, 수용된 코일(110)에 흐르는 전류에 의한 자계가 전력 수신 장치(200, 도 1)를 향한 방향에서 벗어날 가능성을 낮추어 준다.

[68] 회로기판(130)은 코어(12O)의 하측에 위치하게 된다. 회로기판(130)의 일 부분은 코어(12O)를 밑에서 지지하게 된다. 회로기판(130)의 다른 부분에는 코일(110)에 대한 전원의 인가를 제어하는 회로가 내장된다. 상기 제어 회로는, 앞서 설명한 충전전력 제어회로(150, 도 2)를 포함한다.

[69] 도 4는 도 3의 어셈블리를 배면에서 바라본 조립 사시도이다.

[70] 본 도면을 참조하면, 코일(110) 각각의 양단은 코어(12O)와 회로기판(130)을 관통하여 연장하게 된다. 구체적으로, 코일(110)의 양단은 회로기판(130)의 저면{코어(12O)와 마주하는 면의 반대면}에 형성되는 관통홀(137)을 관통한다. 여기서, 그 자유단은 관통홀(137)에 인접하게, 본 도면상으로는 관통홀(137)을 감싸도록 형성되는 접속부(138)에 접속된다.

[71] 접속부(138)는 회로기판(130)의 일 부분(130b)에서 다른 부분(130a)을 향해 연장하는 도선 패턴(139)에 연결된다. 그에 의해, 다른 부분(130a)에 형성되는 충전전력 제어회로(150, 도 2)는 코일(110)과 연결되어 코일(110)을 제어하게 된다.

[72] 이때, 인접한 두 개의 관통홀(137)은 회로기판(130)의 중심선을 기준으로 상부 영역에 놓인다. 다른 한 쌍의 인접한 관통홀(137)은 위 중심선을 기준으로 하부 영역에 놓이게 된다. 그에 의해, 도전 패턴(139)들이 서로 다른 영역에서 구분되어 형성될 수 있다.

[73] 도 5는 도 3의 어셈블리의 분해 사시도이다.

[74] 본 도면을 참조하면, 코일(110)은 한 쌍의 코일들, 다시 말해서 제1 코일(111)과 제2 코일(112)로 구성될 수 있다. 제1 코일(111)과 제2 코일(112)에는 각각 중심 부분에 중공부(111',112')가 형성될 수 있다. 중공부(111',112')의 면적은 코일(111,112)의 권선 정도에 의해 조절될 수 있다.

[75] 제1 코일(111)과 제2 코일(112)은 대체로 동일한 사이즈를 가지도록 권선될 수 있다. 제1 코일(111)과 제2 코일(112)은 각각 하나의 평면을 이루도록 권선된다. 제1 코일(111)과 제2 코일(112)이 이루는 평면들은 서로 평행하게 배치될 수 있다(도 3 참조).

[76] 제1 코일(111)과 제2 코일(112)의 형태는, 타원형으로 형성될 수 있다. 이는 제1

코일(111)과 제2 코일(112)이 중첩되는 면적을 최대화하면서도, 중첩된 제1 코일(111)과 제2 코일(112)이 차지하는 길이 방향 사이즈 역시 최대화하기 위함이다.

[77] 코어(12O)는, 앞서 설명한 바대로, 대체로 직육면체의 형태를 가진다. 코어(12O)의 주면(121)에는 코일(110)을 수용하는 오목부(122,123)가 형성된다. 오목부(122,123)는 제1 깊이로 리세스되는(recessed) 제1 오목부(122)와, 제2 깊이로 리세스되는 제2 오목부(123)를 포함할 수 있다. 본 실시예에서, 제1 코일(111)은 제1 오목부(122)에 수용되고, 제2 코일(112)은 제2 오목부(123)에 수용된다. 이때, 제1 코일(111)이 제2 코일(112)보다 하측에 위치하므로, 상기 제1 깊이는 상기 제2 깊이보다 큰 것이 바람직하다.

[78] 다시 본 도면을 참조하면, 오목부(122,123)는 폐곡선형, 구체적으로는 타원형의 윤곽을 가지도록 리세스되어 형성된다. 오목부(122,123) 전체가 큰 타원형의 윤곽을 형성한다면, 제1 오목부(122)와 제2 오목부(123)는 각각 큰 타원 내에 내접되는 작은 타원들이 일부 겹쳐진 것과 같은 윤곽을 형성하게 된다. 작은 타원들은 각각, 앞서 설명한, 제1 깊이와 제2 깊이로 리세스된다. 작은 타원들이 중첩되는 부분은 제1 깊이로 리세스되어, 제1 오목부(122)로 정의될 수 있다.

[79] 오목부(122,123)의 사이즈는, 서로 일부가 중첩된 제1 코일(111)과 제2 코일(112)이 전체적으로 형성되는 조립체의 외주가 다소 타이트하게(tightly) 수용될 정도가 될 수 있다. 이에 의해, 제1 코일(111)과 제2 코일(112)은 오목부(122,123)에 수용되는 것만으로도, 전력 공급 장치(100) 내에서 설정된 위치에 유지될 수 있다.

[80] 오목부(122,123)는, 그 형태상으로, 측벽(125)과 바닥(126)을 가지게 된다. 측벽(125)은 오목부(122,123)가 리세스된 깊이에 대응하는 높이를 가지게 된다. 측벽(125)은 코일(110)의 두께에 대응하는 사이즈를 가져서, 코일(110)에서 발생된 자계가 측벽(125)을 향하는 방향으로 누설되는 것을 차단 또는 완화하도록 형성될 수 있다. 측벽(125)은, 앞서 설명한 바와 같이, 타이트하게 수용되는 코일(110)의 외주와 접촉하여, 코일(110)이 일정한 위치에 안착되게 하기도 한다.

[81] 오목부(122,123)의 바닥(126)에서는 서포트(127,128)가 돌출 형성될 수 있다. 서포트(127,128)는 각각 제1 코일(111)의 중공부(111')에 삽입되거나 제2 코일(112)의 중공부(112')에 삽입될 수 있는 위치에 형성된다. 그에 의해, 서포트(127,128)는 제1 코일(111)이나 제2 코일(112)가 설정된 위치에서 이탈되지 않아서, 그들 간의 배치 관계가 설정된 대로 유지될 수 있게 한다.

[82] 서포트(127,128)의 형상은 코일(110)의 중공부(111',112')의 내주면의 형상에 대응하여 형성될 수 있다. 본 실시예에서, 서포트(127,128)의 외주는 곡선형인 중공부(111',112')의 내주면에 대응하여, 곡선인 구간을 가진다. 서포트(127,128)의 곡선 구간의 반대 측은 코일(110)의 외주와의 간섭을 피하기 위한 공간 확보를 위해 직선 구간으로 처리될 수 있다. 이에 의해,

서포트(127,128)는 전체적으로 반원형의 단면을 가진 채로 연장하는 돌기가 될 수 있다.

[83] 오목부(122,123)의 바닥(126)에는 코일(111,112)의 양단이 관통하는 제1 관통홀(129)이 형성될 수 있다. 회로기판(130)에는 제1 관통홀(129)에 대응하여, 제2 관통홀(137)이 형성될 것이다. 본 도면에서는 코일(111,112)의 양단이 관통홀(129,137)을 관통하는 모습을 보이기 위해 의도적으로 과장한 길이로 표현했으나, 도 3의 조립도를 참조하면, 본 도면과 같이 길게 형성될 필요가 없음은 당업자라면 충분히 이해할 것이다.

[84] 관통홀(129)은 제1 코일(111)의 양단에 대응하는 한 쌍, 그리고 제2 코일(112)의 양단에 대응하는 한 쌍 등 모두 4 개로 형성된다. 각 쌍의 관통홀(129)은 서로 유사한 배치를 보이고 있다. 구체적으로, 코어(12O)의 중심을 기준으로, 각 다른 쌍의 관통홀(129)들 중 어느 하나들은 서로 대칭되고, 각 다른 쌍의 관통홀(129) 중 다른 하나들 또한 서로 대칭될 수 있다. 이렇게, 관통홀(129)들이 서로 대칭됨은, 제1 코일(111)과 제2 코일(112)이 서로 유사한 형태를 가지도록 형성됨에 관련될 수 있다. 그렇다면, 조립 시에 제1 코일(111)과 제2 코일(112)을 일부러 구분해서 조립해야 하는 불편을 없앨 수 있다.

[85] 도 6은도 3의 코어(120)의 일 변형예에 따른 코어(120')를 보인 사시도이고, 도 7은 도 6의 코어(120')에 코일(111)이 안착된 상태를 보인 부분 개념도이다.

[86] 도 6을 참조하면, 상기 코어(12O')에 있어서, 코일(111,112, 도 3 참조)의 권선 방향을 따라서는, 오목부(122,123)에 그루브(Groove, 120a)가 형성될 수 있다.

[87] 본 도면에서는 제1 오목부(122) 뿐만 아니라 제2 오목부(123)에도 그루브(120a)가 형성된 것을 예시하고 있다. 그러나, 반드시 모든 오목부(122,123)에 그루브(120a)가 형성되지 않을 수도 있다.

[88] 도 7을 참조하면, 그루브(120a)에는 코일(111,112)이 안착 될 수 있다. 그에 의해, 그루브(120a)는, 서포트(127,128, 도 5)와 더불어, 코일(111,112)의 정 위치 유지를 도울 수 있다.

[89] 또한, 코일(111,112)이 그루브(120a)에 안착 됨에 의해, 코일(111,112)의 동손(Copper loss)를 줄일 수 있게 된다.

[90] 도 8은본 발명의 다른 실시예에 따른 무선 전력 통신용 코어 어셈블리 제조 방법을 보인 순서도이다.

[91] 본 도면을 참조하면, 앞서 설명한 무선 전력 통신용 코어 어셈블리 제조 방법은, 코어(12O,120')의 제작을 필요로 할 수 있다.

[92] 코어(12O,120')의 제작을 위해서는, 파우더와 바인더를 섞어서 혼합물을 형성한다(S1). 이때, 파우더는 코어(12O,120')가 자성을 띠도록 할 수 있는 물질을 포함한다. 이를 위하여, 본 실시예에서, 파우더는 망간-아연 성분을 포함할 수 있다.

[93] 상기 혼합물은 코어(12O,120')의 형태를 가지도록 성형되어야 한다(S2). 이를 위하여, 상기 혼합물을 금형에 넣고서 프레싱하여 코어(12O,120')의 형태로

형성할 수 있다. 이러한 프레싱에 의해, 코어(12O,120')는 오목부(122,123)와, 서포트(127,128)와, 관통홀(129)을 가지도록 성형 될 것이다.

[94] 성형된 코어(12O,120')는 소결 과정을 거치게 된다(S3). 소결 과정에서는 망간-아연 파우더에 대하여 저온, 예를 들어 60 ℃ 내지 80 ℃의 온도를 유지하게 될 수 있다.

[95] 소결된 코어(12O,120')의 오목부(122,123)에는 코일(110)을 배치한다(S4).

[96] 코일(110)의 양단은 코어(12O,120')의 관통홀(129)과 회로기판(130)의 관통홀(137)을 거쳐서 회로기판(130)의 저면의 접속부(138)과 접속된다(S5).

[97] 상기와 같은 무선 전력 통신용 코어 어셈블리와 그를 구비하는 무선 전력 통신용 전력 공급 장치, 그리고 무선 전력 통신용 코어 어셈블리 제조 방법은, 위에서 설명된 실시예들의 구성과 작동 방식에 한정되는 것이 아니다. 상기 실시예들은 각 실시예들의 전부 또는 일부가 선택적으로 조합되어 다양한 변형이 이루어질 수 있도록 구성될 수도 있다.

청구범위

[청구항 1] 주면에 오목부가 구비되고, 자성체로 형성되는, 판상형의 코어; 상기 오목부에 수용되며, 각각의 일 부분들이 서로 중첩되도록 배치되는, 복수의 권선형 코일; 및
상기 코일 각각의 양단과 접속되어, 상기 코일에 대한 전원의 인가를 제어하는, 회로기판을 포함하는, 무선 전력 통신용 코어 어셈블리.

[청구항 2] 제1항에 있어서,
상기 오목부는,
제1 깊이로 형성되는 제1 오목부; 및
상기 제1 오목부에 연통되도록 형성되며, 상기 제1 깊이보다 작은 제2 깊이를 가지는, 제2 오목부를 포함하는, 무선 전력 통신용 코어 어셈블리.

[청구항 3] 제2항에 있어서,
상기 오목부는 폐곡선형의 윤곽을 가지도록 형성되고,
상기 제1 오목부 및 상기 제2 오목부는, 상기 오목부의 폐곡선에 내접하는 2 개의 작은 폐곡선들의 일 부분들이 서로 중첩된 형태로 각각 리세스되어 형성되는, 무선 전력 통신용 코어 어셈블리.

[청구항 4] 제3항에 있어서,
상기 작은 폐곡선들의 일 부분들이 서로 중첩된 부분은 상기 제1 깊이로 리세스되는, 무선 전력 통신용 코어 어셈블리.

[청구항 5] 제3항에 있어서,
상기 폐곡선은 타원형인, 무선 전력 통신용 코어 어셈블리.

[청구항 6] 제1항에 있어서,
상기 오목부는 바닥과 측벽을 포함하고,
상기 오목부는, 상기 복수의 중첩된 코일이 전체적으로 형성하는 외주가 상기 측벽과 접촉되게 하는 사이즈로 리세스되는, 무선 전력 통신용 코어 어셈블리.

[청구항 7] 제1항에 있어서,
상기 코일은 각각, 타원형으로 권선되는, 무선 전력 통신용 코어 어셈블리.

[청구항 8] 제7항에 있어서,
상기 복수의 코일은 서로 동일한 사이즈를 가지도록 권선되는, 무선 전력 통신용 코어 어셈블리.

[청구항 9] 제1항에 있어서,
상기 코일은, 상기 코어에서 돌출되는 적어도 하나의 서포트를 포함하고,

상기 서포트는 상기 코일의 중공부에 삽입되도록 형성되는, 무선 전력 통신용 코어 어셈블리.

[청구항 10] 제9항에 있어서,
상기 서포트의 단면의 적어도 일 구간은, 상기 코일의 중공부의 내주면 중 일 부분과 접하도록, 곡선형으로 형성되는, 무선 전력 통신용 코어 어셈블리.

[청구항 11] 제10항에 있어서,
상기 코어는, 상기 코일 각각의 양단이 관통되도록 형성되는 복수의 제1 관통홀을 구비하고,
상기 회로기판은, 상기 제1 관통홀에 대응하여 형성되는 복수의 제2 관통홀을 구비하는, 무선 전력 통신용 코어 어셈블리.

[청구항 12] 제11항에 있어서,
상기 복수의 제1 관통홀은,
상기 코어의 중심을 기준으로 대칭되는 적어도 한 쌍의 관통홀을 포함하는, 무선 전력 통신용 코어 어셈블리.

[청구항 13] 제11항에 있어서,
상기 코일 각각의 양단이 접속되도록, 상기 회로기판의 상기 코어를 마주하는 면의 반대면에 상기 양단의 개수에 대응하여 형성되는, 복수의 접속부를 포함하는, 무선 전력 통신용 코어 어셈블리.

[청구항 14] 제1항에 있어서,
상기 오목부의 저면에 상기 코일의 권선 방향을 따라 형성되어, 상기 코일의 상기 저면과 접촉하는 부분이 수납되는, 그루브를 더 포함하는, 무선 전력 통신용 코어 어셈블리.

[청구항 15] 제1항에 따르며, 상기 회로기판에는 충전전력 공급회로가 형성되는, 무선 전력 통신용 코어 어셈블리; 및
상기 코어 어셈블리를 감싸도록 형성되는, 하우징을 포함하는, 무선 전력 통신용 전력 공급 장치.

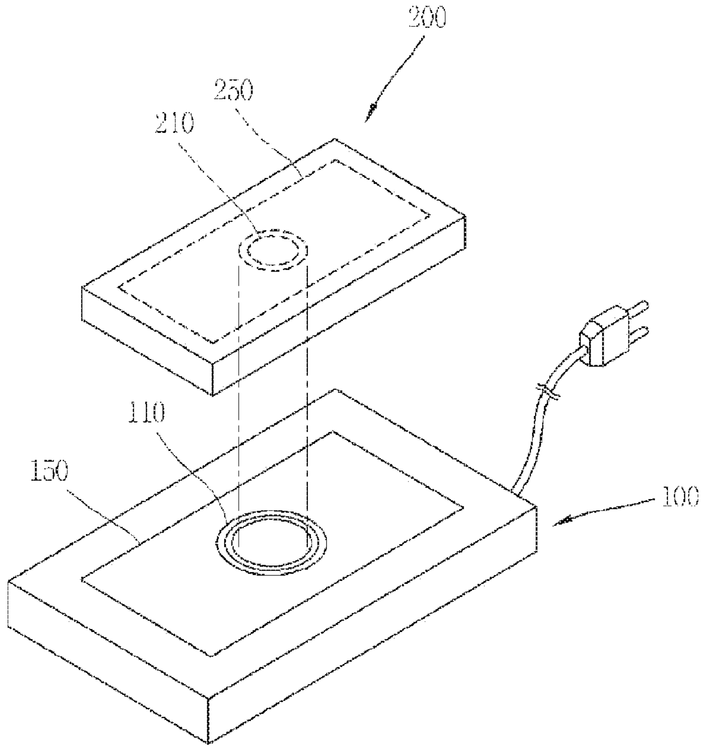
[청구항 16] 자성체인 파우더에 바인더를 첨가하여 혼합물을 형성하는 단계;
상기 혼합물을 금형에 넣고 프레싱하여, 일 면에 오목부가 형성되는 코어로 성형하는 단계;
상기 성형된 코어를 소결하는 단계;
상기 소결된 코어의 오목부에 권선된 복수의 코일의 일 부분들이 서로 중첩되도록 배치하는 단계; 및
상기 코일 각각의 양단부를 회로기판에 접속시키는 단계를 포함하는, 무선 전력 통신용 코어 어셈블리 제조 방법.

[청구항 17] 제16항에 있어서,
상기 파우더는 망간-아연을 포함하는, 무선 전력 통신용 코어

어셈블리 제조 방법.

[청구항 18] 제17항에 있어서,
상기 성형된 코어를 소결하는 단계는,
소결 온도를 60 ℃ 내지 80 ℃로 유지하는 단계를 포함하는, 무선 전력 통신용 코어 어셈블리 제조 방법.

[Fig. 1]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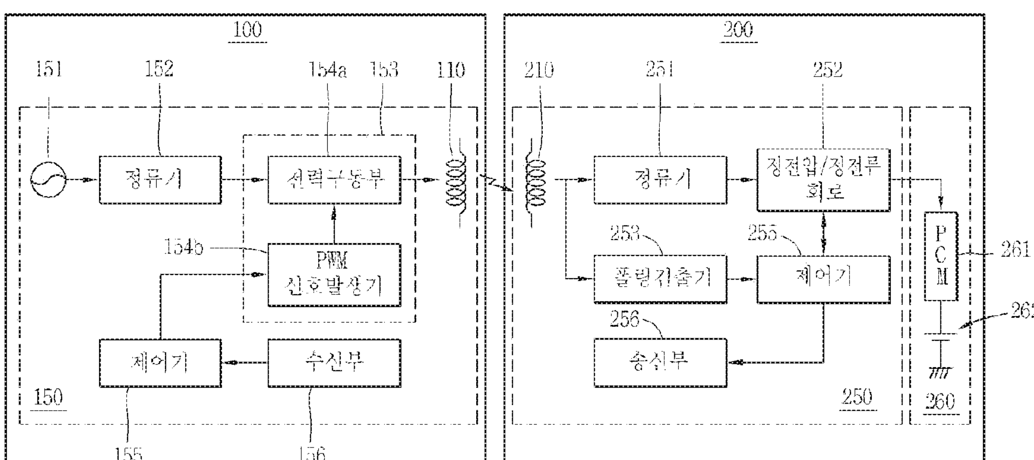
[Fig. 2]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152
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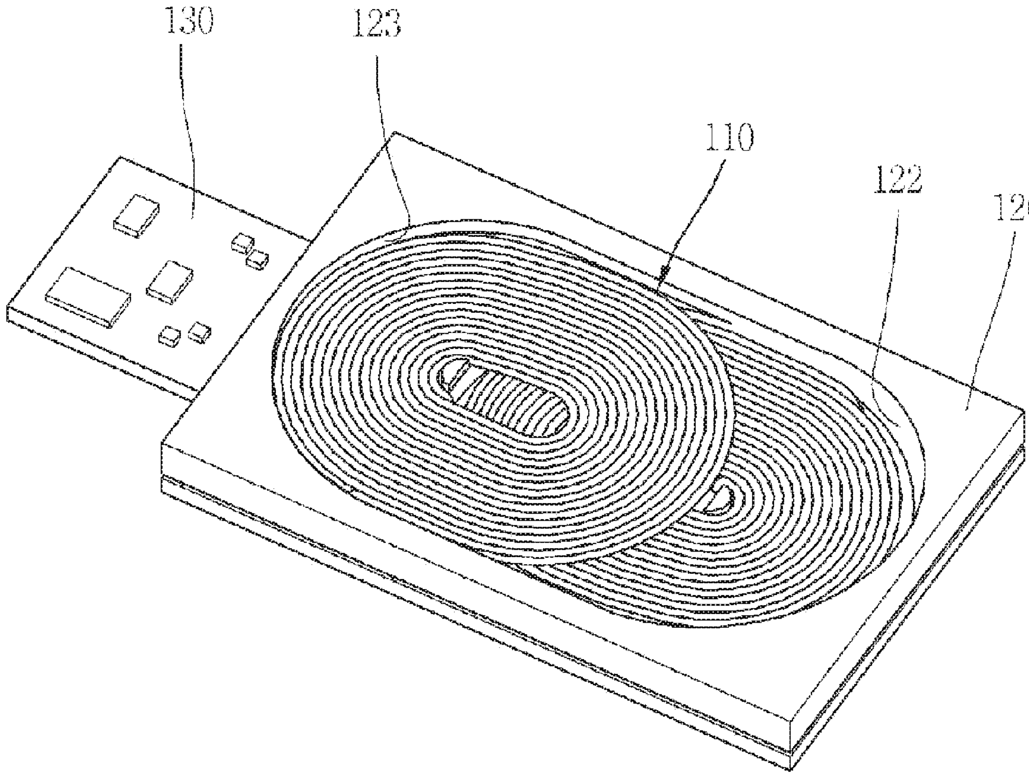
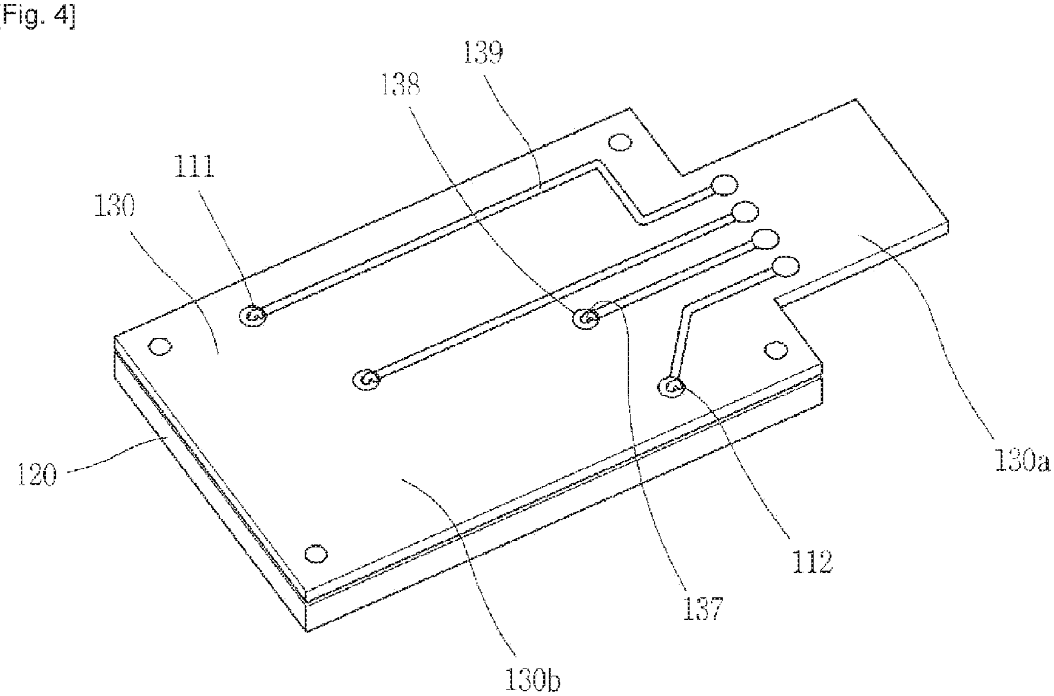
정류기
전력구동부
154b
PWM
신호발생기
제어기
수신부
150
155
156
200
210
251
252
정류기
정전압/정전류
회로
253
255
폴링검출기
제어기
256
송신부
P
C
M
261
262
250
260

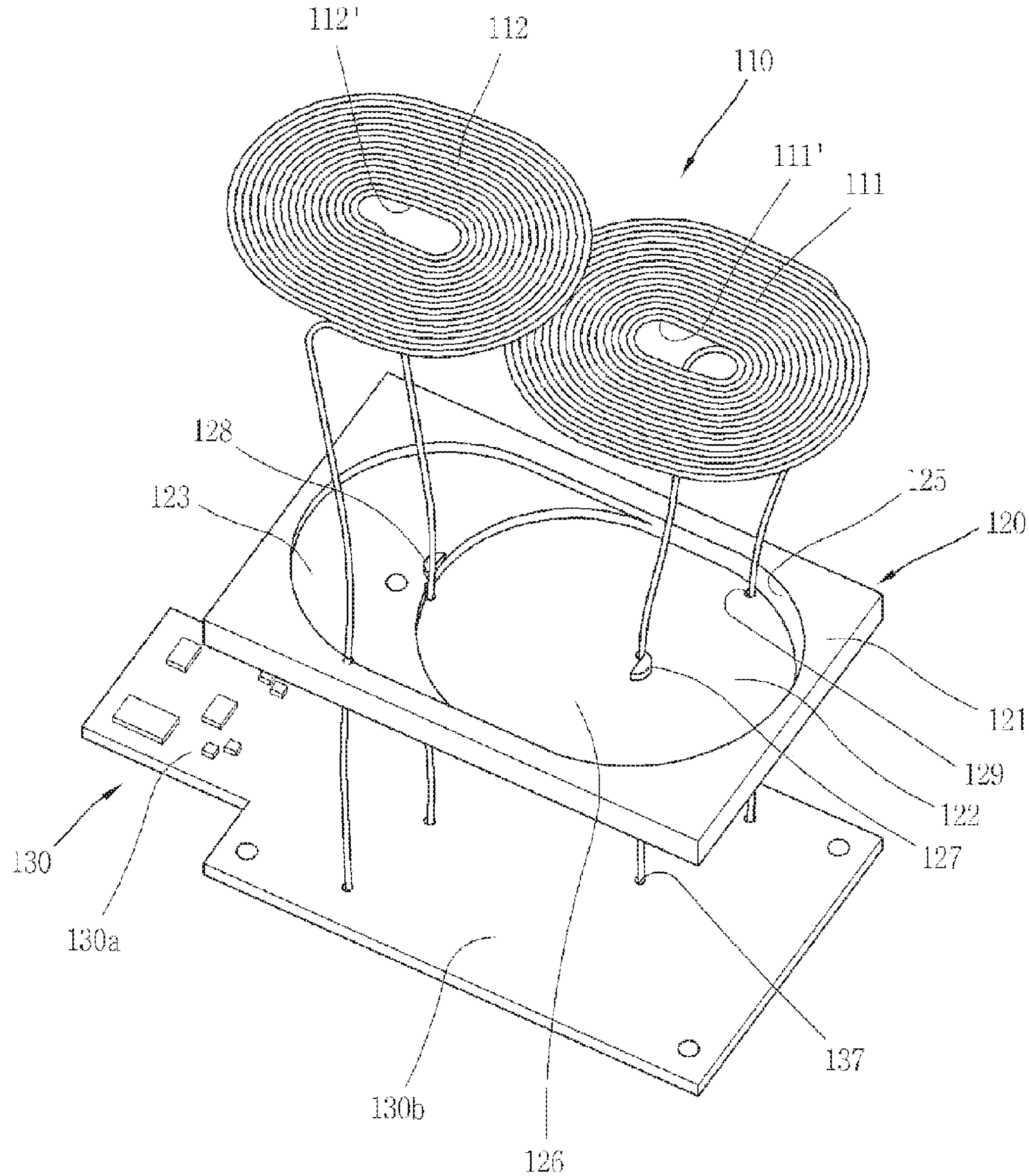
[Fig. 3]



[Fig. 4]



[Fig. 5]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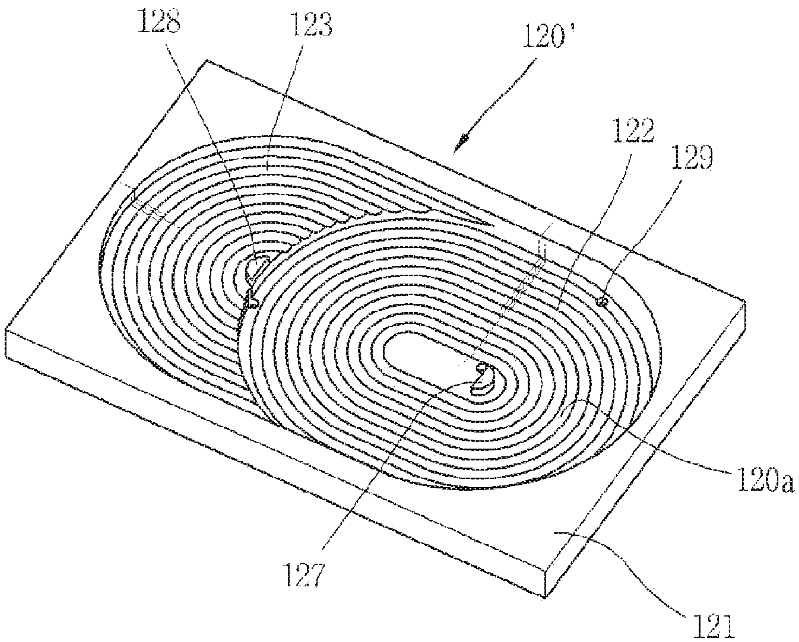
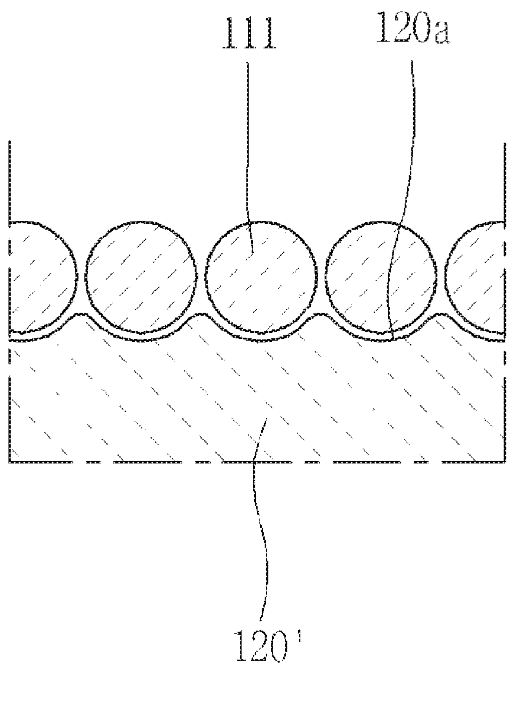
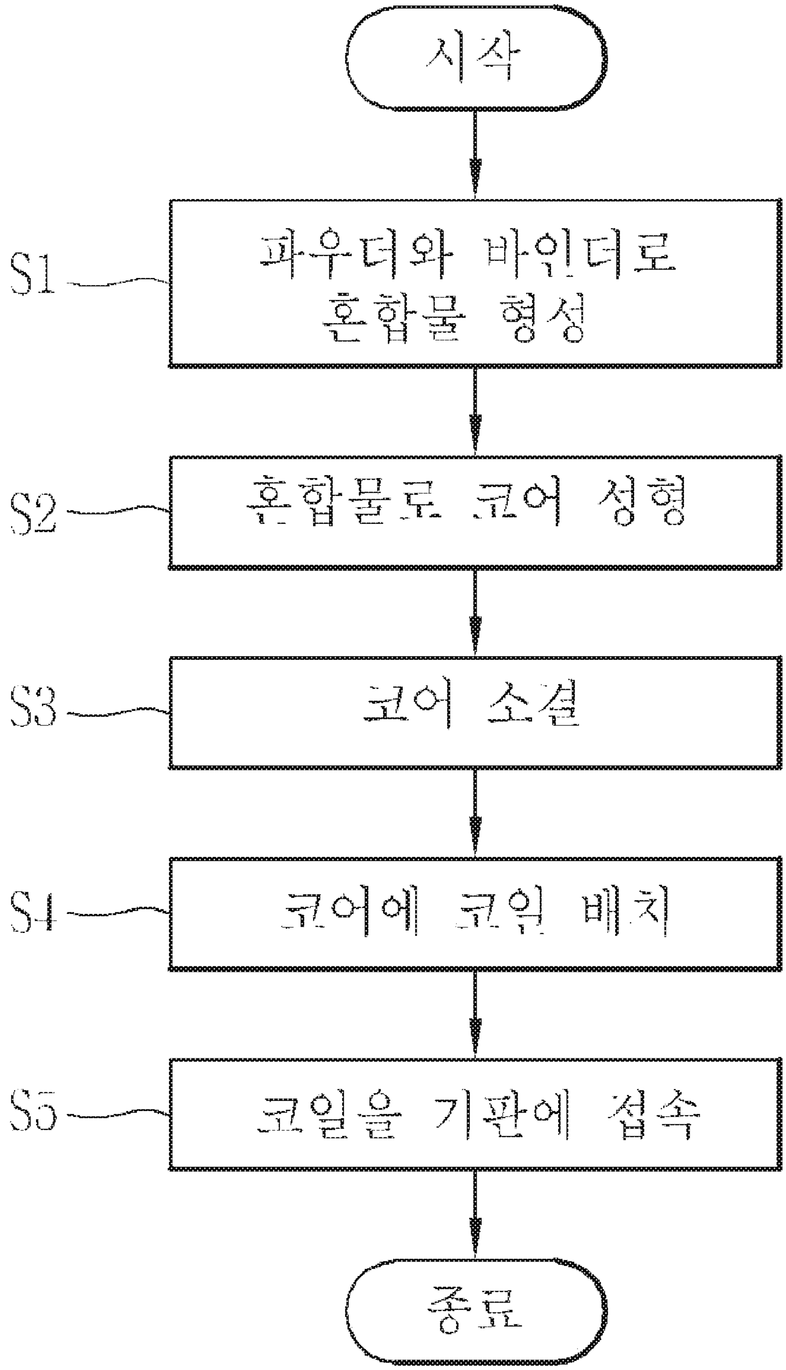
[Fig. 6]



[Fig. 7]



[Fig. 8]


시작
S1
파우더와 바인더로
혼합물 형성
S2
혼합물로 코어 성형
S3
코어 소결
S4
코어에 코일 배치
S5
코일을 기판에 접속
종료

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	13/663,012
Filing Date	October 29, 2012
First Named Inventor	James P. Evans
Art Unit	2836
Examiner Name	Jeong Wook An
Attorney Docket Number	SUN.LGI.420

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Document Number: Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	U1	2009/0029185-A1	01-29-2009	Lee *et al.*	ALL

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. [1]	Foreign Patent Document: Country Code [3] - Number [4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	F1	JP-2009033106-A	02-12-2009	Taida Electronic Ind. Co., Ltd.	ALL	
	F2	JP-2012019302-A	01-26-2012	NEC Tokin Corp.	ALL	
	F3	JP-2004110854-A	04-08-2004	Yokowo Co., Ltd.	ALL	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. [1]	Include name of the author (in CAPITAL LETTERS), title of the article, (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	R1	Office Action dated August 10, 2015 in Japanese Application No. 2015-172306.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

J:\SUN\LGI\420\IDS-Refs\08-16-16\PTO-SB-08(7).doc/jmc

Espacenet

Bibliographic data: JP2009033106 (A) — 2009-02-12

METHOD OF MANUFACTURING MAGNETIC DEVICE, AND MAGNETIC DEVICE

Inventor(s): LEE CHENG-CHANG; LIN MIN-HSIEN; CHANG YU-RU; YUAN ZONG-TING; CHANG HENG-CHUNG; CHIN KOKON; SHING TAI-KANG + (LEE CHENG-CHANG, ; LIN MIN-HSIEN, ; CHANG YU-RU, ; YUAN ZONG-TING, ; CHANG HENG-CHUNG, ; CHIN KOKON, ; SHING TAI-KANG)

Applicant(s): TAIDA ELECTRONIC IND CO LTD + (TAIDA ELECTRONIC IND CO LTD)

Classification: - international: ***H01F17/04; H01F27/255; H01F27/28; H01F41/02; H01F41/04***
- cooperative: **H01F17/0006; H01F41/046;** H01F1/26; H01F1/37; H01F17/04; H01F2017/0066; H01F5/003; Y10T428/12201

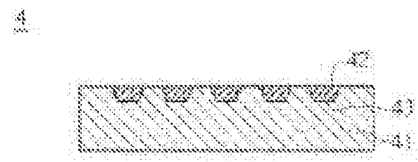
Application number: JP20080109537 20080418

Priority number(s): TW20070127440 20070727

Also published as: US2009029185 (A1) TW200905703 (A)

Abstract of JP2009033106 (A)

PROBLEM TO BE SOLVED: To provide a magnetic device having a thin thickness and a high inductance, and what is more, having no restriction on coil material, and to provide a method of manufacturing the magnetic device. ;SOLUTION: The method of manufacturing a magnetic device includes a step of forming a magnetic substrate 41 with at least one concave groove 43, and a step of installing at least one coil 42 in the concave groove 43. ;COPYRIGHT: (C)2009,JPO&INPIT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41

(19)日本国特許庁(JP)　　(12)公開特許公報(A)　　(11)特許出願公開番号

特開2009-33106

(P2009-33106A)

(43)公開日　平成21年2月12日(2009.2.12)

(51)Int.Cl.		FI			テーマコード(参考)
H01F 41/04	(2006.01)	H01F	41/04	C	5E043
H01F 17/04	(2006.01)	H01F	17/04	F	5E062
H01F 27/28	(2006.01)	H01F	27/28	K	5E070
H01F 41/02	(2006.01)	H01F	41/02	D	
H01F 27/255	(2006.01)	H01F	27/24	D	

審査請求 有　請求項の数 25　OL　(全 11 頁)

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(33)優先権主張国	台湾(TW)

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(74)代理人　100148253
弁理士　今枝　弘充
(74)代理人　100148079
弁理士　梅村　裕明
(74)代理人　100119312
弁理士　清水　栄松
(72)発明者　李　政璋
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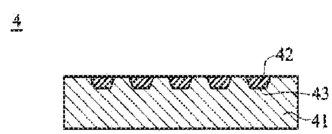
最終頁に続く

(54)【発明の名称】磁性素子の製造方法及び磁性素子

(57)【要約】
【課題】厚さが薄く、高インダクタンスを有し、且つコイル材料が制限されない磁性素子及びその製造方法を提供する。
【解決手段】少なくとも一つの凹溝43を有する磁性基板41を形成するステップ、及び前記凹溝43に少なくとも一つのコイル42を設置するステップを含む磁性素子の製造方法。
【選択図】図4A



【特許請求の範囲】
【請求項1】
少なくとも一つの凹溝を有する磁性基板を形成するステップ、及び
前記凹溝に少なくとも一つのコイルを設置するステップを含むことを特徴とする磁性素子の製造方法。
【請求項2】
磁性基板は、前記磁性基板を焼結、或いは固化することによって、形成され、且つ前記凹溝は、焼結、或いは固化する前に、或いは焼結、或いは固化した後に前記磁性基板に形成されることを特徴とする請求項１に記載の磁性素子の製造方法。
【請求項3】
前記磁性基板を焼結、或いは固化する前に、
前記凹溝に対応する構造を有する金型に磁性粉末を入れるステップ、
前記磁性粉末を、加圧し、前記磁性基板を形成するステップ、及び、
前記金型を取り除くステップを更に含むことを特徴とする請求項２に記載の磁性素子の製造方法。
【請求項4】
前記磁性基板を焼結、或いは固化する前に、旋削加工、エッチングプロセス、インプリンティング、或いは研磨の方式によって、前記磁性基板に前記凹溝を形成するステップを更に含むことを特徴とする請求項２に記載の磁性素子の製造方法。
【請求項5】
前記磁性基板を形成した後に、
フライス加工、放電加工、レーザー加工、半導体製造プロセス、或いは微小電気機械製造プロセスによって、前記磁性基板に前記凹溝を形成するステップを更に含むことを特徴とする請求項２に記載の磁性素子の製造方法。
【請求項6】
前記微小電気機械製造プロセス、或いは前記半導体製造プロセスは、
前記磁性基板にフォトレジスト層を塗布するステップ、
前記凹溝を有するパターンのマスクを前記フォトレジスト層に設置するステップ、
前記マスクによって、前記フォトレジスト層に、露光と現像を行うステップ、
前記磁性基板に、エッチングを行うステップ、及び
前記フォトレジスト層に、フォトレジストの除去を行い、前記凹溝を得るステップを含むことを特徴とする請求項４、或いは請求項５に記載の磁性素子の製造方法。
【請求項7】
前記コイルを形成するステップは、
前記凹溝に金属層を形成するステップ、及び
前記金属層の一部を取り除いて、前記コイルを形成するステップを含むことを特徴とする請求項１に磁性素子の記載の製造方法。
【請求項8】
前記金属層は、電気メッキ、化学メッキ、堆積方式、或いは銅ペースト、或いは銀ペーストを印刷した後に固化して形成されることを特徴とする請求項７に記載の磁性素子の製造方法。
【請求項9】
前記金属層の一部は、半導体製造プロセス、微小電気機械製造プロセス、或いは研磨によって、除去することを特徴とする請求項７に記載の磁性素子の製造方法。
【請求項10】
前記コイルを形成した後、
前記磁性基板と前記コイルに結合材料を形成するステップを更に含むことを特徴とする請求項１に記載の磁性素子の製造方法。
【請求項11】

前記結合材料は、堆積、或いは塗布によって形成され、前記結合材料の材料は、酸化物、窒化物、スピンオンガラス、高分子材料、エポキシ樹脂、或いは絶縁材料であることを特徴とする請求項１０に記載の磁性素子の製造方法。

【請求項12】

前記結合材料と接続、接着、或いは係合するもう一つの磁性基板を形成するステップを更に含むことを特徴とする請求項１０に記載の磁性素子の製造方法。

【請求項13】

前記もう一つの磁性基板は、少なくとも一つの凹溝を有し、前記凹溝に少なくとも一つのコイルが設置されることを特徴とする請求項１２に記載の磁性素子の製造方法。

【請求項14】

少なくとも一つの凹溝を有する磁性基板、及び

前記凹溝に設置される少なくとも一つのコイルを含むことを特徴とする磁性素子。

【請求項15】

前記磁性基板が複数の凹溝を有する時、前記凹溝は、前記磁性基板の相対する二つ側、或いはその内の一つ側に位置されることを特徴とする請求項１４に記載の磁性素子。

【請求項16】

前記磁性基板のその内の一つ側に設置された前記コイルの前記磁性素子は、インダクタであり、前記磁性基板の相対する二つ側に設置された前記コイルの前記磁性素子は、フィルター、変圧器、或いは二重層インダクタであることを特徴とする請求項１５に記載の磁性素子。

【請求項17】

前記磁性基板は、磁心、或いは円柱状磁心であり、前記凹溝は、前記磁心の外表面に設置されることを特徴とする請求項１４に記載の磁性素子。

【請求項18】

前記磁性基板の材料は、フェライト、ニッケル亜鉛フェライト、マンガン亜鉛フェライト、或いは金属系軟磁性粉末と高分子材料の混合からなることを特徴とする請求項１４に記載の磁性素子。

【請求項19】

前記コイルの材料は、銅、或いはアルミニウムなどの金属、合金であることを特徴とする請求項１４に記載の磁性素子。

【請求項20】

前記コイルと前記磁性基板に設置される結合材料を更に含むことを特徴とする請求項１４に記載の磁性素子。

【請求項21】

前記コイルは、前記結合材料と前記磁性基板の間に位置されることを特徴とする請求項２０に記載の磁性素子。

【請求項22】

前記結合材料と結合されるもう一つの磁性基板を更に含むことを特徴とする請求項２１に記載の磁性素子。

【請求項23】

前記もう一つの磁性基板は、少なくとも一つの凹溝を有し、前記凹溝に少なくとも一つのコイルが設置されることを特徴とする請求項２２に記載の磁性素子。

【請求項24】

前記磁性基板の相対する二つ側に設置された二つの結合材料を更に含み、二つの磁性基板により前記二つの結合材料と接合されることを特徴とする請求項１４に記載の磁性素子。

【請求項25】

前記結合材料の材料は、酸化物、窒化物、スピンオンガラス、高分子材料、或いはエポキシ樹脂であることを特徴とする請求項２０、或いは請求項２４に記載の磁性素子。

【発明の詳細な説明】

【技術分野】

【0001】
本発明は、磁性素子の製造方法及び磁性素子に関するものである。
【背景技術】
【0002】
磁性素子は、既に電子製品に必要なインダクタ、或いはノイズフィルターなどに広く応用されている。従来の磁性素子は、エナメル銅線で磁心に巻き線を施す方式で製作されるが、その体積が製造機械の能力、銅線の線径と、磁心のサイズによって制限されることから、小型化の限界を有する。従来の巻き線方式と比べて、マイクロ製造の方式を用いることで、既に市場にある、マイクロ製造の方式で製造されたコモンモードノイズフィルターのように、より体積の小さなインダクタ、或いはノイズフィルターを製造できる。
【0003】
一般の製造プロセスは、高周波の操作に適用するフェライトを基板とし、その上にマイクロ製造の方式で製作されたコイルを施して、インダクタとして機能する磁性素子を形成する。図１に示されるように、コイル１３と二つの結合材料１４、１５を二つのフェライト基板１１、１２で挟み、磁性素子１を形成する。しかし、前記磁性素子１の表面が平坦化に達する必要があることから、前記結合材料１４、１５は、不可欠なものとなり、且つ一定の厚さ以上を達し、全体の素子の厚さを厚くする必要がある。この他に、前記コイル１３の周囲が前記結合材料１４、１５に覆われることから、前記磁性素子１のインダクタンスを低下させる。
【0004】
図２に示されるように、スクリーン印刷の方式で基板２１にフェライト２２、コイル２３、もう一つのフェライト２４と、二つの外部電極２５を順次に形成し、続いて焼結（ｓｉｎｔｅｒｉｎｇ）を行い、磁性素子２を形成する。前記磁性素子２の前記コイル２３は、直接、フェライト２２、２４より覆われているため、比較的薄い厚さと比較的高いインダクタンスを有することができるが、しかし、焼結の温度が１０００～１２００℃に達することから、前記コイル２３の材料を選択する時に制限される。例えば、アルミニウムでは、前記コイル２３の材料とすることができない。
【0005】
図３に示されるように、電気メッキの方式で基板３１にフェライト３２、シード層３５、コイル３３、もう一つのフェライト３４と保護層３６を順次に形成し、磁性素子３を形成する。前記磁性素子３の前記コイル３３は、前記フェライト３２、３４により直接覆われているため、比較的薄い厚さと比較的高いインダクタンスを有することができるが、しかし、電気メッキから製作された前記フェライト３２、３４の磁気的性質は、焼結で製作されたフェライトと比べることができないため、前記磁性素子３のインダクタンス、或いは品質係数（Ｑ）のいずれも比較的悪い。
【0006】
よって、上述の問題を解決するには、コイルの材料を制限せずに、且つ厚さが薄く、高インダクタンスを有することができる磁性素子及びその製造方法が必要である。
【発明の開示】
【発明が解決しようとする課題】
【0007】
上述の課題に鑑み、本発明の目的は、厚さが薄く、高インダクタンスを有し、且つコイル材料が制限されない磁性素子の製造方法及び磁性素子を提供する。
【課題を解決するための手段】
【0008】
上述の目的を達成するために、本発明に基づく磁性素子の製造方法は、少なくとも一つの凹溝を有する磁性基板を形成するステップ、及び前記凹溝に少なくとも一つのコイルを設置するステップを含む。
【0009】
上述の目的を達成するために、本発明に基づく磁性素子は、磁性基板と少なくとも一つ

のコイルを含む。前記磁性基板は、少なくとも一つの凹溝を有し、前記凹溝に前記コイルを設置する。

【発明の効果】

【0010】

本発明の磁性素子とその製造方法は、まず、前記磁性基板を形成する。前記磁性基板は、前記凹溝を有し、前記コイルを収容する。従来技術と比べて、本発明の前記コイルは、前記磁性基板により直接覆われるため、比較的厚さが薄く、高インダクタンスを有することができる。また、本発明は、まず、前記磁性基板を形成してから、前記コイルを形成するので、仮に、焼結、或いは固化を選択して、製造された前記磁性基板は、相当良好な磁気的性質を有することができ、且つ前記コイルの材料も製造プロセスの温度による制限を受けないことができる。

【発明を実施するための最良の形態】

【0011】

本発明についての目的、特徴、長所が一層明確に理解されるよう、以下に実施形態を例示し、図面を参照にしながら、詳細に説明する。

【0012】

図４Ａに示されるように、本発明の好ましい実施例の磁性素子４は、磁性基板４１と少なくとも一つのコイル４２を含む。前記磁性基板４１は、焼結、或いは固化方式で成型され、その内の一つ側は、少なくとも一つの凹溝４３を有し、前記凹溝４３は、前記コイル４２を収容する。前記磁性基板４１が焼結方式で成型される場合、その材料はフェライト（ｆｅｒｒｉｔｅ）を選択して、高分子材料と混合する。前記磁性基板４１が固化方式で成型される場合、その材料は、金属系軟磁性粉末を選択して、高分子材料と混合する。フェライトは、例えば、ニッケル亜鉛フェライト（ＮｉＺｎ　ｆｅｒｒｉｔｅ）、マンガン亜鉛フェライト（ＭｎＺｎ　ｆｅｒｒｉｔｅ）である。前記コイル４２の材料は、金属、或いは合金であり、例えば銅、アルミニウムなどである。

【0013】

本実施例では、前記磁性素子４は、いくつかの変化を有することができ、以下は、図４Ｂ～図４Ｆを例に説明する。もちろん、その他にも更に多くの変化を有することができる。

【0014】

図４Ｂに示されるように、磁性素子４ａの前記磁性基板４１Ａは、円柱状の磁心からなり、前記凹溝４３Ａは、前記磁心の外表面に位置し、前記コイル４２Ａは、前記凹溝４３Ａ内に収容される。

【0015】

図４Ｃに示されるように、前記磁性素子４ｂの前記凹溝４３、４３Ｂは、前記磁性基板４１Ｂの相対する二つ側、すなわち両側面に位置し、前記コイル４２、４２Ｂは、前記凹溝４３、４３Ｂ内にそれぞれ設置することで、二つの側にいずれも前記コイル４２、４２Ｂの前記磁性素子４ｂを形成する。

【0016】

図４Ｄに示されるように、前記磁性素子４ｃは、前記磁性基板４１と前記コイル４２の上に形成された結合材料４４を更に含み、前記コイル４２を前記結合材料４４と前記磁性基板４１の間に位置させる。前記磁性素子４ｃは、前記結合材料４４と結合したもう一つの磁性基板４５を更に含み、前記結合材料４４の材料は、酸化物、窒化物、スピンオンガラス、高分子材料、エポキシ樹脂、或いはその他の接着効果、或いは絶縁効果を有する材料であることができ、前記磁性基板４５を前記結合材料４４によって、前記磁性基板４１に接着し、且つ前記磁性基板４５の材料が前記コイル４２の短絡を招くリスクを防ぐ。また、前記磁性基板４５を増設することによって、前記磁性素子４ｃのインダクタンスを増加し、且つインダクタの損耗を下げることができる。

【0017】

図４Ｅに示されるように、前記磁性素子４ｄは、二つの磁性素子４によって、互いに結

合して形成する。二つの磁性素子４間は、結合材料４４によって、接合し、且つ隔てることができる。
【0018】
図４Ｆに示されるように、前記磁性素子４ｅは、前記磁性素子４ｂにより上、下側にもう一つの磁性基板４５をそれぞれ接着して、成型される。前記結合材料４４によって、前記磁性基板４５を接着することができる。
【0019】
上述の片側コイルを有する前記磁性素子４、４ａ、４ｃは、インダクタ、或いは片側コイルだけを必要とする電子素子に応用することができる。両側コイルを有する前記磁性素子４ｂ、４ｄ、４ｅは、フィルター、変圧器、二重層インダクタ構造、或いは両側コイルを必要とする電子素子に応用することができる。
【0020】
図５Ａ～図５Ｄを参照下さい。以下は、前記磁性素子４、４ｃで本発明の好ましい実施例の磁性素子の製造方法を説明する。
【0021】
まず、図５Ａに示されるように、磁性基板を焼結、或いは固化して、磁性基板４１を形成する。前記磁性基板４１は、少なくとも一つの凹溝４３を有する。続いて、図５Ｂに示されるように、凹溝４３に金属層４６を形成する。さらに図５Ｃに示されるように、前記金属層４６の一部を取り除き、前記コイル４２を形成する。これによって、前記磁性素子４を製作することができる。前記金属層４６は、電気メッキ、化学メッキ、或いは堆積方式で形成、或いは銅ペースト、銀ペーストを印刷した後に固化して形成することができる。尚、堆積方式は具体的な方法として、ＰＶＤ（Ｐｈｙｓｉｃａｌ　ｖａｐｏｒ　ｄｅｐｏｓｉｔｉｏｎ）、またはＣＶＤ（Ｃｈｅｍｉｃａｌ　ｖａｐｏｒ　ｄｅｐｏｓｉｔｉｏｎ）がある。また、前記金属層４６の一部は、半導体製造プロセスにおけるエッチング方式、微小電気機械製造プロセスにおけるエッチング方式、或いは研磨によって、除去することができる。
【0022】
また、図５Ｄに示されるように、製造方法は、コイル４２の片側に結合材料４４を形成するステップを更に含み、前記コイル４２を結合材料４４と前記磁性基板４１との間に位置させる。続いて、もう一つの磁性基板４５を更に設置して、前記結合材料４４と接合することによって、前記磁性素子４ｃを製作することができる。前記結合材料４４は、堆積、或いは塗布によって形成することができ、前記磁性基板４５は、接着、或いは係合によって、前記結合材料４４と接合することができる。
【0023】
また、前記磁性素子４ａ、４ｂ、４ｄ、４ｅも上述の製造方法に沿って、成型することができる。注意すべきことは、前記磁性素子４ａの前記磁性基板４１Ａが磁心であることから、前記金属層を形成する時に、前記磁性基板４１Ａを同時に回転することができ、前記金属層を均一に形成する。これは前記磁性基板４１Ａは、円柱形の基板であり、磁性基板４１Ａの軸心に従って回転することで、金属層を均一に形成できる。前記磁性素子４ｂの凹溝は、二つ側、すなわち両面側に位置しているため、二つの金属層を形成する必要がある。前記磁性素子４ｄは、二つの前記磁性素子４を製作した後に、前記結合材料４４によって接着し、形成することができる。前記磁性素子４ｅは、前記磁性素子４ｂと前記磁性素子４ｃの製造プロセスを結合して製造することができる。
【0024】
上述の各実施例では、前記磁性基板４１の凹溝４３は、いくつかの方式で形成することができる。以下、図６Ａ～図６Ｃを参照に、第一の形成方式を説明する。
【0025】
図６Ａに示されるように、まず、磁性粉末を金型５に入れる。前記金型５は、前記凹溝４３に対応する構造を有し、続いて、前記金型５によって、磁性粉末を加圧し、磁性基板４７を形成する。前記金型５の前記凹溝４３に対応する構造は、一般の機械加工、エッチ

ング、放電加工、或いはＵＶＬＩＧＡのマイクロ電鋳方式によって製作することができる。尚、ＵＶＬＩＧＡ（ＵＶ－ＬＩＧＡ）のマイクロ電鋳方式とは、ＵＶ光またはＸ線により厚膜フォトレジストに対して露光を行い、更に露出されている部分にマイクロ電鋳によって金属膜を成膜して、金型５を形成することであり、いわゆる「ロールオーバー（ｒｏｌｌｏｖｅｒ）」である。磁性粉末の材料は、フェライトと高分子材料の混合、或いは金属系軟磁性粉末と高分子材料の混合であることができる。続いて、図６Ｂに示されるように、前記金型５を取り除き、最後に、図６Ｃに示されるように、前記磁性基板４７を加温焼結（フェライト粉末などの場合）、或いは固化（金属系軟磁性粉末などの場合）し、前記凹溝４３を有する前記磁性基板４１を形成する。注意すべきことは、この方式で前記凹溝４３を形成するのは、焼結、或いは固化を行う前である。

【0026】

図７Ａ～図７Ｃを参照下さい。以下は、前記凹溝４３の第二の形成方式を説明する。

【0027】

図７Ａに示されるように、まず、未焼結、或いは未固化の磁性基板４７Ａを提供する。続いて、図７Ｂに示されるように、前記磁性基板４７に前記凹溝４３を形成する。本実施例では、前記凹溝４３は、旋削加工、微小電気機械製造プロセス、半導体製造プロセス、インプリンティング、或いは研磨の方式によって形成することができる。前記微小電気機械製造プロセス、或いは前記半導体製造プロセスは、前記磁性基板４７Ａにフォトレジスト層の塗布を含むことができる。尚、インプリンティングは、凸起部のある金型によって、焼結されていないまたは固化されていない磁性基板４７Ａ（図７参照）に刷り込むことで、コイルパターン（凹溝４３）を形成するものである。続いて、前記凹溝４３を有するパターンのマスクを前記フォトレジスト層に設置し、続いて、マスクによって、フォトレジスト層に、露光と現像を行った後、前記磁性基板４７Ａにエッチングを行う。最後に、フォトレジスト層にフォトレジストの除去を行い、前記凹溝４３を得る。図７Ｃに示されるように、前記磁性基板４７Ａに焼結、或いは固化を行い、前記凹溝４３を有する前記磁性基板４１を形成する。この方式で前記凹溝４３を形成するのも、焼結、或いは固化を行う前である。

【0028】

図８Ａ～図８Ｃを参照下さい。以下は、前記凹溝４３の第三の形成方式を説明する。

【0029】

図８Ａに示されるように、まず、磁性基板を焼結、或いは固化し、磁性基板４１を形成する。続いて、図８Ｂに示されるように、前記磁性基板４１に前記凹溝４３を形成する。前記凹溝４３は、フライス加工、放電加工、レーザー加工、半導体製造プロセス、或いは微小電気機械製造プロセスによって、前記磁性基板４１に形成することができる。前記微小電気機械製造プロセス、或いは前記半導体製造プロセスは、前記磁性基板４１にフォトレジスト層ＰＲの塗布を含むことができ、続いて、前記凹溝４３を有するパターンのマスクを前記フォトレジスト層ＰＲに設置した後、前記マスクによって、前記フォトレジスト層ＰＲに、露光と現像を行い、さらに、前記磁性基板４１に、エッチングを行う（図８Ｂの如く）。最後に、前記フォトレジスト層ＰＲにフォトレジストの除去を行い、前記凹溝４３を得る（図８Ｃの如く）。注意すべきことは、この方式で前記凹溝４３を形成するのは、焼結、或いは固化を行った後である。

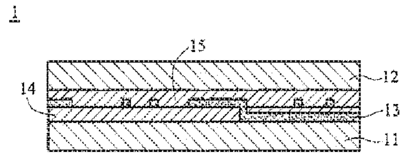
【0030】

上述をまとめると、本発明の磁性素子とその製造方法は、まず、前記磁性基板を形成する。前記磁性基板は、前記凹溝を有し、前記コイルを収容する。従来技術と比べて、本発明の前記コイルは、前記磁性基板により直接覆われるため、比較的厚さが薄く、高インダクタンスを有することができる。また、本発明は、まず、前記磁性基板を焼結、或いは固化してから、前記コイルを形成することから、製造された前記磁性基板は、相当良好な磁気的性質を有することができ、且つ前記コイルの材料も製造プロセスの温度による制限を受けないことができる。

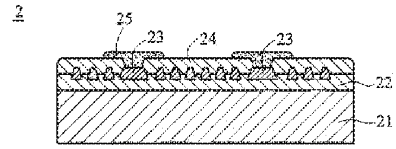
【0031】

以上、本発明の好適な実施例を例示したが、これは本発明を限定するものではなく、本発明の精神及び範囲を逸脱しない限りにおいては、当業者であれば行い得る少々の変更や修飾を付加することは可能である。従って、本発明が保護を請求する範囲は、特許請求の範囲を基準とする。
【図面の簡単な説明】
【0032】
【図1】第一の従来磁性素子の概略図である。
【図2】第二の従来磁性素子の概略図である。
【図3】第三の従来磁性素子の概略図である。
【図4A】本発明の各種の好ましい第一の実施例の磁性素子の概略図である。
【図4B】本発明の各種の好ましい第二の実施例の磁性素子の概略図である。
【図4C】本発明の各種の好ましい第三の実施例の磁性素子の概略図である。
【図4D】本発明の各種の好ましい第四の実施例の磁性素子の概略図である。
【図4E】本発明の各種の好ましい第五の実施例の磁性素子の概略図である。
【図4F】本発明の各種の好ましい第六の実施例の磁性素子の概略図である。
【図5】本発明の好ましい実施例に基づいた二つの磁性素子の製造プロセス図である。
【図6】本発明の好ましい実施例に基づいた磁性素子の凹溝の第一の製造プロセス図である。
【図7】本発明の好ましい実施例に基づいた磁性素子の凹溝の第二の製造プロセス図である。
【図8】本発明の好ましい実施例に基づいた磁性素子の凹溝の第三の製造プロセス図である。
【符号の説明】
【0033】
１　磁性素子
１１、１２　フェライト基板
１３　コイル
１４、１５、４４　結合材料
２、３、４、４ａ、４ｂ、４ｃ、４ｄ、４ｅ　磁性素子
２１、３１　基板
２２、２４、３２、３４　フェライト
２３、３３、４２、４２Ａ、４２Ｂ　コイル
２５　外部電極
３６　保護層
４１、４１Ａ、４１Ｂ、４５　磁性基板
４３、４３Ａ、４３Ｂ　凹溝
４６　金属層
４７、４７Ａ　磁性基板
５　金型
ＰＲ　フォトレジスト層

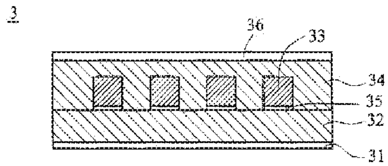
【図1】



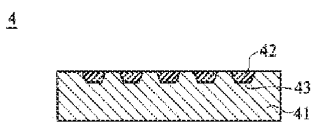
【図2】



【図3】



【図4A】



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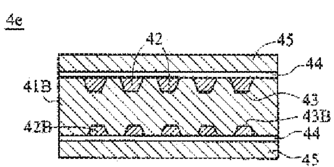

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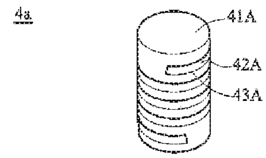

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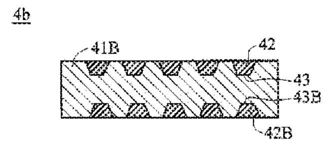

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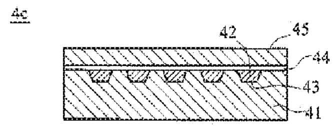

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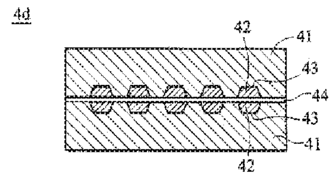

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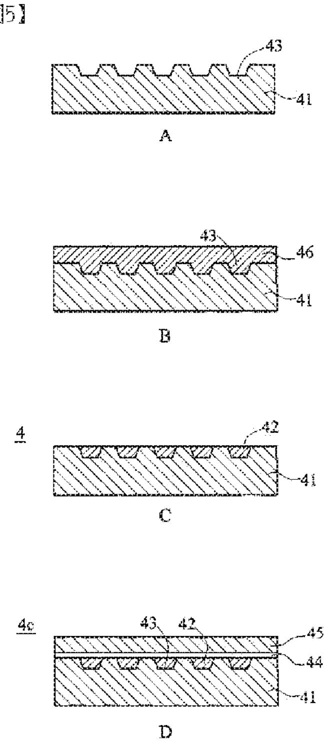

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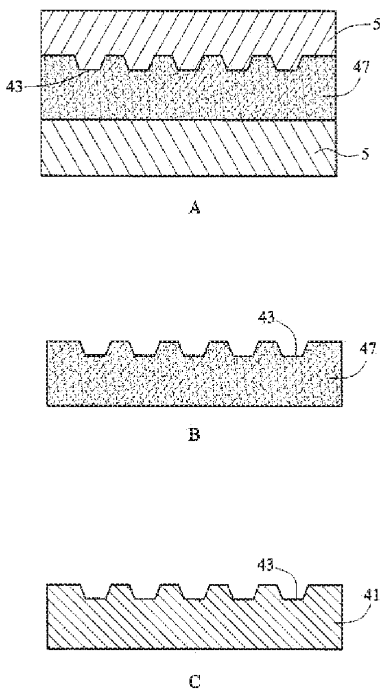

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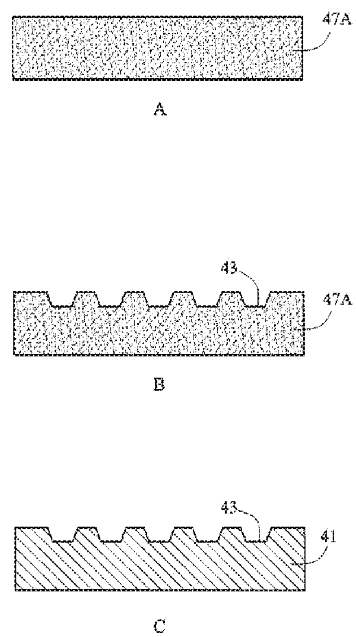

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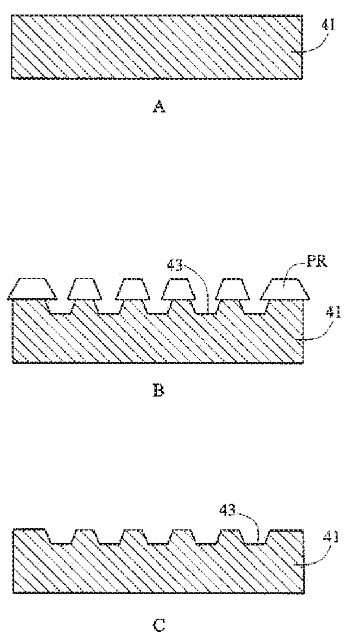

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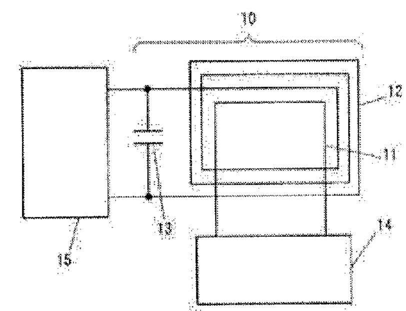

(54)ANTENNA MODULE AND NON-CONTACT POWER TRANSMISSION DEVICE

(57)Abstract

PROBLEM TO BE SOLVED: To provide an antenna module and non-contact power transmission which allow the same antenna to be used for electric power transmission and communication even if magnetic field resonance is used.

SOLUTION: An antenna 10 comprises a first coil 11 and a second coil 12 which is placed outside the first coil 11 and adjusted to any resonance frequency by LC resonance. The first coil 11 is connected to a reception power circuit 14 and the second coil 12 is connected with a communication circuit 15. The antenna module switches between electric power transmission and communication by controlling the impedance of the communication circuit 15.

CLAIMS

[Claim(s)]

[Claim 1]

It has an antenna which consists of a first coil of looped state, and a second coil of looped state arranged at the inside or the outside of said first coil, An antenna module switching transfer of power and communication by connecting said first coil to an incoming circuit, being connected to a communication circuit and controlling impedance of the aforementioned communication circuit while adjusting said second coil to any resonance frequency.

[Claim 2]

The antenna module according to claim 1, wherein it gives a reactance component to the aforementioned communication circuit and transfer of power differs in frequency from communication.

[Claim 3]

The antenna module according to claim 1 or 2 having arranged a magnetic body at the aforementioned antenna.

[Claim 4]

The antenna module according to any one of claims 1 to 3 having arranged a shield plate at the aforementioned antenna.

[Claim 5]

The antenna module according to any one of claims 1 to 4 having replaced the aforementioned incoming circuit with a power transmission circuit, and considering it as power transmission equipment.

[Claim 6]

The antenna module according to any one of claims 1 to 5 having arranged multiple aforementioned antennas.

[Claim 7]

Non-contact transfer-of-power equipment using the antenna module according to any one of claims 1 to 6.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

The present invention relates to an antenna module and non-contact transfer-of-power equipment, especially relates to an antenna module suitable to a portable device and non-contact transfer-of-power equipment, such as a mobile phone, a headset, a digital camera, and a digital video.

[Background of the Invention]

[0002]

In the non-contact transfer of power using electromagnetic induction, non-contact transfer of power is possible by using combining a simple plane coil as an antenna, and non-contact electric power charging equipment, a noncontact IC card, a reader writer, etc. are put in practical use.

[0003]

However, since the transfer-of-power efficiency changes with the positional relationship of the power transmission side antenna and the power receiving side antenna largely when electromagnetic induction is used, In order to maintain the transfer of power in a well head, it is necessary to provide a mechanism which becomes always constant [the positional relationship of the power transmission side antenna and the power receiving side antenna]. As opposed to such problem, the means using magnetic field resonance like a Patent document 1 is disclosed.

[0004]

Fig.4 is the figure which describes an example of the antenna module by a prior art. As shown in Fig.4, the conventional antenna 50 consists of two coils, and comprises the first coil 51 which consists of the loop coil linked to the incoming circuit 54, and the second coil 52 which has the resonance of a certain specific frequency linked to the capacitor 53. The second coil 52 is excited and the second coil 52 can transmit electric power from the second coil 52, if the electric power which had specific frequency in the first coil 51 is input. Even if the positional relationship of the power transmission side antenna and the power receiving side antenna has shifted more compared with the case where electromagnetic induction is used according to the method using this magnetic field resonance, It becomes unnecessary to provide a mechanism which it becomes it is efficient and possible to send electric power, and becomes always constant [the positional relationship of the power transmission side antenna and the power receiving side antenna].

[0005]

In order to perform transfer of power safely, it is necessary to communicate authentication of the portable device used as the candidate for charge, etc. but, and. Since a mount space will increase or interference between antennas, etc. will occur if the antenna for charge and a communications aerial are made separate, it is desirable that transfer of power and communication can be performed with one antenna.

[Citation list]

[Patent literature]

[0006]

[Patent document 1] JP,2009-501510,A

[Summary of Invention]

[Problem to be solved by the invention]

[0007]

However, by the prior art of a Patent document 1 description, when trying to perform transfer of power and communication using the same frequency band, with the antenna for carrying out transfer of power using magnetic field resonance, the transfer of power in a well head cannot communicate RF-ID communication of a possible thing, etc. Since low Q value is needed when this uses it as communications antennas, such as RF-ID communication, while high Q value is needed the antenna for magnetic field resonance, in the antenna for magnetic field resonance, satisfactory Q value required for a communications antenna is not obtained.

[0008]

Therefore, also in the non-contact transfer of power using magnetic field resonance, it is desirable that transfer of power and communication can be performed using the same antenna.

[0009]

the present invention is made in order to solve the problem of the above-mentioned prior art, and it comes out.

Even if resonance is used for the object, there is in providing an antenna module and non-contact transfer of power which can perform transfer of power and communication with the same antenna.

[Means for solving problem]

[0010]

According to the present invention, an antenna is arranged the outside or inside a first coil and a first coil, And the second coil adjusted to any resonance frequency by LC resonance is provided, A first coil is connected to an incoming circuit, the second coil is connected to the communication circuit, between a communication circuit and a second coil in a communication circuit, the impedance of the both ends of a second coil is controlled and the antenna possessing the control circuit to which Q value can be changed is obtained.

[0011]

Namely, according to the present invention, it has an antenna which consists of the first coil of looped state, and the second coil of the looped state arranged at the inside or the outside of the above-mentioned first coil, The above-mentioned first coil is connected to an incoming circuit, while adjusting the above-mentioned second coil to any resonance frequency, it is connected to a communication circuit and the antenna module switching transfer of power and communication is obtained by controlling the impedance of the aforementioned communication circuit.

[0012]

According to the present invention, a reactance component is given to the aforementioned communication circuit and the above-mentioned antenna module, wherein transfer of power differs in frequency from communication is obtained.

[0013]

According to the present invention, the above-mentioned antenna module having arranged the magnetic body at the aforementioned antenna is obtained.

[0014]

According to the present invention, the above-mentioned antenna module having arranged the shield plate at the aforementioned antenna is obtained.

[0015]

According to the present invention, the aforementioned incoming circuit is replaced with a power transmission circuit, and the above-mentioned antenna module considering it as power transmission equipment is obtained.

[0016]

According to the present invention, the above-mentioned antenna module having arranged multiple aforementioned antennas is obtained.

[0017]

According to the present invention, the non-contact transfer-of-power equipment using the above-mentioned antenna module is obtained.

[Effect of the Invention]

[0018]

As mentioned above, by the present invention, even if it uses magnetic field resonance, the antenna module and non-contact transfer of power which can perform transfer of power and communication with the same antenna can be provided.

[0019]

By keeping current from flowing into a communication circuit as much as possible from a second coil by making sufficiently large impedance of the communication circuit seen from the second coil at the time of transfer of power according to the present invention. The minimum can be taken in the resonance point of an antenna, Q value can become high, and it can make the impedance of the antenna seen from the incoming circuit drive as an antenna for magnetic field resonance for it being efficient and performing transfer of power. By what the part by which the communication circuit was loaded on the second coil by making sufficiently small impedance of the communication circuit seen from the second coil at the time of communication, and Q value are lowered for, Since a Q factor required as a communications aerial can be satisfied, an antenna can be made to drive as a communications aerial.

[Brief Description of the Drawings]

[0020]

[Drawing 1]It is the figure which describes an example of the antenna module by the present invention.

[Drawing 2]It is the figure which describes the antenna module in the working example 1 of the present invention. Fig.2 (a) is the figure showing a plane. Fig.2 (b) is the figure showing a bottom surface.

[Drawing 3]It is the figure which describes the antenna module in the working example 2 of the present invention.

[Drawing 4]It is the figure which describes an example of the antenna module by a prior art.

[Description of Embodiments]

[0021]

Hereinafter, it describes about an embodiment of the invention using Drawings.

[0022]

Fig.1 is the figure which describes an example of the composition of the antenna module by the present invention. As shown in Fig.1, an antenna module of the present invention comprises the following:

Antenna 10.

Incoming circuit 14.

Communication circuit 15.

The antenna 10 consists of the first coil 11 and the second coil 12 arranged at the outside of the first coil 11. As for the second coil 12, resonance frequency is adjusted to any frequency and the first coil 11 is connected to the incoming circuit 14. By the control circuit which the second coil 12 was connected to the communication circuit 15, and was further installed in the communication circuit 15 and between the communication circuit and the second coil, By controlling the impedance of the both ends of the second coil 12, and controlling the impedance to the communication circuit 15, it is constituted so that transfer of power and communication may be switched. At the time of transfer of power, transfer of power and communication are separated from the communication circuit 15 in [the second coil 12] equivalent circuit, and a change is performed by connecting the second coil 12 with the communication circuit 15 in them at the time of communication. The second coil 12 may be arranged inside the first coil 11.

[0023]

Like the above-mentioned communication circuit 15, the incoming circuit 14, The function which controls the impedance of the both ends of the first coil 11 is given, at the time of communication, by making sufficiently large impedance of the incoming circuit 14 seen from the first coil 11, the interference to the second coil 12 from the first coil 11 can be inhibited, and a communication characteristic can also be improved.

[0024]

The antenna 10 is produced on planar substrates, such as FPC and FR-4 substrate. Or it is also producible only by winding.

[0025]

The LC resonance of the second coil 12 is adjusted by connecting the second coil 12 and the capacitor 13 in parallel, and also the capacity component which arose by the lap of the self resonance of the second coil 12 and the copper foil patterns on a substrate can also be used for it.

[0026]

A reactance component can be given to an incoming circuit or a communication circuit, and different frequency can also be used by transfer of power and communication by changing the resonance frequency of an antenna.

[0027]

An incoming circuit can be replaced to a power transmission circuit, and can also be used as power transmission equipment.

[0028]

A magnetic body may be arranged at the back face of an antenna. The material of a magnetic body whose high frequency, such as NiZn ferrite, is also low-loss is desirable. The composite which combined the magnetic material with several different amplitude permeability may be sufficient.

[0029]

A shield material may be arranged at the back face of a magnetic body.

[0030]

An antenna may be used combining plurality.

[Work example 1]

[0031]

Hereinafter, it describes about an example of the composition of the module in the working example of the present invention.

[0032]

Fig.2 is the figure which describes the antenna module in the working example 1 of the present invention, and the figure in which Fig.2 (a) shows a plane, and Fig.2 (b) are the figures showing a bottom surface. Fig.2 (a) omits and shows the receiving circuit and the communication circuit. As shown in Fig.2, the antenna 30 comprises the first coil 31 of looped state, and the second coil 32 of looped state. The dimension of the antenna 30 was 40 mm x 20 mm, and it produced it on the FR-4 substrate. From the outside of the antenna 30, the second coil 32 has been arranged and the first coil 31 has been arranged inside the second coil 32. The first coil 31 consisted of a 1 turn-plane coil, and it is 0.5 mm in coil pattern width, and it produced it inside the second coil 32. The second coil 32 consisted of four turn coils, and it produced it in coil pattern 0.5 mm in width, and 0.3 mm of coil pattern gaps. It connected with the capacitor 33, the second coil 32 had LC resonance, and resonance frequency adjusted it to 13.56 MHz. The ends 31a and 31b of the plane (surface) first coil 31 and the ends 32a and 32b of the second coil 32 are connected to the ends 31c and 31d at the bottom (back surface) and the ends 32c and 32d via the through-hole of a substrate, respectively. Resonance frequency should just be adjusted and the capacitor 33 may have more than one if needed.

[0033]

In the antenna 30, the first coil 31 is connected to the incoming circuit 34 via the terminal 38 of Fig.2 (b), the incoming circuit 34 is provided with a first solid state switch, and a first solid state switch is switched in opening and a short circuit of the terminal of the first coil 31 by IC control. The second coil 32 is connected to the communication circuit 35 via the terminal 39, the communication circuit 35 is provided with a second solid state switch, and a second solid state switch is switched in opening and a short circuit of coil 32 second terminal by IC control. Thus, the control circuit of each impedance consisted of an IC and a solid state switch.

[0034]

The operation is described about the antenna module of the present invention which has the antenna 30 constituted as mentioned above.

[0035]

When performing transfer of power, it is controlled by IC control so that a first solid state switch becomes open [a short circuit and a second solid state switch]. At this time, the first coil 31 and the second coil 32 are combined by magnetic field combination. If the antenna 30 is placed all over the magnetic field which is 13.56 MHz, the second coil 32 is excited by the magnetic field, and for LC resonance, is efficient and can receive electric power. This electric power is taken out by the first coil 31, it is transmitted to an incoming circuit and the transfer of power of it becomes possible. As mentioned above, the Reason for making a second solid state switch open, When both first solid state switches and second solid state switches are short, in order for a part of electric power which the second coil 32 received to flow into a communication circuit, When the voltage which transfer-of-power efficiency was deteriorated and occurred to the both ends of the second coil 32 will be applied to a communication circuit and it transmits big electric power, it is because a communication circuit may be destroyed.

[0036]

When communicating, it is controlled by IC control so that a first solid state switch becomes short [opening and a second solid state switch]. At this time, the first coil 31 does not function as a coil and magnetic field combination does not arise between the first coil 31 and the second coil 32. If the antenna 30 is placed all over the magnetic field which is 13.56 MHz, a magnetic field will excite, the voltage which arose to the both ends of the second coil 32 will be applied to a communication circuit, and communication of the second coil 32 will be attained. As mentioned above, since the first coil 31 will be excited so that excitation of the second coil 32 may be inhibited when both the Reasons for making a first solid state switch open have short first solid state switch and second solid state switch, a communication characteristic deteriorates. However, when degradation of a communication characteristic is minor, a first solid state switch is not necessarily required.

[Work example 2]

[0037]

As the antenna described in working example 1 is made into one unit and it was shown in Fig.3, power transmission equipment or power receiving equipment can consist of arranging the antenna of two or more units. Fig.3 is the figure which describes the antenna module in the working example 2 of the present invention. As shown in Fig.3, the antenna module of the working example 2 has the antenna 40 provided with three units of antenna units which consists of the first coil 41 and the second coil 42.

[0038]

When arranging multiple antennas, it is not limited to arrangement which comes in contact with next doors, but it may pile up, or an interval may be opened and it may arrange.

[0039]

The antenna module for power transmission can be arbitrarily changed with one unit of antennas, and may have a dismountable structure for one unit of every antennas.

[0040]

The maximum power transmission electric power which can carry out transfer of power from the antenna module for power transmission is adjustable by the number of the antennas which constitute the antenna module for power transmission. For example, if the electric power per [1W] one unit of antennas can be transmitted, a maximum of 4W of power transmission of the power transmission antenna equipment which comprises four units of antennas is attained.

[0041]

By adding the control system which can choose the antenna magnetized among the antennas of the antenna module for power transmission, some antennas of power transmission equipment are used and it also becomes possible to perform transfer of power.

[0042]

If sum total power transmission electric power is below the maximum power transmission electric power, the transfer of power to the antenna module for a plurality of power receiving is also possible for the antenna module for power transmission.

[0043]

The maximum power receiving electric power of the antenna module for power receiving is adjustable by the number of the antennas which constitute the antenna module. For example, if the electric power per [1W] one unit of antennas can be received, a maximum of 4W of electricity-receiving of the antenna module for power receiving which comprises four units of antennas is attained.

[0044]

As mentioned above, although the embodiment of the invention and the working example were described using Drawings, the present invention is not limited to these examples, it is a range which does not deviate from the summary of the present invention, and even if there is change of a component or composition, it is contained in the present invention. For example, various deformation implementation of it not being limited to what was shown in Fig.1, omitting a part of the component, adding other components, or changing connecting relation is possible for the composition of an antenna. A mechanical switch can also be used instead of a solid state switch. The resonance frequency of a coil can be set to any frequency. That is, if it is a person skilled in the art, the various deformation and correction which can naturally be made are also included in the present invention.

[Explanations of letters or numerals]

[0045]

10, 30, and 40 Antenna

11, 31, 41, and 51 The 1st coil

12, 32, 42, and 52 The 2nd coil

13, 33, and 53 Capacitor

14, 34, and 54 Incoming circuit

15 and 35 Communication circuit

31a, 31b, 31c, 31d, 32a, 32b, 32c, and 32d End

38 and 39 Terminal

50 The conventional antenna

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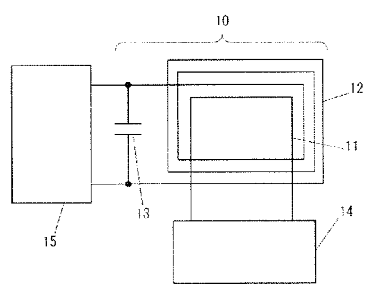
5J047 AA04 AA08 AA12 AB02 AB11 FD01

(54) 【発明の名称】アンテナモジュール及び非接触電力伝送装置

(57) 【要約】
【課題】　磁界共鳴を用いても、電力伝送と通信を同じアンテナで行うことができるアンテナモジュール及び非接触電力伝送を提供すること。
【解決手段】　アンテナ１０は、第１のコイル１１と、この第１のコイル１１の外側に配置され、かつＬＣ共振により任意の共振周波数に調整された第２のコイル１２を具備し、第１のコイル１１は受電回路１４に接続され、第２のコイル１２は、通信回路１５に接続されている。通信回路１５のインピーダンスを制御することにより、電力伝送と通信を切り替える。
【選択図】　図１



【特許請求の範囲】
【請求項１】
ループ状の第１のコイルと、前記第１のコイルの内側又は外側に配置されたループ状の第２のコイルからなるアンテナを備え、前記第１のコイルは受電回路に接続され、前記第２のコイルは任意の共振周波数に調整するとともに、通信回路に接続され、前記通信回路のインピーダンスを制御することにより、電力伝送と通信を切り替えることを特徴とするアンテナモジュール。
【請求項２】
前記通信回路にリアクタンス成分を持たせ、電力伝送と通信とで周波数が異なることを特徴とする請求項１に記載のアンテナモジュール。
【請求項３】
前記アンテナに磁性体を配置したことを特徴とする請求項１又は２に記載のアンテナモジュール。
【請求項４】
前記アンテナにシールド板を配置したことを特徴とする請求項１～３のいずれかに記載のアンテナモジュール。
【請求項５】
前記受電回路を送電回路に代えて、送電装置としたことを特徴とする請求項１～４のいずれかに記載のアンテナモジュール。
【請求項６】
前記アンテナを複数個配置したことを特徴とする請求項１～５のいずれかに記載のアンテナモジュール。
【請求項７】
請求項１～６のいずれかに記載のアンテナモジュールを用いたことを特徴とする非接触電力伝送装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、アンテナモジュール及び非接触電力伝送装置に係り、特に携帯電話、ヘッドセット、デジタルカメラ、デジタルビデオ等の携帯機器に好適なアンテナモジュール及び非接触電力伝送装置に関する。
【背景技術】
【０００２】
電磁誘導を利用した非接触電力伝送においては、単純な平面コイルをアンテナとして組み合わせて用いることで非接触電力伝送が可能であり、非接触電力充電装置ならびに非接触型ＩＣカード、リーダーライター等が実用化されている。
【０００３】
しかしながら、電磁誘導を利用した場合、送電側アンテナと受電側アンテナの位置関係により、その電力伝送効率が大きく変化してしまうため、高効率での電力伝送を維持するためには、送電側アンテナと受電側アンテナの位置関係が常に一定となるような機構を具備する必要がある。このような課題に対して、例えば、特許文献１のような磁界共鳴を用いた手段が開示されている。
【０００４】
図４は、従来技術によるアンテナモジュールの一例を説明する図である。図４に示すように、従来のアンテナ５０は、２つのコイルからなり、受電回路５４と接続したループコイルからなる第１のコイル５１と、コンデンサ５３と接続した、ある特定の周波数の共振を有する第２のコイル５２から構成される。第２のコイル５２は、第１のコイル５１に、特定の周波数を持った電力が入力されると、第２のコイル５２が励磁され、第２のコイル５２から電力を伝送することができる。この磁界共鳴を用いた方法によれば、電磁誘導を用いた場合に比べ、送電側アンテナと受電側アンテナの位置関係がよりズレていても、高

効率で電力を送ることが可能となり、送電側アンテナと受電側アンテナの位置関係が常に一定となるような機構を具備する必要がなくなる。

【０００５】

また、安全に電力伝送を行うためには、充電対象となる携帯機器の認証等の通信を行なう必要があるが、充電用アンテナと通信用アンテナを別々にすると、搭載スペースが増加したり、アンテナ間の干渉などが発生したりしてしまうため、１つのアンテナで電力伝送と通信ができることが望ましい。

【先行技術文献】

【特許文献】

【０００６】

【特許文献１】特表２００９－５０１５１０号公報

【発明の概要】

【発明が解決しようとする課題】

【０００７】

しかしながら、特許文献１記載の従来技術では、同じ周波数帯域を用いて、電力伝送と通信を行なおうとした場合、磁界共鳴を用いた電力伝送をするためのアンテナでは、高効率での電力伝送は可能であるものの、ＲＦ－ＩＤ通信等の通信を行うことができない。これは、磁界共鳴用アンテナは高いＱ値が必要とされるのに対し、ＲＦ－ＩＤ通信等の通信アンテナとして使用する場合は低いＱ値が必要となるため、磁界共鳴用アンテナでは、通信アンテナに必要な満足なＱ値が得られない。

【０００８】

したがって、磁界共鳴を利用した非接触電力伝送においても、同じアンテナを用いて電力伝送と通信が行なえることが望ましい。

【０００９】

本発明は、上記従来技術の課題を解決するためになされたものであり、その目的は、磁界共鳴を用いても、電力伝送と通信を同じアンテナで行うことができるアンテナモジュール及び非接触電力伝送を提供することにある。

【課題を解決するための手段】

【００１０】

本発明によれば、アンテナは第１のコイルと、第１のコイルの外側もしくは内側に配置され、かつＬＣ共振により任意の共振周波数に調整された第２のコイルを具備し、第１のコイルは受電回路に接続され、第２のコイルは通信回路に接続されており、通信回路内又は通信回路と第２のコイルの間には、第２のコイルの両端のインピーダンスを制御し、Ｑ値を変化させることができる制御回路を具備することを特徴とするアンテナが得られる。

【００１１】

即ち、本発明によれば、ループ状の第１のコイルと、前記第１のコイルの内側又は外側に配置されたループ状の第２のコイルからなるアンテナを備え、前記第１のコイルは受電回路に接続され、前記第２のコイルは任意の共振周波数に調整するとともに、通信回路に接続され、前記通信回路のインピーダンスを制御することにより、電力伝送と通信を切り替えることを特徴とするアンテナモジュールが得られる。

【００１２】

また、本発明によれば、前記通信回路にリアクタンス成分を持たせ、電力伝送と通信とで周波数が異なることを特徴とする上記のアンテナモジュールが得られる。

【００１３】

また、本発明によれば、前記アンテナに磁性体を配置したことを特徴とする上記のアンテナモジュールが得られる。

【００１４】

また、本発明によれば、前記アンテナにシールド板を配置したことを特徴とする上記のアンテナモジュールが得られる。

【００１５】

また、本発明によれば、前記受電回路を送電回路に代えて、送電装置としたことを特徴とする上記のアンテナモジュールが得られる。

【００１６】

また、本発明によれば、前記アンテナを複数個配置したことを特徴とする上記のアンテナモジュールが得られる。

【００１７】

また、本発明によれば、上記のアンテナモジュールを用いたことを特徴とする非接触電力伝送装置が得られる。

【発明の効果】

【００１８】

以上のように、本発明により、磁界共鳴を用いても、電力伝送と通信を同じアンテナで行うことができるアンテナモジュール及び非接触電力伝送を提供することができる。

【００１９】

本発明によれば、電力伝送時には、第２のコイルからみた通信回路のインピーダンスを十分大きくすることによって、第２のコイルから通信回路へ電流ができるだけ流れないようにすることで、受電回路からみたアンテナのインピーダンスは、アンテナの共振点にて、最小値をとり、Ｑ値が高くなり、高効率で電力伝送を行うための、磁界共鳴用アンテナとして駆動させることができる。また、通信時には、第２のコイルからみた通信回路のインピーダンスを十分小さくすることによって、第２のコイルに通信回路が負荷された分、Ｑ値を下げることで、通信用アンテナとして必要なＱ特性を満足することができるため、アンテナを通信用アンテナとして駆動させることができる。

【図面の簡単な説明】

【００２０】

【図１】本発明によるアンテナモジュールの一例を説明する図である。

【図２】本発明の実施例１におけるアンテナモジュールを説明する図である。図２（ａ）は、平面を示す図。図２（ｂ）は、底面を示す図。

【図３】本発明の実施例２におけるアンテナモジュールを説明する図である。

【図４】従来技術によるアンテナモジュールの一例を説明する図である。

【発明を実施するための形態】

【００２１】

以下、本発明の実施の形態について、図面を用いて説明する。

【００２２】

図１は、本発明によるアンテナモジュールの構成の一例を説明する図である。図１に示すように、本発明のアンテナモジュールは、アンテナ１０と、受電回路１４と、通信回路１５とから構成される。アンテナ１０は、第１のコイル１１と、第１のコイル１１の外側に配置された第２のコイル１２からなる。第２のコイル１２は、任意の周波数に共振周波数が調整されており、第１のコイル１１は、受電回路１４に接続されている。第２のコイル１２は、通信回路１５に接続され、さらに通信回路１５内又は通信回路と第２のコイルの間に設置された制御回路により、第２のコイル１２の両端のインピーダンスを制御し、通信回路１５へのインピーダンスを制御することにより、電力伝送と通信を切り替えるよう構成される。電力伝送と通信を切り替えは、電力伝送時には、通信回路１５と第２のコイル１２が等価回路的に切り離され、通信時には、通信回路１５と第２のコイル１２が接続されることにより行われる。なお、第２のコイル１２は、第１のコイル１１の内側に配置してもよい。

【００２３】

また、上記通信回路１５と同様に、受電回路１４は、第１のコイル１１の両端のインピーダンスを制御する機能を持たせ、通信時には、第１のコイル１１からみた受電回路１４のインピーダンスを十分大きくすることで、第１のコイル１１から第２のコイル１２への干渉を抑制し、通信特性を向上させることもできる。

【００２４】

アンテナ１０は、ＦＰＣやＦＲ－４基板等の平面基板上に作製される。もしくは、巻き線のみで作製することもできる。

【００２５】

第２のコイル１２のＬＣ共振は、第２のコイル１２とコンデンサ１３を並列に接続することで調整されるほか、第２のコイル１２の自己共振および、基板上の銅箔パターンの重なりによって生じた容量成分を用いることもできる。

【００２６】

受電回路もしくは、通信回路にリアクタンス成分を持たせ、アンテナの共振周波数を変化させることで、電力伝送と通信で、異なる周波数を利用することもできる。

【００２７】

受電回路は、送電回路に置き換え、送電装置として使用することもできる。

【００２８】

アンテナの背面に磁性体を配置しても良い。磁性体は、ＮｉＺｎフェライト等の高周波でも低損失である材料が望ましい。また、複数の異なる透磁率を持った磁性材料を組み合わせた複合材でもよい。

【００２９】

磁性体の背面には、シールド材を配置してもよい。

【００３０】

アンテナは複数個を組み合わせて使用してもよい。

【実施例１】

【００３１】

以下、本発明の実施例におけるモジュールの構成の一例について説明する。

【００３２】

図２は、本発明の実施例１におけるアンテナモジュールを説明する図であり、図２（ａ）は、平面を示す図、図２（ｂ）は、底面を示す図である。図２（ａ）では、受信回路、通信回路を省略して示している。図２に示すように、アンテナ３０は、ループ状の第１のコイル３１とループ状の第２のコイル３２から構成される。アンテナ３０の寸法は、４０ｍｍ×２０ｍｍとし、ＦＲ－４基板上に作製した。アンテナ３０の外側から、第２のコイル３２を配置し、第２のコイル３２の内側に第１のコイル３１を配置した。第１のコイル３１は１ターン平面コイルからなり、コイルパターン幅０．５ｍｍで、第２のコイル３２の内側に作製した。第２のコイル３２は、４ターンコイルからなり、コイルパターン幅０．５ｍｍ、コイルパターン間隙０．３ｍｍで作製した。第２のコイル３２は、コンデンサ３３と接続し、ＬＣ共振を持ち、共振周波数が１３．５６ＭＨｚに調整した。平面（表面）の第１のコイル３１の端部３１ａ、３１ｂ、第２のコイル３２の端部３２ａ、３２ｂは、底面（裏面）の端部３１ｃ、３１ｄ、及び端部３２ｃ、３２ｄにそれぞれ、基板の貫通孔を介して接続されている。コンデンサ３３は、共振周波数が調整されればよく、必要に応じて複数個あってもよい。

【００３３】

アンテナ３０において、第１のコイル３１は、図２（ｂ）の端子３８を介して受電回路３４に接続され、受電回路３４は第１の半導体スイッチを備え、第１の半導体スイッチはＩＣ制御によって、第１のコイル３１の端子のオープンとショートを切り替えられる。第２のコイル３２は、端子３９を介して通信回路３５に接続され、通信回路３５は第２の半導体スイッチを備え、第２の半導体スイッチはＩＣ制御によって、第２のコイル３２端子のオープンとショートを切り替えられる。このように、それぞれのインピーダンスの制御回路は、ＩＣと半導体スイッチで構成した。

【００３４】

以上のように構成された、アンテナ３０を有する本発明のアンテナモジュールについて、その動作を説明する。

【００３５】

電力伝送を行う場合、ＩＣ制御によって、第１の半導体スイッチがショート、第２の半

導体スイッチがオープンとなるように制御される。このとき、第１のコイル３１と第２のコイル３２は磁場結合によって結合している。アンテナ３０が１３．５６ＭＨｚの磁場中に置かれると、第２のコイル３２は磁場によって励磁され、かつ、ＬＣ共振のために、高効率で電力を受電することができる。この電力は第１のコイル３１によって取り出され、受電回路に伝送されることで、電力伝送が可能となる。上述のように、第２の半導体スイッチをオープンにする理由は、第１の半導体スイッチと第２の半導体スイッチがともにショートとなっていた場合、第２のコイル３２が受電した電力の一部が通信回路に流れてしまうため、電力伝送効率が低下し、また、第２のコイル３２の両端に発生した電圧が通信回路に印加されることとなり、大電力を伝送する場合には、通信回路が破壊される可能性もあるためである。

【００３６】

通信を行なう場合、ＩＣ制御によって、第１の半導体スイッチがオープン、第２の半導体スイッチがショートとなるように制御される。このとき、第１のコイル３１はコイルとして機能せず、第１のコイル３１と第２のコイル３２の間に磁場結合は生じない。アンテナ３０が１３．５６ＭＨｚの磁場中に置かれると、第２のコイル３２は磁場によって励磁され、第２のコイル３２の両端に生じた電圧が通信回路に印加され、通信が可能となる。上述のように、第１の半導体スイッチをオープンにする理由は、第１の半導体スイッチと第２の半導体スイッチがともにショートとなっていた場合、第２のコイル３２の励磁を阻害するように第１のコイル３１が励磁されてしまうため、通信特性が劣化する。しかし、通信特性の劣化が軽微な場合には、必ずしも第１の半導体スイッチが必要なわけではない。

【実施例２】

【００３７】

実施例１で説明したアンテナを１単位として、図３に示したように、複数単位のアンテナを配置することで、送電装置もしくは受電装置を構成することができる。図３は、本発明の実施例２におけるアンテナモジュールを説明する図である。図３に示すように、実施例２のアンテナモジュールは、第１のコイル４１、第２のコイル４２からなるアンテナ単位を３単位備えたアンテナ４０を有する。

【００３８】

アンテナを複数個配置する場合には、隣同士に接するような配置に限定されず、重ねたり、間隔を開けたりして配置してもよい。

【００３９】

送電用のアンテナモジュールは、アンテナ１単位で任意に変更することが可能であり、アンテナ１単位ごとに取り外し可能な構造を持っていても良い。

【００４０】

送電用のアンテナモジュールから電力伝送できる最大送電電力は、送電用のアンテナモジュールを構成しているアンテナの数で調整可能である。例えば、アンテナ１単位あたり１Ｗの電力を送電できるとすれば、アンテナ４単位から構成される送電アンテナ装置は、最大４Ｗまで送電可能となる。

【００４１】

また、送電用のアンテナモジュールのアンテナのうち、励磁させるアンテナを選択できる制御システムを付加することで、送電装置のアンテナの一部分を使用し、電力伝送を行うことも可能となる。

【００４２】

また、送電用のアンテナモジュールは、合計送電電力が最大送電電力以下であれば、複数の受電用のアンテナモジュールへの電力伝送も可能である。

【００４３】

受電用のアンテナモジュールの最大受電電力はアンテナモジュールを構成しているアンテナの数で調整可能である。例えば、アンテナ１単位あたり１Ｗの電力を受電できるとすれば、アンテナ４単位から構成される受電用のアンテナモジュールは、最大４Ｗまで受電

可能となる。

【００４４】

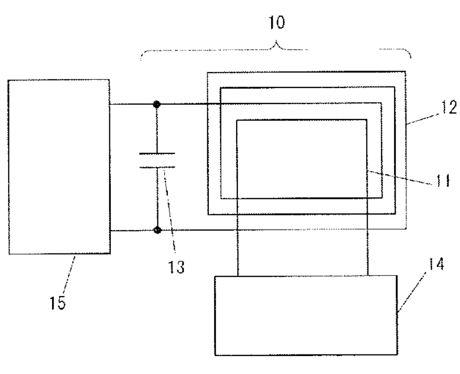
以上、図面を用いて本発明の実施の形態及び実施例を説明したが、本発明はこれらの例に限定されるものではなく、本発明の要旨を逸脱しない範囲で、部材や構成の変更があっても本発明に含まれる。例えば、アンテナの構成は図１に示したものに限定されず、その構成要素の一部を省略したり、他の構成要素を追加したり、接続関係を変更するなどの種々の変形実施が可能である。また、半導体スイッチの代わりに、機械スイッチを用いることもできる。また、コイルの共振周波数は、任意の周波数に設定することが可能である。すなわち、当業者であれば当然なしえるであろう各種変形や修正もまた、本発明に含まれるものである。

【符号の説明】

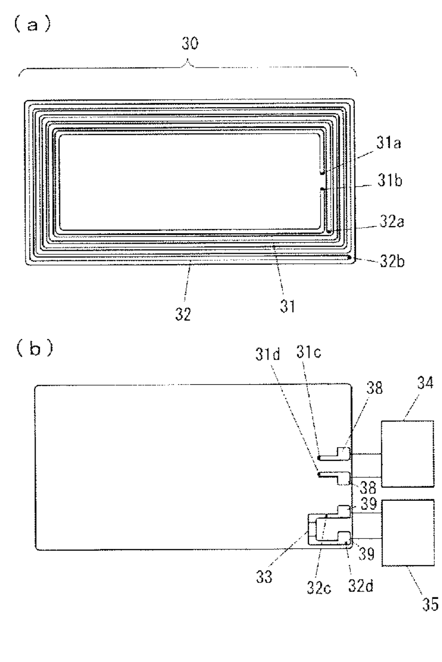
【００４５】

１０、３０、４０　アンテナ
１１、３１、４１、５１　第１のコイル
１２、３２、４２、５２　第２のコイル
１３、３３、５３　コンデンサ
１４、３４、５４　受電回路
１５、３５　通信回路
３１ａ、３１ｂ、３１ｃ、３１ｄ、３２ａ、３２ｂ、３２ｃ、３２ｄ　端部
３８、３９　端子
５０　従来のアンテナ

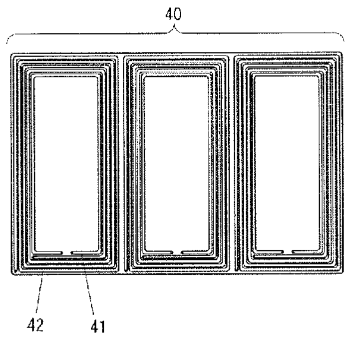
【図１】



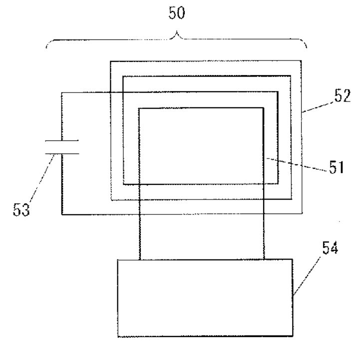
【図２】



【図３】



【図４】



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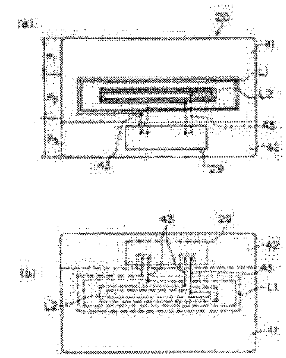

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(54)RADIO CARD

(57)Abstract

PROBLEM TO BE SOLVED: To provide a radio card with less possibility that an antenna for electric power waves and an antenna for data waves are covered by fingers of hand, etc. which hold the card, by which each antenna becomes approximately similar receiving status and sure transmission/reception is made possible in the case of holding up the card to communication equipment.

SOLUTION: In the radio card which receives electric power waves of first frequency to be transmitted from external communication equipment and data waves of second frequency different from the first frequency respectively, it is constituted by arranging a first coil forming the antenna for electric power waves which receives the electric power waves at a center part of one surface of a rectangular card-shaped substrate formed by a member transmitting radio

waves and arranging a second coil forming the antenna for data waves which receives the data waves so as to become double circles with the first coil at a center part of one surface of the substrate.

CLAIMS

[Claim(s)]

[Claim 1]

It is a wireless card which receives power waves of first frequency transmitted from an external communication apparatus, and data waves of said first frequency and different second frequency, respectively,

While arranging a first coil that forms an antenna for power waves which receives the aforementioned power waves in the central part of one surface of a card shape substrate of a rectangle formed by a component which transmits an electric wave, A wireless card which arranges a second coil which forms an antenna for data waves which receives the aforementioned data waves so that it may become said first coil and a double ring in the central part of one surface of the aforementioned substrate, and is characterized by things.

[Claim 2]

The wireless card according to claim 1 arranging said first coil and a second coil, respectively to a central ward when said first coil and a second coil were formed in respectively flat rectangular shape and the aforementioned substrate was classified into three by a shorter side.

[Claim 3]

The wireless card according to claim 1 arranging said second coil to the inside surrounded with said first coil on the same plane of the aforementioned substrate.

[Claim 4]

While while was classified into three of the aforementioned substrates and arranging a circuit component except said first coil and a second coil in a Type on the long side side, The wireless card according to claim 2 having laminated an insulating layer on both sides of the aforementioned substrate to which said first coil, a second coil, and a circuit component were arranged, having attended a Type on the long side side of another side classified into three of the aforementioned substrates, and arranging a magnetic recording layer on the surface of the aforementioned insulating layer of one side.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

In the present invention, transmission and reception by radio are performed between a wireless card of a non-cell type and a radio card reader writer (communication apparatus) which have a portable wireless communication function, for example. Therefore, while performing transmission of electric power, transmission of data, and reception from a radio card reader writer to a wireless card, it is related with a wireless card of a non-cell type used for a wireless communication system which performs transmission and reception of data from a wireless card to a radio card reader writer.

[Background of the Invention]

[0002]

By the wireless card constituted by the IC card of rectangle card size these days substantially card shape being developed, and holding up this wireless card before a radio card reader writer, By transmitting and receiving between radio card reader writers according to non-contact, there is a wireless communication system which delivers and receives data etc. A control means (CPU) containing storage cells, such as semiconductor memory, is mounted on this wireless card.
By storing proper data in a storage cell, it becomes possible to use as an ID card (personal identification card), a commuter pass, etc.

[0003]

If it was in the conventional wireless card, there were some which mounted the cell used as the operation power of the circuit element mounted, but the cost for the life of a cell and a changing battery, etc. had become a problem.

[0004]

Then, without mounting a cell etc. on a wireless card, a wireless card receives the electric wave transmitted from a radio card reader writer, and the technology of rectifying this reception radio wave and obtaining the DC power for operation power is proposed. From a radio card reader writer, the one method modulates the power waves for electric power transmission with a data signal, and transmits electric power and data to a wireless card with one frequency signal, respectively. Other methods transmit electric power and data from a radio card reader writer to a wireless card with two frequency signals with the data waves for data transmission, respectively on the power waves for electric power transmission, and different frequency from this.

[Description of the Invention]

[Problem to be solved by the invention]

[0005]

If it is in the method of using one frequency signal which modulated power waves with the data signal, the recovery of the data signal on the wireless card side is comparatively easy. However, when a plurality of wireless communication systems which used the same frequency approach and are provided, a wireless card is used as a commuter pass, for example, If it was when a plurality of ticket gate equipment which performs the ticket gate was installed side by side, it was easy to be subject to the influence of the power waves from other ticket gate equipment which approached, and there was fault that measures, such as shielding, were needed.

[0006]

If it is in the method of transmitting power waves and data waves on different frequency, As compared with data waves, power waves are very big electric power (for example, 10 twice as many 7th power electric power as this), and the data waves of weak electric power will receive the superimposed signal carried out to the power waves of big electric power in the antenna which receives data waves by the wireless card side.

[0007]

However, it is in the actual condition which the practical art which extracts data waves from power waves has not established. In order to extract data waves, what used the coil element is considered easily, but the coil element is not suitable as an element which a shape dimension mounts on a wireless card largely.

[0008]

The coil element is not suitable for 1-chip IC (integrated circuit) changing the circuit mounted on a wireless card. It is common to use conventionally the high frequency which multiplied the first frequency of power waves as a response wave from a wireless card to a radio card reader writer, and it needed the measure against the spurious radiation by a multiplying circuit.

[0009]
If it was in the method of transmitting power waves and data waves on different frequency from a radio card reader writer, there was fault that sufficient space to arrange the antenna which receives power waves and data waves to a wireless card, respectively was not obtained.
[0010]
And although power waves are transmitted with very big electric power from a radio card reader writer as compared with data waves, Power waves must be received efficiently, it becomes what has a big outside diameter size of the antenna for power waves which is needed with a wireless card only by it, and the arrangement is difficult for securing operation power capacity sufficient with a wireless card.
[0011]
Then, the present invention has few possibilities that the antenna for power waves and the antenna for data waves may be covered by the digiti manus holding this card, etc. when holding up this card to a communication apparatus, And it aims at providing the wireless card whose positive transmission and reception each antenna serves as substantially same receiving condition, and are attained.
[Means for solving problem]
[0012]
The wireless cards of the present invention are power waves of the first frequency transmitted from an external communication apparatus. And it is a wireless card which receives the data waves of the above-mentioned first frequency and different second frequency, respectively, While arranging the first coil that forms the antenna for power waves which receives the aforementioned power waves in the central part of one surface of the card shape substrate of the rectangle formed by the component which transmits an electric wave, The second coil which forms the antenna for data waves which receives the aforementioned data waves is arranged so that it may become the above-mentioned first coil and a double ring in the central part of one surface of the aforementioned substrate.
[Effect of the Invention]
[0013]
The first coil that forms in the central part of the card the antenna for power waves which receives power waves according to the wireless card of the present invention, By

arranging the second coil which forms the antenna for data waves which receives data waves so that it may become a double ring, When holding up to a communication apparatus, there are few possibilities that a first coil and second coil may be covered with the finger holding this card, etc., moreover, a first coil and second coil serve as substantially same receiving condition, and the receiving conditions of both coils do not differ substantially.

[0014]

According to the wireless card of the present invention, there is no possibility that a first coil and second coil may be covered with the finger holding this card, etc., by arranging by making a first coil and second coil into a flat rectangle to the central ward classified into three by the shorter side of this card.

[0015]

According to the wireless card of the present invention, by arranging a second coil to the inside surrounded by the first coil on the same plane of a substrate, power waves can be received more efficiently, capacity of operation power is made so much to a big thing, and it can operate reliably.

[Best Mode of Carrying Out the Invention]

[0016]

Hereinafter, with reference to Drawings, it describes about an embodiment of the invention.

Fig.1 shows the composition of the wireless communication system with which the wireless card concerning this embodiment is applied -- it comes out. This wireless communication system comprises the radio card reader writer 10 and the wireless card 20 as a communication apparatus which communicate by non-contact. From the radio card reader writer 10, with big continuous unmodulated electric power, the power waves f1 of first frequency, And the data waves f2 of second frequency lower than first frequency are transmitted to the wireless card 20 via the antenna 11 for power waves, and the antenna 12 for data waves, respectively with the weak electric power by which ASK modulation was carried out with the data signal.

[0017]

The first frequency of the power waves f1 is 13.56 MHz here, for example, and the second frequency of the data waves f2 is 3.39 MHz which carried out 1 / 4 dividing of the first frequency, for example. The power waves f1 are transmitted with twice as many electric power as this the 7th power of 10 as opposed to the data waves f2.

[0018]

The wireless card 20, The antenna 24 for data waves which consists of the antenna 21 for power waves which consists of the parallel circuit of the first coil L1 and the first capacitor C1, the rectification circuit 22 for power supply generation, the frequency divider 23, and the parallel circuit of the second coil L2 and the second capacitor C2, the transceiver change-over switch 25, the demodulator circuit 26, It is constituted by the modulation circuit 27 and CPU(central processing unit) 28 as a control means.

[0019]

That is, in the wireless card 20, it is rectified in the rectification circuit 22, the power waves f1 received with the antenna 21 for power waves serve as direct current voltage, and this is used as operation power +B. Some power waves f1 received with the antenna 21 for power waves are sent to the frequency divider 23, for example, the second frequency as a dividing signal by which 1 / 4 dividing were carried out is generated, and it is sent to the modulation circuit 27 here.

[0020]

The reply signal over the radio card reader writer 10 is input into the modulation circuit 27 from CPU28, and it is sent to it as the response wave f3 at the transceiver change-over switch 25 at the time which the second frequency by which ASK modulation was carried out with this reply signal shows to Fig.6. While the input signal containing the data waves received with the antenna 24 for data waves is sent to the demodulator circuit 26 via the transceiver change-over switch 25 and data waves are extracted suitably, waveform shaping is carried out, and it gets over as a data signal, and is sent to CPU28.

[0021]

Although the antenna 24 for data waves is an LC resonance circuit, it is setting the resonance frequency as the second frequency of the data waves f2 and reception of the power waves f1 is oppressed compared with reception of the data waves f2, Since the Q factor of an antenna is not steep, it is hard to say that it is sufficient to extract only the data waves f2.

[0022]

And transmit the input from the antenna 24 for data waves to the demodulator circuit 26 by inputting a transceiver switching signal into the transceiver change-over switch

25 from CPU28, or. Or change control is carried out suitably that it should transmit so that the response wave f3 modulated from the modulation circuit 27 may be turned to the radio card reader writer 10 from the antenna 24 for data waves and it may transmit.

[0023]

The demodulator circuit 26 is constituted by the extracting circuit 26a which extracts the received data waves, for example, and the shaping circuit 26b which shapes the extracted data-waves signal in waveform and carries out the demodulation output of the data signal.

[0024]

The circuit component of the wireless card 20 is formed into 1-chip IC29 except for the first coil L1 that forms the antenna 21 for power waves, and the second coil L2 which forms the antenna 24 for data waves.

[0025]

Fig.2 shows the composition of the extracting circuit 26a in the demodulator circuit 26 in detail. That is, the data-waves signal from the antenna 24 for data waves is input into the input terminal 31. The input terminal 31 is connected to the base of NPN transistor T1 of the first amplifying circuit 32 via the capacitor C3 for DC blocking. The collector of the transistor T1 is connected to operation power +B via the parallel circuit of the collector resistance R1 and the collector capacitor C4. The emitter of the transistor T1 is grounded via the parallel circuit of the emitter resistance R2 and the emitter capacitor C5. While the collector and base of the transistor T1 are connected via the bias resistance R3, the collector of the transistor T1 is connected to the base of NPN transistor T2 of the second amplifying circuit 33 via the capacitor C6 for DC blocking.

[0026]

While the collector of the transistor T2 is connected to operation power +B via the parallel circuit of the collector resistance R4 and the collector capacitor C7, the emitter of the transistor T2 is grounded. While the collector and base of the transistor T2 are connected via the bias resistance R5, the base of the transistor T2 is grounded via the bias resistance R6. The collector of the transistor T2 is connected to the base of NPN transistor T3 of the 3rd amplifying circuit 34 via the capacitor C8 for DC blocking.

[0027]

While the collector of transistor T3 is connected to operation power +B via the parallel circuit of the collector resistance R7 and the collector capacitor C9, the emitter of transistor T3 is grounded. The base of transistor T3 is grounded via the bias resistance R9 while being connected to operation power +B via the bias resistance R8. The collector of transistor T3 is connected to the base of NPN transistor T4 of the 4th amplifying circuit 35 via the capacitor C10 for DC blocking.

[0028]

While the collector of the transistor T4 is connected to operation power +B via the parallel circuit of the collector resistance R10 and the collector capacitor C11, the emitter of the transistor T4 is grounded. While the collector and base of the transistor T4 are connected via the bias resistance R11, the collector of the transistor T4 is connected to the outgoing end 36 via the resistance R12.

[0029]

In the extracting circuit 29 of such composition, the bias set is made so that the 1st - the 4th amplifying circuit 32, 33, 34, and 35 may operate as B class or a C class. Then, although the data waves f2 of the weak electric power d1 seem to show the input signal given to the input terminal 31 in the superimposed Fig.3 (a) carried out at the power waves f1 of the big electric power b1, The data waves f2 are amplified on a high gain by the amplifying operation of B class of the first amplifying circuit 32, or C class, and the power waves f1 are amplified on a gain smaller than this.

[0030]

As a result, as an amplified output of the first amplifying circuit 32, as shown in Fig.3 (b), the electric power of the data waves f2 is amplified to D1, and the rate of a relative ratio of electric power with the power waves f1 is improved. Then, by amplifying similarly in the 2nd, 3rd, and 4th amplifying circuit 33, 34, and 35, the electric power of the data waves f2 is amplified more, and the rate of a relative ratio with the power waves f1 may be improved substantially.

[0031]

In the 1st and 4th amplifying circuit 32 and 35, each base of the transistors T1 and T4 may be grounded via bias resistance. In the 2nd, 3rd, and 4th amplifying circuit 33, 34, and 35, each emitter of the transistor T2, T3, and T4 may be grounded via emitter resistance, and bias voltage may be set up to become C class operation more.

[0032]

One of circuits may be excluded and one of circuits may be in the 1st which constitutes the extracting circuit 26a - the 4th amplifying circuit 32, 33, 34, and 35 duplicately. In short, according to the rate of a relative ratio of the electric power of the superimposed data waves f2 carried out, the number of stages of an amplifying circuit may be suitably set to the power waves f1 input at it. Therefore, the extracting circuit 26a may comprise one step of amplifying circuit.

[0033]

To each transistor T1 and T2 of the 1st - the 4th amplifying circuit 32, 33, 34, and 35, T3, and the collector of T4, The collector capacitors C4, C7, C9, and C11 are provided, and as these amplifying-circuit characteristics are shown in Fig.4, in higher frequency, a gain is deteriorated to the frequency signal more than predetermined frequency. Then, the gain of the power waves f1 of high frequency is made to be deteriorated by setting the second frequency of the data waves f2 as the neighborhood a gain is deteriorated to frequency, amplification is oppressed, and the data waves f2 of low frequency can be amplified on a high gain. The power waves f1 to the data waves f2 can be extracted also from such the amplifying-circuit characteristic.

[0034]

By the way, if it is in the first amplifying circuit 32, and the emitter resistance R2 is provided and the transistor T1 conducts, emitter potential will rise and voltage negative feedback will act. Since the bias resistance R3 has connected between collectors with the base of the transistor T1, if the transistor T1 conducts, collector potential will descend and base potential will also descend in connection with this. Therefore, current negative feedback acts. Therefore, in both the first amplifying circuits 32, voltage and current negative feedback act and the saturation of the transistor T1 is avoided. If it is in the 2nd and 4th amplifying circuit 33 and 35, current negative feedback acts by the bias resistance R5 and R11, and the saturation of the transistors T2 and T4 is avoided. It does not become the data waves f2 are distorted or impossible saturation's detecting this.

[0035]

A signal as shows the extracting circuit 26a to Fig.5 (b) to an input signal as shown in Fig.5 (a) by each amplifying operation of the 1st - the 4th amplifying circuit 32, 33, 34, and 35 like **** is outputted to the outgoing end 36. That is, the input which was the electric power d1 of the data waves f2 turns into the electric power D4 of the data waves f2 to electric power B4 of the power waves f1 to the electric power b1 of the power waves f1, and it becomes what has a big rate of a relative ratio of the electric power of the data waves f2. Then, it can restore to a data signal as easily shown in Fig.5 (c) by shaping in waveform suitably the output of the extracting circuit 26a as shown in Fig.5 (b) in the shaping circuit 26b.

[0036]

In the above-mentioned description, although NPN transistors T1 and T2, T3, and T4 are used as each amplifier of the 1st - the 4th amplifying circuit 32, 33, 34, and 35, a field effect transistor may be used as an amplifier. While being able to inhibit the power consumption by the amplifying circuit itself and being able to give sufficient margin to the capacity of operation power by using a field effect transistor, it is suitable also although a 1-chip IC form is carried out.

[0037]

Next, with reference to Fig.7, it describes in detail about the structure of the wireless card 20. The wireless card 20 assembles and shines on the substrate 41 of the rectangle of the business-card size formed, the component, for example, the dielectric, which transmit an electric wave, as shown in Fig.7. That is, the first coil L1 and the second coil L2 are arranged at the central section P2 from which the surface of the substrate 41 was classified into three by strip shape by the shorter side side. It is formed in rectangular shape with both the 1st and the second flat coils L1 and L2, and it is substantially arranged on concentric so that it may become the inside surrounded with the first coil L1 with a ring with the second coil L2 double on the same plane.

[0038]

On the surface of the substrate 41, the ground foil 42 is provided by Type P3 on one long side side, and 1-chip IC29 is installed on this ground foil 42. It is suitably connected by the through hole (not shown) for carrying out the electrical link of the path cords 43 and 43, --, the surface and the back surface of the substrate 41 that 1chipIC29, the 1st, and the second coils L1 and L2 provided at the surface and the back surface of the substrate 41.

[0039]

The 1st and 2nd coil L1 and L2 and the ground foil 42, the path cords 43 and 43, and -- are formed by etching of conducting foil, vacuum evaporation of electric conduction metal, etc., for example.

[0040]

As shown in Fig.8 (a) and (b), the insulating layers 44 and 45 are laminated by the surface and the back surface of the substrate 41, respectively, and all the circuit components containing the 1st and the second coils L1 and L2 are sealed. Type P1 on the long side side of different another side from the long side side where the ground foil 42 was provided is attended, and the magnetic recording layer 46 is arranged by the surface of one insulating layer 44 or 45. Thus, as for the wireless card 20, an outside is formed in the card shape of the rectangle of business-card size as a whole.

[0041]

In such composition, the substrate 41 and the insulating layers 44 and 45, By having the wireless card 20 in the hand 30, turning the surface or the back surface of the wireless card 20 to the radio card reader writer 10, and holding it up, as shown in Fig.9 in order to make electromagnetic waves transmit, The antenna 21 for power waves containing the first coil L1 of a central part receives the power waves f1 from the radio card reader writer 10, the antenna 24 for data waves containing the second coil L2 receives the data waves f2, and it functions as the wireless card 20.

[0042]

Here, from the form of the rectangle of the business-card size of the wireless card 20, when holding up the wireless card 20 to the radio card reader writer 10, as shown in Fig.9, it is held with the long side side in many cases by the hand 30. As a result, there are few possibilities that the 1st arranged by the central section P2 classified into three by the shorter side side and the second coils L1 and L2 may be covered with the finger of the hand 30, etc., and they can receive reliably the power waves f1 and the data waves f2 so much.

[0043]

Since the first coil L1 was made into big form, the power waves f1 can be received so much efficiently, capacity of the operation power of the wireless card 20 can be made into a big thing, and operation of the wireless card 20 is made reliably.

[0044]

By and the thing for which the coil of another side is arranged to the inside surrounded with one coil so that it may become a double ring on the same plane about the first coil L1 and the second coil L2, One coil at the time of arranging and arranging next is covered with a finger etc., only the coil of another side cannot receive the power waves f1 or the data waves f2, and each receiving condition of the 1st and the second coils L1 and L21 becomes substantially the same.

[0045]

Since the insulating layers 44 and 45 are laminated so that the circuit component of the wireless card 20 may be sealed, it is hard to produce electric accidents, such as disconnection of a coil and a circuit short circuit, and rich in durability. And if the 1st, the second coils L1 and L2, etc. are constituted from etching or vacuum evaporation, it is suitable although manufactured in large quantities inexpensive.

[0046]

And if the wireless card 20 is used as a commuter pass etc., on the surface of one insulating layer 44 or 45, The term of validity, the popular use section, etc. are printed suitably, and the data of the above-mentioned term of validity, the popular use section, etc. is suitably recorded on the magnetic recording layer 46, and the data of the above-mentioned term of validity, the popular use section, etc. is suitably memorized by the storage cell of CPU28 still in a similar manner.

[0047]

Then, if the radio card reader writer 10 is installed in the automatic ticket gate machine of a station, etc., If the magnetic reader etc. are installed without performing an examination-of-tickets act in non-contact, and installing the radio card reader writer 10, If an examination-of-tickets act is performed using the data recorded on the magnetic recording layer 46 and this automatic ticket gate machine is not installed, either, the alphabetic data printed on the surface can perform an examination-of-tickets act.

[0048]

Although arranged to central section in the above-mentioned description by making the first coil L1 and the second coil L2 into flat rectangular shape, If the magnetic recording layer 46 is not provided, the 1st and the second coils L1 and L2 may be arranged so that a central part may be surrounded on the whole surface of the substrates 41 other than the place where 1-chip IC29 is mounted.

[0049]

It is not necessary to necessarily provide the first coil L1 and the second coil L2 to the central section uniformly classified into three by the shorter side side of the substrate 41, and they should just be arranged by the central part. The first coil L1 and the second coil L2 may be provided by the surface and the back surface of the substrate 41, respectively.

[0050]

According to the wireless communication system of the above-mentioned embodiment, as described above, since the low second frequency which carried out dividing of the first frequency of power waves is used, compared with the thing using the conventional multiplying circuit etc., the response wave from a wireless card has little spurious radiation, and it does not need the component for spurious radiation prevention for it. And since the second frequency which carried out dividing of the first frequency of power waves is used for both data waves and a response wave, data waves and a response wave can be transmitted [response wave] and received with one antenna. Therefore, it is suitable to the wireless card from which especially a miniaturization is requested.

[0051]

Since according to the wireless communication system of the above-mentioned embodiment the superimposed data waves carried out are extracted using the amplifying circuit where a gain is deteriorated to power waves so that frequency is high, The power waves of high frequency are oppressed, the data waves of low frequency are amplified on a high gain, the rate of a relative ratio to the power waves of data waves can be improved even in a proper size by providing the number of stages of an amplifying circuit suitably, and the recovery of the data waves by a shaping circuit to a data signal is easy.

[0052]

Since the superimposed data waves carried out are extracted using the amplifying circuit which operates by B class or C class to power waves according to the wireless communication system of the above-mentioned embodiment, The large power waves of electric power are oppressed, the superimposed weak data waves carried out are amplified by the envelope curve of power waves on a high gain, the rate of a relative ratio to the power waves of data waves can be improved even in a proper size by providing the number of stages of an amplifying circuit suitably, and the recovery of the data waves by a shaping circuit to a data signal is easy.

[0053]

According to the wireless communication system of the above-mentioned embodiment, by the data waves and the response wave which are transmitted and received between a radio card reader writer and a wireless card, since both ASK modulation is used, the circuit for restoring to a signal will become very easy. Since the amplifying circuit as an extracting circuit is formed without including a coil element, a circuit can be miniaturized as a coil element with a big dimension is not needed. And an IC form is easy.

[0054]

The first coil that forms in the central part of the card the antenna for power waves which receives power waves according to the wireless card of the above-mentioned embodiment, And since the second coil which forms the antenna for data waves which receives data waves was arranged so that it might become a double ring, When holding up to a radio card reader writer, there are few possibilities that a first coil and second coil may be covered with the finger holding this card, etc., moreover, a first coil and second coil serve as substantially same receiving condition, and the receiving conditions of both coils do not differ substantially. Since a first coil and second coil are provided on the substrate which makes electromagnetic waves transmit, it can communicate, even if it holds up which surface to wireless card reader rye.

[0055]

Since it has arranged to the central ward classified into three by the shorter side side of the substrate of the rectangle of business-card size by making a first coil and second coil into flat rectangular shape according to the wireless card of the above-mentioned embodiment, there is no possibility that a first coil and second coil may be covered with the finger holding this card, etc.

[0056]

Since the second coil has been arranged to the inside surrounded by the first coil on the same plane of a substrate according to the wireless card of the above-mentioned embodiment, power waves can be received more efficiently, capacity of operation power is made so much to a big thing, and it can operate reliably.

[0057]

Since the circuit component containing a first coil and second coil is sealed by the insulating layer according to the wireless card of the above-mentioned embodiment, it is hard to produce electric accidents, such as disconnection of a coil and a short circuit of a circuit, and rich in durability. And it can use only as a wireless card of a wireless communication system also as a magnetic card in which reading of data etc. are made between magnetic readers by recording the same contents as the data memorized by the storage cell of CPU, etc. on the magnetic recording layer provided on the surface of the insulating layer.

[0058]

Since the amplifying circuit operates as B class or a C class according to the extracting circuit of the demodulator circuit in the wireless card of the above-mentioned embodiment, the superimposed data waves carried out are amplified by power waves on a gain higher than power waves, the rate of a relative ratio of the electric power of the data waves to power waves is improved, and it becomes easy to extract data waves. And while being able to constitute a circuit small so much, excluding a coil element as a circuit configuration element, it is suitable to the IC form of a circuit. Therefore, like the circuit mounted on a wireless card, while there are dimensional restrictions, it is the optimal as an extracting circuit which constitutes the circuit where a 1-chip IC form is desired.

[0059]

Since it has the characteristic that a gain is deteriorated as frequency with a high amplifying circuit according to the extracting circuit of the above-mentioned embodiment, the power waves of high frequency serve as a low gain, and the data waves of frequency lower than it serve as a high gain. As a result, the rate of a relative ratio of the electric power of the data waves to power waves is improved, and an amplified output becomes easy to extract data waves.

[0060]

Since two or more steps of amplifying circuits where the rate of a relative ratio of the electric power of data waves is enlarged to power waves are connected according to the extracting circuit of the above-mentioned embodiment, the rate of a relative ratio which can extract data waves easily can be made by setting up a number of stages suitably according to the rate of a relative ratio of the electric power of the power waves of a first input, and data waves.

[Brief Description of the Drawings]

[0061]

[Drawing 1]The block diagram showing the composition of the wireless communication system concerning an embodiment of the invention.

[Drawing 2]The circuit diagram showing the specific configuration example of the extracting circuit in a demodulator circuit.
[Drawing 3]The wave form chart showing an example of the amplifying operation by an extracting circuit.
[Drawing 4]The characteristic figure of the frequency which the amplifying circuit of an extracting circuit has versus a gain.
[Drawing 5]The wave form chart for describing operation of an extracting circuit.
[Drawing 6]The wave form chart showing an example of the response wave transmitted from a wireless card.
[Drawing 7]It is the figure for describing the structure of a wireless card, and as for (a), it is a surface view and (b) is a back view.
[Drawing 8]With the figure which describes laminating an insulating layer on both sides of the substrate which constitutes a wireless card, (a) is a vertical section side view after lamination, and (b) is an exploded perspective view.
[Drawing 9]The perspective view showing an example of the busy condition of a wireless card.
[Explanations of letters or numerals]
[0062]
10 -- radio card reader writer (communication apparatus), 11 -- antenna for power waves, 12 -- antenna for data waves, 20 -- wireless card, 21 -- antenna for power waves, 22 -- rectification circuit, 23 -- frequency divider, 24 -- antenna for data waves, 25 -- transceiver change-over switch, 26 -- demodulator circuit, 26 a -- extracting circuit, 26 b -- shaping circuit, 27 -- modulation circuit, 28 -- CPU (control means), 29 -- 1-chip IC, 32 - 35 -- amplifying circuit, and L1 [.... A path cord, 44, 45 / .... An insulating layer, 46 / .... A magnetic recording layer and f1 / .... Power waves and f2 / .... Data waves and f3 / .... Response wave.] -- A first coil, L2 .... A second coil, 41 .... A substrate, 43

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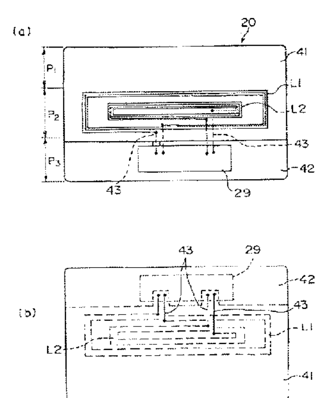
(54)【発明の名称】無線カード

(57)【要約】
【課題】本カードを通信装置に対してかざす際に、本カードを保持する手の指などで電力波用アンテナおよびデータ波用アンテナが覆われるおそれが少なく、しかも、各アンテナはほぼ同様の受信状況となり、確実な送受信が可能となる無線カードを提供する。
【解決手段】外部の通信装置から送信される第１の周波数の電力波、および、前記第１の周波数と異なる第２の周波数のデータ波をそれぞれ受信する無線カードにおいて、前記電力波を受信する電力波用アンテナを形成する第１のコイルを電波を透過する部材で形成された長方形のカード状基板の一方の面の中央部に配設するとともに、前記データ波を受信するデータ波用アンテナを形成する第２のコイルを前記基板の一方の面の中央部で前記第１のコイルと２重の輪となるように配設してなる。
【選択図】　図７



【特許請求の範囲】
【請求項１】
外部の通信装置から送信される第１の周波数の電力波、および、前記第１の周波数と異なる第２の周波数のデータ波をそれぞれ受信する無線カードであって、
前記電力波を受信する電力波用アンテナを形成する第１のコイルを電波を透過する部材で形成された長方形のカード状基板の一方の面の中央部に配設するとともに、前記データ波を受信するデータ波用アンテナを形成する第２のコイルを前記基板の一方の面の中央部で前記第１のコイルと２重の輪となるように配設してなることを特徴とする無線カード。
【請求項２】
前記第１のコイルおよび第２のコイルをそれぞれ偏平な長方形状に形成し、かつ、前記基板を短辺で３つに区分したときの中央区部に前記第１のコイルおよび第２のコイルをそれぞれ配設したことを特徴とする請求項１記載の無線カード。
【請求項３】
前記基板の同一平面上で前記第１のコイルで囲まれる内側に前記第２のコイルを配設したことを特徴とする請求項１記載の無線カード。
【請求項４】
前記第１のコイルおよび第２のコイルを除く回路部材を前記基板の３つに区分された一方の長辺側の区分に配設するとともに、前記第１のコイルおよび第２のコイルおよび回路部材が配設された前記基板の両面に絶縁層を積層し、前記基板の３つに区分された他方の長辺側の区分に臨んで片側の前記絶縁層の表面に磁気記録層を配設したことを特徴とする請求項２記載の無線カード。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、たとえば、携帯可能な無線通信機能を有する無電池式の無線カードと無線カードリーダ・ライタ（通信装置）との間で無線による送受信を行なうことにより、無線カードリーダ・ライタから無線カードに対して電力の送信やデータの送信および受信を行なうとともに、無線カードから無線カードリーダ・ライタに対してデータの送信および受信を行なう無線通信システムに用いられる無電池式の無線カードに関する。
【背景技術】
【０００２】
最近、ほぼ名刺サイズの長方形なカード状のＩＣカードによって構成された無線カードが開発され、この無線カードを無線カードリーダ・ライタの前にかざすことで、非接触により無線カードリーダ・ライタとの間で送受信を行なうことにより、データなどを授受する無線通信システムがある。この無線カードには、半導体メモリなどの記憶素子を含む制御手段（ＣＰＵ）が搭載されており、記憶素子に適宜なデータを記憶させておくことにより、ＩＤカード（個人識別カード）や定期券などとして用いることが可能となる。
【０００３】
従来の無線カードにあっては、搭載される回路素子の動作電源となる電池を搭載するようにしたものがあるが、電池の寿命および電池交換のためのコストなどが問題となっていた。
【０００４】
そこで、無線カードに電池などを搭載することなく、無線カードリーダ・ライタから送信される電波を無線カードで受信し、この受信電波を整流して動作電源用の直流電力を得る技術が提案されている。その１つの方法は、無線カードリーダ・ライタから、電力送信用の電力波をデータ信号で変調して、１つの周波数信号で電力およびデータをそれぞれ無線カードに送信するものである。他の方法は、無線カードリーダ・ライタから、電力送信用の電力波と、これとは異なる周波数でデータ送信用のデータ波との２つの周波数信号により、無線カードに対して電力およびデータをそれぞれ送信するものである。
【発明の開示】

【発明が解決しようとする課題】
【０００５】
電力波をデータ信号で変調した１つの周波数信号を用いる方法にあっては、無線カード側でのデータ信号の復調が比較的に簡単である。しかるに、同一周波数を用いた複数の無線通信システムが近接して設けられた場合、たとえば、無線カードを定期券として、その改札を行なう複数の改札装置が並設された場合などにあっては、近接した他の改札装置からの電力波の影響を受け易く、遮蔽などの対応策が必要となるという不具合があった。
【０００６】
また、電力波とデータ波を異なる周波数で送信する方法にあっては、データ波に比較して電力波が極めて大きな電力（たとえば１０の７乗倍の電力）であり、無線カード側でデータ波を受信するアンテナでは、大きな電力の電力波に微弱な電力のデータ波が重畳された信号を受信することとなる。
【０００７】
ところが、電力波からデータ波を抽出する実用的技術が確立していない現状にある。データ波を抽出するために、コイル素子を用いたものが容易に考えられるが、コイル素子は形状寸法が大きく、無線カードに搭載する素子として適していない。
【０００８】
また、無線カードに搭載する回路を１チップＩＣ（集積回路）化するにも、コイル素子は適していない。さらに、従来は、無線カードから無線カードリーダ・ライタへの応答波としては、電力波の第１の周波数を逓倍した高周波を用いるのが一般的であり、逓倍回路による不要輻射への対策を必要としていた。
【０００９】
また、無線カードリーダ・ライタから、電力波とデータ波を異なる周波数で送信する方法にあっては、無線カードに、電力波とデータ波をそれぞれ受信するアンテナを配設するのに充分なスペースが得られないという不具合があった。
【００１０】
そして、無線カードリーダ・ライタからは、データ波に比較して電力波が極めて大きな電力で送信されるが、無線カードで充分な動作電源容量を確保するには電力波を効率よく受信しなければならず、それだけで無線カードで必要となる電力波用アンテナの外径寸法が大きなものとなり、その配置が困難である。
【００１１】
そこで、本発明は、本カードを通信装置に対してかざす際に、本カードを保持する手の指などで電力波用アンテナおよびデータ波用アンテナが覆われるおそれが少なく、しかも、各アンテナはほぼ同様の受信状況となり、確実な送受信が可能となる無線カードを提供することを目的とする。
【課題を解決するための手段】
【００１２】
本発明の無線カードは、外部の通信装置から送信される第１の周波数の電力波、および、前記第１の周波数と異なる第２の周波数のデータ波をそれぞれ受信する無線カードであって、前記電力波を受信する電力波用アンテナを形成する第１のコイルを電波を透過する部材で形成された長方形のカード状基板の一方の面の中央部に配設するとともに、前記データ波を受信するデータ波用アンテナを形成する第２のコイルを前記基板の一方の面の中央部で前記第１のコイルと２重の輪となるように配設してなることを特徴とする。
【発明の効果】
【００１３】
本発明の無線カードによれば、カードの中央部に、電力波を受信する電力波用アンテナを形成する第１のコイルと、データ波を受信するデータ波用アンテナを形成する第２のコイルとを２重の輪となるように配設することにより、通信装置にかざす際に、本カードを保持する指などで第１のコイルおよび第２のコイルが覆われる虞れが少なく、しかも、第１のコイルおよび第２のコイルはほぼ同様の受信状況となり、双方のコイルの受信状況が

大幅に異なるようなことはない。

【００１４】

また、本発明の無線カードによれば、第１のコイルおよび第２のコイルを偏平な長方形として、本カードの短辺で３つに区分した中央区部に配設することにより、本カードを保持する指などで第１のコイルおよび第２のコイルが覆われる虞れがない。

【００１５】

また、本発明の無線カードによれば、基板の同一平面上で第１のコイルに囲まれる内側に第２のコイルを配設することにより、電力波をより効率よく受信することができ、それだけ動作電源の容量を大きなものにでき、動作を確実になし得る。

【発明を実施するための最良の形態】

【００１６】

以下、本発明の実施の形態について図面を参照して説明する。

図１は、本実施の形態に係る無線カードが適用される無線通信システムの構成を示すである。この無線通信システムは、非接触で通信を行なう通信装置としての無線カードリーダ・ライタ１０と無線カード２０とから構成される。無線カードリーダ・ライタ１０からは、連続した無変調の大きな電力で第１の周波数の電力波ｆ１、および、データ信号によりＡＳＫ変調された微弱な電力で第１の周波数よりも低い第２の周波数のデータ波ｆ２が、それぞれ電力波用アンテナ１１、データ波用アンテナ１２を介して無線カード２０に対して送信される。

【００１７】

ここに、電力波ｆ１の第１の周波数は、たとえば、１３．５６ＭＨｚであり、データ波ｆ２の第２の周波数は、たとえば、第１の周波数を１／４分周した３．３９ＭＨｚである。また、電力波ｆ１は、データ波ｆ２に対して、たとえば、１０の７乗倍の電力で送信される。

【００１８】

無線カード２０は、第１のコイルＬ１と第１のコンデンサＣ１との並列回路からなる電力波用アンテナ２１、電源生成用の整流回路２２、分周回路２３、第２のコイルＬ２と第２のコンデンサＣ２との並列回路からなるデータ波用アンテナ２４、送受信切換スイッチ２５、復調回路２６、変調回路２７、および、制御手段としてのＣＰＵ（セントラル・プロセッシング・ユニット）２８によって構成されている。

【００１９】

すなわち、無線カード２０において、電力波用アンテナ２１で受信された電力波ｆ１は、整流回路２２で整流されて直流電圧となり、これが動作電源＋Ｂとして用いられる。また、電力波用アンテナ２１で受信された電力波ｆ１の一部は、分周回路２３に送られ、ここで、たとえば、１／４分周された分周信号としての第２の周波数が生成され、変調回路２７に送られる。

【００２０】

変調回路２７には、ＣＰＵ２８から無線カードリーダ・ライタ１０に対する応答信号が入力され、この応答信号でＡＳＫ変調された第２の周波数が図６に示すごとき応答波ｆ３として送受信切換スイッチ２５に送られる。また、データ波用アンテナ２４で受信されたデータ波を含む入力信号が送受信切換スイッチ２５を介して復調回路２６に送られ、データ波が適宜に抽出されるとともに、波形整形されてデータ信号として復調され、ＣＰＵ２８に送られる。

【００２１】

なお、データ波用アンテナ２４は、ＬＣ共振回路であり、その共振周波数をデータ波ｆ２の第２の周波数に設定することで、電力波ｆ１の受信がデータ波ｆ２の受信に比べて抑圧されるが、アンテナのＱ特性が急峻でないために、データ波ｆ２のみを抽出するには充分とは言い難い。

【００２２】

そして、送受信切換スイッチ２５には、ＣＰＵ２８から送受信切換信号が入力されるこ

とにより、データ波用アンテナ２４からの入力を復調回路２６に伝送したり、あるいは、変調回路２７からの変調された応答波ｆ３をデータ波用アンテナ２４から無線カードリーダ・ライタ１０に向けて送信するよう伝達すべく、適宜に切換え制御される。

【００２３】
復調回路２６は、たとえば、受信したデータ波を抽出する抽出回路２６ａ、および、抽出されたデータ波信号を波形整形してデータ信号を復調出力する整形回路２６ｂによって構成されている。

【００２４】
なお、無線カード２０の回路部材は、電力波用アンテナ２１を形成する第１のコイルＬ１、および、データ波用アンテナ２４を形成する第２のコイルＬ２を除いて、１チップＩＣ２９化されている。

【００２５】
図２は、復調回路２６における抽出回路２６ａの構成を詳細に示している。すなわち、データ波用アンテナ２４からのデータ波信号は、入力端３１に入力される。入力端３１は、直流阻止用コンデンサＣ３を介して第１の増幅回路３２のＮＰＮ形トランジスタＴ１のベースに接続される。トランジスタＴ１のコレクタは、コレクタ抵抗Ｒ１とコレクタコンデンサＣ４との並列回路を介して動作電源＋Ｂに接続される。トランジスタＴ１のエミッタは、エミッタ抵抗Ｒ２とエミッタコンデンサＣ５の並列回路を介して接地される。トランジスタＴ１のコレクタとベースとがバイアス抵抗Ｒ３を介して接続されるとともに、トランジスタＴ１のコレクタは、直流阻止用コンデンサＣ６を介して第２の増幅回路３３のＮＰＮ形トランジスタＴ２のベースに接続される。

【００２６】
トランジスタＴ２のコレクタは、コレクタ抵抗Ｒ４とコレクタコンデンサＣ７との並列回路を介して動作電源＋Ｂに接続されるとともに、トランジスタＴ２のエミッタは接地される。トランジスタＴ２のコレクタとベースとがバイアス抵抗Ｒ５を介して接続されるとともに、トランジスタＴ２のベースはバイアス抵抗Ｒ６を介して接地される。トランジスタＴ２のコレクタは、直流阻止用コンデンサＣ８を介して、第３の増幅回路３４のＮＰＮ形トランジスタＴ３のベースに接続される。

【００２７】
トランジスタＴ３のコレクタは、コレクタ抵抗Ｒ７とコレクタコンデンサＣ９との並列回路を介して動作電源＋Ｂに接続されるとともに、トランジスタＴ３のエミッタは接地される。トランジスタＴ３のベースは、バイアス抵抗Ｒ８を介して動作電源＋Ｂに接続されるとともに、バイアス抵抗Ｒ９を介して接地される。トランジスタＴ３のコレクタは、直流阻止用コンデンサＣ１０を介して第４の増幅回路３５のＮＰＮ形トランジスタＴ４のベースに接続される。

【００２８】
トランジスタＴ４のコレクタは、コレクタ抵抗Ｒ１０とコレクタコンデンサＣ１１との並列回路を介して動作電源＋Ｂに接続されるとともに、トランジスタＴ４のエミッタは接地される。トランジスタＴ４のコレクタとベースとがバイアス抵抗Ｒ１１を介して接続されるとともに、トランジスタＴ４のコレクタは、抵抗Ｒ１２を介して出力端３６に接続される。

【００２９】
このような構成の抽出回路２９において、第１～第４の増幅回路３２，３３，３４，３５は、Ｂ級またはＣ級として動作するようにバイアス設定がなされている。そこで、入力端３１に与えられる入力信号は、大きな電力ｂ１の電力波ｆ１に微弱な電力ｄ１のデータ波ｆ２が重畳された図３（ａ）に示すようなものであるが、第１の増幅回路３２のＢ級またはＣ級の増幅動作により、データ波ｆ２が高い利得で増幅され、電力波ｆ１はこれよりも小さい利得で増幅される。

【００３０】
この結果、第１の増幅回路３２の増幅出力としては、図３（ｂ）に示すように、データ

波ｆ２の電力がＤ１まで増幅され、電力波ｆ１との電力の相対比率が改善される。そこで、第２，第３，第４の増幅回路３３，３４，３５で同様に増幅することで、よりデータ波ｆ２の電力が増幅されて、電力波ｆ１との相対比率が大幅に改善され得る。

【００３１】

なお、第１，第４の増幅回路３２，３５において、トランジスタＴ１，Ｔ４の各ベースをバイアス抵抗を介して接地してもよい。また、第２，第３，第４の増幅回路３３，３４，３５において、トランジスタＴ２，Ｔ３，Ｔ４の各エミッタをエミッタ抵抗を介して接地し、バイアス電圧をよりＣ級動作となるように設定してもよい。

【００３２】

さらに、抽出回路２６ａを構成する第１～第４の増幅回路３２，３３，３４，３５は、いずれかの回路が省かれていてもよく、また、いずれかの回路が重複していてもよい。要は、入力される電力波ｆ１と、それに重畳されるデータ波ｆ２の電力の相対比率に応じて適宜に増幅回路の段数を設定すればよい。したがって、１段の増幅回路で抽出回路２６ａが構成されていてもよい。

【００３３】

また、第１～第４の増幅回路３２，３３，３４，３５の各トランジスタＴ１，Ｔ２，Ｔ３，Ｔ４のコレクタには、コレクタコンデンサＣ４，Ｃ７，Ｃ９，Ｃ１１が設けられており、これらの増幅回路特性は、図４に示すように、所定周波数以上の周波数信号に対して、高い周波数ほど利得が低下する。そこで、データ波ｆ２の第２の周波数を、周波数に対して利得が低下する付近に設定することで、高い周波数の電力波ｆ１の利得を低下させて増幅を抑圧し、低い周波数のデータ波ｆ２を高い利得で増幅し得る。このような増幅回路特性からも、電力波ｆ１からデータ波ｆ２を抽出し得る。

【００３４】

ところで、第１の増幅回路３２にあっては、エミッタ抵抗Ｒ２が設けられており、トランジスタＴ１が導通するとエミッタ電位が上昇し、電圧負帰還が作用する。また、バイアス抵抗Ｒ３がトランジスタＴ１のベースとコレクタ間を接続しているので、トランジスタＴ１が導通するとコレクタ電位が下降し、これに伴いベース電位も下降する。よって、電流負帰還が作用する。したがって、第１の増幅回路３２は、電圧と電流負帰還がともに作用し、トランジスタＴ１の飽和が回避される。また、第２，第４の増幅回路３３，３５にあっては、バイアス抵抗Ｒ５，Ｒ１１により電流負帰還が作用し、トランジスタＴ２，Ｔ４の飽和が回避される。これにより、データ波ｆ２が歪んだり、飽和により検出不能となるようなことがない。

【００３５】

上述のごとき、第１～第４の増幅回路３２，３３，３４，３５の各増幅動作により、抽出回路２６ａは、図５（ａ）に示すような入力信号に対して、図５（ｂ）に示すような信号が出力端３６に出力される。すなわち、電力波ｆ１の電力ｂ１に対してデータ波ｆ２の電力ｄ１であった入力が、電力波ｆ１の電力Ｂ４に対してデータ波ｆ２の電力Ｄ４となり、データ波ｆ２の電力の相対比率が大きなものとなる。そこで、図５（ｂ）に示すような抽出回路２６ａの出力を、適宜に整形回路２６ｂで波形整形することで、容易に図５（ｃ）に示すようなデータ信号を復調できる。

【００３６】

なお、上記説明では、第１～第４の増幅回路３２，３３，３４，３５の各増幅素子としてＮＰＮ形トランジスタＴ１，Ｔ２，Ｔ３，Ｔ４を用いているが、増幅素子として電界効果トランジスタを用いてもよい。電界効果トランジスタを用いることで、増幅回路自体による消費電力を抑制することができ、動作電源の容量に充分な余裕を与えることができるとともに、１チップＩＣ化するのにも好適である。

【００３７】

次に、無線カード２０の構造について、図７を参照して詳細に説明する。無線カード２０は、図７に示すごとく、電波を透過する部材たとえば誘電体で形成された名刺大の長方形の基板４１上に組み立てられている。すなわち、基板４１の表面が短辺側で３つに短冊

状に区分された中央区分Ｐ２に、第１のコイルＬ１および第２のコイルＬ２が配置される。第１，第２のコイルＬ１，Ｌ２はともに、偏平な長方形状に形成され、第１のコイルＬ１で囲まれる内側に第２のコイルＬ２が同一平面上で２重の輪となるようにほぼ同心上に配置される。

【００３８】

また、基板４１の表面で、一方の長辺側の区分Ｐ３には、グランド箔４２が設けられ、このグランド箔４２上に１チップＩＣ２９が設置されている。１チップＩＣ２９および第１，第２のコイルＬ１，Ｌ２は、基板４１の表面と裏面に設けた接続線４３，４３，…および基板４１の表面と裏面とを電気的接続するためのスルーホール（図示せず）により適宜に接続される。

【００３９】

なお、第１，第２コイルＬ１，Ｌ２およびグランド箔４２および接続線４３，４３，…は、たとえば、導電箔のエッチングや導電金属の蒸着などにより形成される。

【００４０】

さらに、基板４１の表面および裏面には、図８（ａ）（ｂ）に示すように、絶縁層４４，４５がそれぞれ積層形成されて、第１，第２のコイルＬ１，Ｌ２を含む回路部材が全て密封されている。また、グランド箔４２が設けられた長辺側とは異なる他方の長辺側の区分Ｐ１に臨んで、磁気記録層４６が一方の絶縁層４４または４５の表面に配設される。このようにして、無線カード２０は、全体として外形が名刺大の長方形のカード状に形成される。

【００４１】

このような構成において、基板４１および絶縁層４４，４５は、電磁波を透過させるため、図９に示すように、無線カード２０を手３０に持って、無線カード２０の表面または裏面を無線カードリーダ・ライタ１０に向けてかざすことで、無線カードリーダ・ライタ１０からの電力波ｆ１を中央部の第１のコイルＬ１を含む電力波用アンテナ２１で受信し、データ波ｆ２を第２のコイルＬ２を含むデータ波用アンテナ２４で受信し、無線カード２０として機能する。

【００４２】

ここで、無線カード２０を無線カードリーダ・ライタ１０にかざす際には、無線カード２０の名刺大の長方形の形状から、図９に示すように、手３０で長辺側を持って保持される場合が多い。この結果、短辺側で３つに区分した中央区分Ｐ２に配設された第１，第２のコイルＬ１，Ｌ２が、手３０の指などで覆われる虞れが少なく、それだけ電力波ｆ１およびデータ波ｆ２を確実に受信し得る。

【００４３】

また、第１のコイルＬ１を大きな形状としたので、それだけ電力波ｆ１を効率よく受信でき、無線カード２０の動作電源の容量を大きなものとすることができ、無線カード２０の動作が確実になされる。

【００４４】

そして、第１のコイルＬ１および第２のコイルＬ２を同一平面上で２重の輪となるように、一方のコイルで囲まれる内側に他方のコイルを配設することで、隣に並べて配設した場合の一方のコイルが指などで覆われ、他方のコイルのみが電力波ｆ１またはデータ波ｆ２を受信できるようなことがなく、第１および第２のコイルＬ１，Ｌ２１の各受信状況はほぼ同様となる。

【００４５】

さらに、無線カード２０の回路部材が密封されるように、絶縁層４４，４５が積層形成されるので、コイルの断線や回路短絡などの電気的事故が生じにくく、また、耐久性に富む。しかも、第１，第２のコイルＬ１，Ｌ２などをエッチングや蒸着で構成すれば、安価に大量に製造するのに好適である。

【００４６】

そして、無線カード２０を例えば定期券などとして用いるならば、一方の絶縁層４４ま

たは４５の表面に、通用期間および通用区間などが適宜に印刷され、また、磁気記録層４６に上記通用期間および通用区間などのデータが適宜に記録され、さらに、同様にＣＰＵ２８の記憶素子に上記通用期間および通用区間などのデータが適宜に記憶される。

【００４７】
すると、駅の自動改札装置などに無線カードリーダ・ライタ１０が設置されていれば、非接触にて検札行為が実行され、また、無線カードリーダ・ライタ１０が設置されずに磁気読取装置などが設置されているならば、磁気記録層４６に記録されたデータを用いて検札行為を実行させ、かかる自動改札装置も設置されていなければ、表面に印刷された文字データにより検札行為を行なうことができる。

【００４８】
なお、上記説明では、第１のコイルＬ１および第２のコイルＬ２を偏平な長方形状として中央区分に配設したが、磁気記録層４６が設けられないならば、１チップＩＣ２９が搭載される場所以外の基板４１の表面全体で中央部を囲むように第１，第２のコイルＬ１，Ｌ２を配設してもよい。

【００４９】
また、第１のコイルＬ１および第２のコイルＬ２は、基板４１の短辺側で３つに均等に区分された中央区分に必ずしも設けなくてもよく、中央部に配設されればよい。さらに、第１のコイルＬ１および第２のコイルＬ２が基板４１の表面と裏面にそれぞれ設けられていてもよい。

【００５０】
以上説明したように、上記実施の形態の無線通信システムによれば、無線カードからの応答波に、電力波の第１の周波数を分周した低い第２の周波数を用いているので、従来の逓倍回路などを用いるものに比べて不要輻射が少なく、不要輻射防止のための部材を必要としない。しかも、データ波と応答波は、ともに電力波の第１の周波数を分周した第２の周波数を用いるので、データ波と応答波を１つのアンテナで送受信できる。したがって、特に小形化を要望される無線カードに好適である。

【００５１】
また、上記実施の形態の無線通信システムによれば、電力波に重畳されたデータ波を、周波数が高いほど利得が低下する増幅回路を用いて抽出するので、高い周波数の電力波が抑圧され、低い周波数のデータ波が高い利得で増幅され、増幅回路の段数を適宜に設けることで、データ波の電力波に対する相対比率を適宜な大きさにまで改善でき、整形回路によるデータ波からデータ信号の復調が容易である。

【００５２】
また、上記実施の形態の無線通信システムによれば、電力波に重畳されたデータ波を、Ｂ級またはＣ級で動作する増幅回路を用いて抽出するので、電力の大きい電力波が抑圧され、電力波の包絡線に重畳される微弱なデータ波が高い利得で増幅され、増幅回路の段数を適宜に設けることで、データ波の電力波に対する相対比率を適宜な大きさにまで改善でき、整形回路によるデータ波からデータ信号の復調が容易である。

【００５３】
さらに、上記実施の形態の無線通信システムによれば、無線カードリーダ・ライタと無線カードとの間で送受信されるデータ波と応答波で、ともにＡＳＫ変調を用いているので、信号を復調するための回路が極めて簡単なものとなる。さらに、抽出回路としての増幅回路を、コイル素子を含まずに形成するので、寸法の大きなコイル素子を必要としないだけ回路を小形化できる。しかも、ＩＣ化が容易である。

【００５４】
また、上記実施の形態の無線カードによれば、カードの中央部に、電力波を受信する電力波用アンテナを形成する第１のコイル、および、データ波を受信するデータ波用アンテナを形成する第２のコイルを２重の輪となるように配設したので、無線カードリーダ・ライタにかざす際に、本カードを保持する指などで第１のコイルおよび第２のコイルが覆われる虞れが少なく、しかも、第１のコイルおよび第２のコイルはほぼ同様の受信状況とな

り、双方のコイルの受信状況が大幅に異なるようなことはない。さらに、電磁波を透過させる基板上に第１のコイルおよび第２のコイルが設けられているので、いずれの面を無線カードリーダ・ライにかざしても通信を行なうことができる。

【００５５】

また、上記実施の形態の無線カードによれば、第１のコイルおよび第２のコイルを偏平な長方形状として、名刺大の長方形の基板の短辺側で３つに区分した中央区部に配置したので、本カードを保持する指などで第１のコイルおよび第２のコイルが覆われる虞れがない。

【００５６】

また、上記実施の形態の無線カードによれば、基板の同一平面上で第１のコイルに囲まれる内側に第２のコイルを配置したので、電力波をより効率よく受信することができ、それだけ動作電源の容量を大きなものにでき、動作を確実になし得る。

【００５７】

さらに、上記実施の形態の無線カードによれば、第１のコイルおよび第２のコイルを含む回路部材が絶縁層により密封されるので、コイルの断線や回路の短絡などの電気的事故が生じにくく、また、耐久性に富む。そして、ＣＰＵの記憶素子に記憶されているデータと同じ内容などを、絶縁層の表面に設けた磁気記録層に記録することで、無線通信システムの無線カードとしてのみならず、磁気読取装置との間でデータの読取りなどがなされる磁気カードとしても用いることができる。

【００５８】

また、上記実施の形態の無線カードにおける復調回路の抽出回路によれば、増幅回路がＢ級またはＣ級として動作するので、電力波に重畳されるデータ波が電力波よりも高い利得で増幅され、電力波に対するデータ波の電力の相対比率が改善され、データ波を抽出し易くなる。しかも、コイル素子を回路構成要素として含んでおらず、それだけ回路を小形に構成することができるとともに、回路のＩＣ化に好適である。したがって、無線カードに搭載される回路のように、寸法的制約があるとともに１チップＩＣ化が望まれる回路を構成する抽出回路として最適である。

【００５９】

また、上記実施の形態の抽出回路によれば、増幅回路が高い周波数ほど利得が低下する特性を有するので、高い周波数の電力波は低い利得となり、それよりも低い周波数のデータ波は高い利得となる。この結果、増幅出力は、電力波に対するデータ波の電力の相対比率が改善され、データ波を抽出し易くなる。

【００６０】

さらに、上記実施の形態の抽出回路によれば、電力波に対してデータ波の電力の相対比率を大きくする増幅回路を複数段接続するので、最初の入力の電力波とデータ波の電力の相対比率に応じて段数を適宜に設定することで、容易にデータ波を抽出し得る相対比率となし得る。

【図面の簡単な説明】

【００６１】

【図１】本発明の実施の形態に係る無線通信システムの構成を示すブロック図。

【図２】復調回路における抽出回路の具体的な構成例を示す回路図。

【図３】抽出回路による増幅動作の一例を示す波形図。

【図４】抽出回路の増幅回路が有する周波数対利得の特性図。

【図５】抽出回路の動作を説明するための波形図。

【図６】無線カードから送信される応答波の一例を示す波形図。

【図７】無線カードの構造を説明するための図で、（ａ）は表面図、（ｂ）は裏面図。

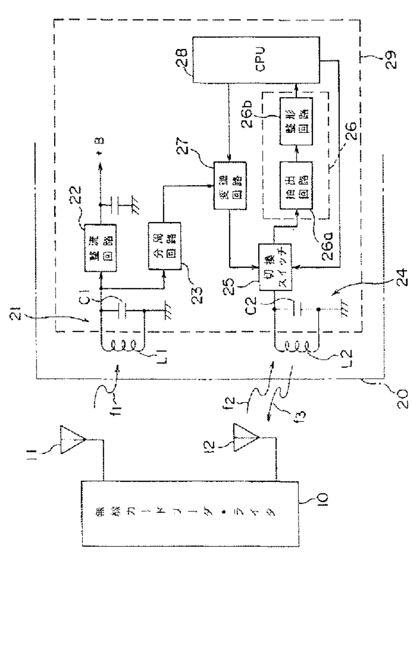
【図８】無線カードを構成する基板の両面に絶縁層を積層することを説明する図で、（ａ）は積層後の縦断側面図、（ｂ）は分解斜視図。

【図９】無線カードの使用状態の一例を示す斜視図。

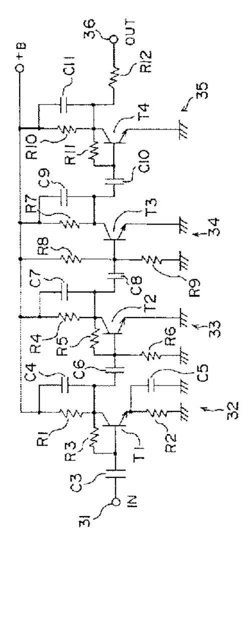
【符号の説明】

【００６２】
１０…無線カードリーダ・ライタ（通信装置）、１１…電力波用アンテナ、１２…データ波用アンテナ、２０…無線カード、２１…電力波用アンテナ、２２…整流回路、２３…分周回路、２４…データ波用アンテナ、２５…送受信切換スイッチ、２６…復調回路、２６ａ…抽出回路、２６ｂ…整形回路、２７…変調回路、２８…ＣＰＵ（制御手段）、２９…１チップＩＣ、３２～３５…増幅回路、Ｌ１…第１のコイル、Ｌ２……第２のコイル、４１……基板、４３……接続線、４４，４５……絶縁層、４６……磁気記録層、ｆ１……電力波、ｆ２……データ波、ｆ３……応答波。

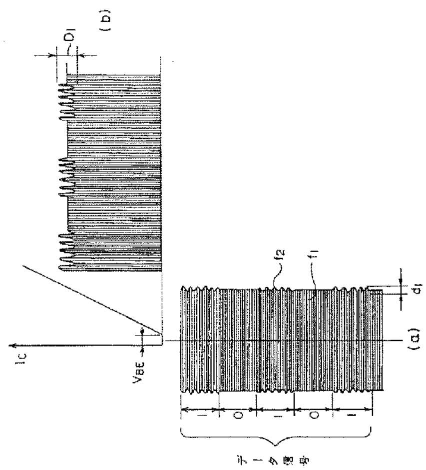
【図１】



【図２】

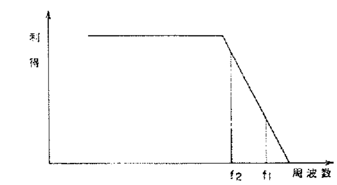


【図３】



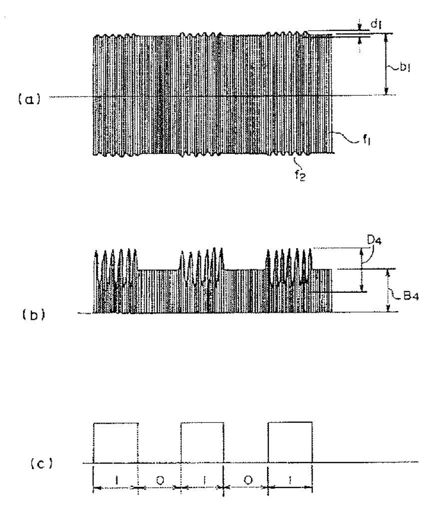
D1
(b)
f2
f1
d1
(a)
Ic
VBE
1
0
1
0
1

【図４】



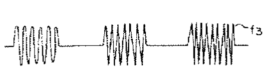
利得
f2
f1
周波数

【図５】



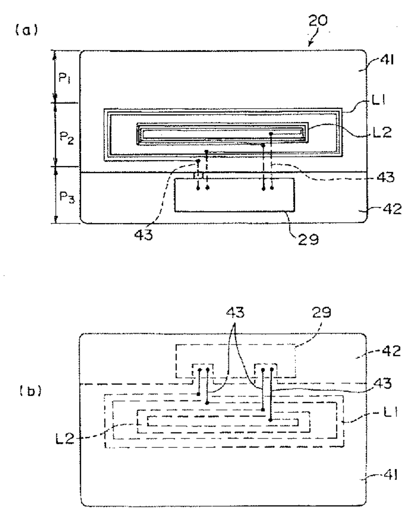
d1
b1
(a)
f1
f2
D4
B4
(b)
(c)
1
0
1
0
1

【図６】



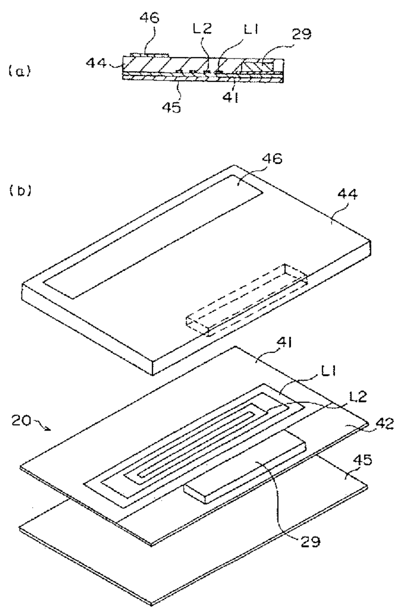
f3

【図７】

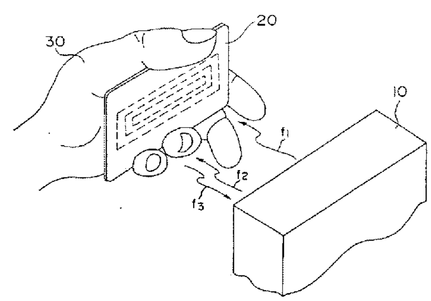


(a)
20
41
P1
P2
P3
L1
L2
43
42
29
(b)

【図８】



【図９】



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First Named Inventor/Applicant Name:	Jeong Wook AN
Filer:	Jeff Lloyd/Jessica Cowart
Attorney Docket Number:	SUN.LGI.420

Filed as Large Entity

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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				