AO 120 (Rev. 08/10)

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

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 District of Delaware on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	6/25/2015	District of Delaware

PLAINTIFF	DEFENDANT
Evolved Wireless, LLC	ZTE Corporation, ZTE (USA) Inc., and ZTE Solutions Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,746,916 B2	6/29/2010	Evolved Wireless, LLC
2	US 7,768,965 B2	8/3/2010	Evolved Wireless, LLC
3	US 7,809,373 B2	10/5/2010	Evolved Wireless, LLC
4	US 7,881,236 B2	2/1/2011	Evolved Wireless, LLC
5	US 8,218,481 B2	7/10/2012	Evolved Wireless, LLC

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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)

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

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 District of Delaware on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	6/25/2015	District of Delaware

PLAINTIFF	DEFENDANT
Evolved Wireless, LLC	Lenovo Group Ltd., Lenovo (United States) Inc., and Motorola Mobility LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,746,916 B2	6/29/2010	Evolved Wireless, LLC
2	US 7,768,965 B2	8/3/2010	Evolved Wireless, LLC
3	US 7,809,373 B2	10/5/2010	Evolved Wireless, LLC
4	US 7,881,236 B2	2/1/2011	Evolved Wireless, LLC
5	US 8,218,481 B2	7/10/2012	Evolved Wireless, LLC

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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)

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

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 District of Delaware on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	6/25/2015	District of Delaware

PLAINTIFF	DEFENDANT
Evolved Wireless, LLC	Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,746,916 B2	6/29/2010	Evolved Wireless, LLC
2	US 7,768,965 B2	8/3/2010	Evolved Wireless, LLC
3	US 7,809,373 B2	10/5/2010	Evolved Wireless, LLC
4	US 7,881,236 B2	2/1/2011	Evolved Wireless, LLC
5	US 8,218,481 B2	7/10/2012	Evolved Wireless, LLC

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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)

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

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 District of Delaware on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	6/25/2015	District of Delaware

PLAINTIFF	DEFENDANT
Evolved Wireless, LLC	Microsoft Corporation; Microsoft Mobile OY; Nokia Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,746,916 B2	6/29/2010	Evolved Wireless, LLC
2	US 7,768,965 B2	8/3/2010	Evolved Wireless, LLC
3	US 7,809,373 B2	10/5/2010	Evolved Wireless, LLC
4	US 7,881,236 B2	2/1/2011	Evolved Wireless, LLC
5	US 8,218,481 B2	7/10/2012	Evolved Wireless, LLC

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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)

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

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 District of Delaware on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	6/25/2015	District of Delaware

PLAINTIFF	DEFENDANT
Evolved Wireless, LLC	HTC Corporation and HTC America, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,746,916 B2	6/29/2010	Evolved Wireless, LLC
2	US 7,768,965 B2	8/3/2010	Evolved Wireless, LLC
3	US 7,809,373 B2	10/5/2010	Evolved Wireless, LLC
4	US 7,881,236 B2	2/1/2011	Evolved Wireless, LLC
5	US 8,218,481 B2	7/10/2012	Evolved Wireless, LLC

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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

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
11/563,909	11/28/2006	Seung Hee Han	7836-1

CONFIRMATION NO. 1721

POA ACCEPTANCE LETTER

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

OC000000071667572

Date Mailed: 11/04/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/30/2014.

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.

/agizaw/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

ZTE/SAMSUNG/HTC 1002-0006

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.

Electronic Acknowledgement Receipt

EFS ID:	20560608
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	7836-1
Receipt Date:	30-OCT-2014
Filing Date:	28-NOV-2006
Time Stamp:	13:26:30
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		Statement_Under_373c_w_POA_EWL.pdf	2530874 87485c93f6fa988b3d0c92ac5376c2f7b2e5df5d	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Assignee showing of ownership per 37 CFR 3.73.	1	3
	Power of Attorney	4	4
Warnings:			
Information:			
	Total Files Size (in bytes):	2530874	

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/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: EVOLVED WIRELESS LLC

Application No./Patent No.: 7,746,916 Filed/Issue Date: June 29, 2010

Titled: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

EVOLVED WIRELESS LLC, 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: MIN SEOK NOH et al. To: LG ELECTRONICS INC.

   The document was recorded in the United States Patent and Trademark Office at Reel 019027, Frame 0593, or for which a copy thereof is attached.

2. From: LG ELECTRONICS INC. To: TQ LAMBDA LLC

   The document was recorded in the United States Patent and Trademark Office at Reel 032343, Frame 0761, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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, 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 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: TQ LAMBDA LLC To: EVOLVED WIRELESS LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 034039, Frame 0403, 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.

/Jason H. Vick/	October 30, 2014
Signature	Date
Jason H. Vick	303-863-9700
Printed or Typed Name	Title or Registration Number

ZTE/SAMSUNG/HTC 1002-0011

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. 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 TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 62574

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number: 62574

OR

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

Assignee Name and Address: EVOLVED WIRELESS LLC
805 Las Cimas Parkway, Suite 240
Austin, TX 78746

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Abha S Divine	Date	October 22, 2014
Name	Abha Divine	Telephone	
Title	Managing Director		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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 and select option 2.

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
11/563,909	11/28/2006	Seung Hee Han	

CONFIRMATION NO. 1721

POA ACCEPTANCE LETTER

62574
Jason H. Vick
Sheridan Ross, PC
Suite # 1200
1560 Broadway
Denver, CO 80202

OC000000067295087

Date Mailed: 03/21/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/10/2014.

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.

/dtvernon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

ZTE/SAMSUNG/HTC 1002-0013

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
11/563,909	11/28/2006	Seung Hee Han	2101-3280

CONFIRMATION NO. 1721

35884
LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

POWER OF ATTORNEY NOTICE

OC000000067295086

Date Mailed: 03/21/2014

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/10/2014.

- 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).

/dtvernon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014, 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 TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

■ Practitioners associated with Customer Number: 62574

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

■ The address associated with Customer Number: 62574

OR

☐

Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address: TQ LAMBDA, LLC
805 Las Cimas Parkway, Suite 240
Austin, TX 78746

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Abha S Divine	Date	2/27/14
Name	Abha S. Divine	Telephone	(512) 609-1820
Title	Managing Director		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, 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 and select option 2.

ZTE/SAMSUNG/HTC 1002-0015

Electronic Acknowledgement Receipt

EFS ID:	18424616
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	2101-3280
Receipt Date:	10-MAR-2014
Filing Date:	28-NOV-2006
Time Stamp:	18:23:32
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		Statement_Under_373c_w_POA.pdf	519808 cc2f44f5e68ba001890968a4f4b86672c27b196e	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Assignee showing of ownership per 37 CFR 3.73.	1	2
	Power of Attorney	3	3
Warnings:			
Information:			
	Total Files Size (in bytes):	519808	

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/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: TQ LAMBDA LLC

Application No./Patent No.: 7,746,916 Filed/Issue Date: June 29, 2010

Titled: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

TQ LAMBDA LLC, 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: Min Seok Noh et al. To: LG ELECTRONICS INC.

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

   Reel 019027, Frame 0593, or for which a copy thereof is attached.

2. From: LG ELECTRONICS INC. To: TQ LAMBDA LLC

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

   Reel 032343, Frame 0761, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 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, 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 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

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.

Signature	March 10, 2014 Date
Jason H. Vick Printed or Typed Name	45285 Title or Registration Number

PTO/SB/47 (03-09)
Approved for use through 05/31/2015. OMB 0651-0016
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.

"FEE ADDRESS" INDICATION FORM

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

- OR -

Fax to:
571-273-6500

INSTRUCTIONS: The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. **When to check the first box below**: If you have a Customer Number to represent the fee address. **When to check the second box below**: If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see the Manual of Patent Examining Procedure (MPEP) § 403.

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☑ Customer Number: 62574

OR

☐ The attached Request for Customer Number (PTO/SB/125) form.

PATENT NUMBER (if known)	APPLICATION NUMBER
7,746,916	11/563,909

Completed by (check one):

☐ Applicant/Inventor

/Jason H. Vick/
Signature

☑ Attorney or Agent of record 45,285 (Reg. No.)

Jason H. Vick
Typed or printed name

☐ Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

303-863-9700
Requester's telephone number

☐ Assignee recorded at Reel _____ Frame_____

March 10, 2014
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more that one signature is required, see below*.

☑ * Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.363. 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. 11 and 1.14. This collection is estimated to take 5 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, VA 22313- 1450. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS.
SEND TO: Mail Stop M Correspondence, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 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:

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.

Electronic Acknowledgement Receipt

EFS ID:	18424704
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	2101-3280
Receipt Date:	10-MAR-2014
Filing Date:	28-NOV-2006
Time Stamp:	18:27:52
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	Change of Address	Fee_Address.pdf	151377 c108282c222fcb7cb0d6da273005184be8b5c174	no	2

Warnings:	
Information:	

Total Files Size (in bytes):	151377

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.

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 NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	06/29/2010	7746916	2101-3280	1721

35884 7590 06/09/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

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 580 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):

Seung Hee Han, Seoul, KOREA, REPUBLIC OF;
Min Seok Noh, Seoul, KOREA, REPUBLIC OF;
Yeon Hyeon Kwon, Suwon-si, KOREA, REPUBLIC OF;
Hyun Hwa Park, Anyang-si, KOREA, REPUBLIC OF;
Hyun Woo Lee, Anyang-si, KOREA, REPUBLIC OF;
Dong Cheol Kim, Uiwang-si, KOREA, REPUBLIC OF;

ZTE/SAMSUNG/HTC 1002-0024

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

35884 7590 05/25/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

NOTIFICATION DATE	DELIVERY MODE
05/25/2010	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):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

ZTE/SAMSUNG/HTC 1002-0025

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	11/563,909	HAN ET AL.	
	Examiner	Art Unit	
	ADOLF DSOUZA	2611	

All Participants:

(1) *ADOLF DSOUZA*.

(2) *Jeffrey Lotspeich (Reg. No,. 45,737*.

Status of Application: _____

(3) _____.

(4) _____.

Date of Interview: *5/11/2010*

Time: -

Type of Interview:
☒ Telephonic
☐ Video Conference
☐ Personal (Copy given to: ☐ Applicant ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes ☒ No
If Yes, provide a brief description: .

Part I.

Rejection(s) discussed:
none

Claims discussed:
none

Prior art documents discussed:
none

Part II.

SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:

Publications requested a subsititute specificatiion since the font for the equations on some pages was too small for publication. Examiner requested Applicant to provide a subsitute specification with changes made in the appropriate places, keeping the page content and numbering the same. After having it approved by Publications, Applicant submitted the specification to IFW.

Part III.

☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.
☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

/Adolf DSouza/
Examiner, Art Unit 2611

(Applicant/Applicant's Representative Signature – if appropriate)

ZTE/SAMSUNG/HTC 1002-0026

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
11563909	11/28/2006	HAN ET AL.	2101-3280

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
ADOLF DSOUZA	
ART UNIT	**PAPER**
2611	20100512

DATE MAILED:

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

Commissioner for Patents

(1) Printer Rush document attached
(2) Interview Summary PTO-413B attached

/Adolf DSouza/
Examiner, Art Unit 2611

PTO-90C (Rev.04-03)

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

35884 7590 05/17/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

NOTIFICATION DATE	DELIVERY MODE
05/17/2010	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):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

ZTE/SAMSUNG/HTC 1002-0028

Interview Summary	Application No.	Applicant(s)	
	11/563,909	HAN ET AL.	
	Examiner	Art Unit	
	ADOLF DSOUZA	2611	

All participants (applicant, applicant's representative, PTO personnel):

(1) *ADOLF DSOUZA*. (3)_____.

(2) *Jeffrey Lotspeich (Reg. No. 45737)*. (4)_____.

Date of Interview: *20 April 2010*.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *24 and 31*.

Identification of prior art discussed: *none*.

Agreement with respect to the claims f)☒ was reached. g)☐ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *Applicant wanted to amend the claims to include the term "circular shifted"to provide additional clarification to the claim.. Examiner agreed that it would not change the scope of the claim since the circular shifting is operation is stated in the claim prior to where the changes were proposed.* .

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Adolf DSouza/ Examiner, Art Unit 2611	

ZTE/SAMSUNG/HTC 1002-0029

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Response to Rule 312 Communication	Application No.	Applicant(s)
	11/563,909	HAN ET AL.
	Examiner	**Art Unit**
	ADOLF DSOUZA	2611

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

1. ☒ The amendment filed on *21 April 2010* under 37 CFR 1.312 has been considered, and has been:

   a) ☒ entered.

   b) ☐ entered as directed to matters of form not affecting the scope of the invention.

   c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
   Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

   d) ☐ disapproved. See explanation below.

   e) ☐ entered in part. See explanation below.

   Attachment: PTO-413 Interview Summary Form attached

/David C. Payne/
Supervisory Patent Examiner, Art Unit 2611

/Adolf DSouza/
Examiner, Art Unit 2611

ZTE/SAMSUNG/HTC 1002-0031

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)

35884 7590 03/19/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

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.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	06/21/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
DSOUZA, JOSEPH FRANCIS A	2611	375-142000

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 LEE, HONG, DEGERMAN, KANG & WAIMEY
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 ELECTRONICS INC.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): SEOUL, REPUBLIC OF 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)**

☐ 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 credit any overpayment, to Deposit Account Number 50-2290 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Sevan Savsa/ Date May 12, 2010

Typed or printed name Sevan Savsa Registration No. 61,718

This collection of information 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.

ZTE/SAMSUNG/HTC 1002-0032

Electronic Patent Application Fee Transmittal

Application Number:	11563909
Filing Date:	28-Nov-2006
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Filer:	Sevan Savsa/Nicolette Dolas
Attorney Docket Number:	2101-3280

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

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:				
Utility Appl issue fee	1501	1	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1810**

Electronic Acknowledgement Receipt

EFS ID:	7601752
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Sevan Savsa/Nicolette Dolas
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3280
Receipt Date:	12-MAY-2010
Filing Date:	28-NOV-2006
Time Stamp:	19:16:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1810
RAM confirmation Number	7180
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	2101-3280-Transmittal-IssueFee.pdf	445268 46bb4f0a3d653288fc230915470fbc6457d6aa3d	no	1
Warnings:					
Information:					
2	Issue Fee Payment (PTO-85B)	2101-3280_PartB.pdf	2154828 e5627d17627c703e85908eca5f3134628d657390	no	1
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	32125 e59c6539d93b8d9d43199886ebeaad14bef56d00	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2632221		

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.

Customer No. 035884 **Docket: 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee Han et al.	Art Unit: 2611
Serial No: 11/563,909	Examiner: Dsouza, Joseph Francis A.
Filed: November 28, 2006	Confirmation No.: 1721
For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	

TRANSMITTAL OF ISSUE FEE

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Allowance dated March 19, 2010, enclosed are the following:

☒ Form Part B - Issue Fee Transmittal.

☒ Inventor(s) or Assignee(s) is entitled to **LARGE** entity.

☒ The Commissioner is hereby authorized to charge the Issue Fee in the amount of $1,810 and any deficiency in payment or credit any overpayment to **Deposit Account No. 502290.**

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

Date: May 12, 2010

By: /Sevan Savsa/
Sevan Savsa
Registration No. 61,718
Attorney for Applicant(s)

Customer No. 035884 **Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Seung Hee Han et al.	Art Unit:	2611
Serial No:	11/563,909	Examiner:	Dsouza, Joseph Francis A.
Filed:	November 28, 2006		
For:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Confirmation No.:	1721

SUBMISSION OF SUBSTITUTE SPECIFICATION

Mail Stop ISSUE FEE
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

This paper accompanies the substitute specification filed herewith.

ZTE/SAMSUNG/HTC 1002-0038

REMARKS

Pursuant to telephone conversations on May 10 and 11, 2010, between the Examiner and the undersigned, Applicant submits the included substitute specification. The substitute specification has no new matter.

During these conversations, the Examiner indicated that the font size of various portions of the originally filed specification need increasing to permit proper publication of the issued patent. The Examiner identified pages 6, 10-13 and 15-17 as problematic. The attached substitute specification has increased font size and is believed to address the noted concerns. Since there are no changes to the text of the application, no redline version has been submitted.

The Examiner is invited to contact the undersigned (213-623-2221) should the need arise.

Customer No. 035884

Date: May 11, 2010

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

/Jeffrey Lotspeich/

_____

Jeffrey J. Lotspeich
Registration No. 45,737
Attorney for Applicant

Customer No. 35884 Attorney Docket No. 2101-3280

PATENT APPLICATION

OF

Seung Hee HAN, Min Seok NOH, Yeon Hyeon KWON, Hyun Hwa PARK, Hyun Hwa PARK, Hyun Woo LEE, and Dong Cheol KIM

FOR

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

[0001] This application claims the benefit of Korean Application No. P2005-114306, filed on November 28, 2005, Korean Application No. P2006-62467, filed on July 4, 2006, and Korean Application No. P2006-64091, filed on July 7, 2006, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a method of generating and transmitting code sequence, and more particularly, to a method and apparatus for generating and transmitting code sequence in a wireless communication system.

Discussion of the Related Art

[0003] Usually, a pilot signal or a preamble of a wireless communication system is referred to as a reference signal used for initial synchronization, cell search, and channel estimation. Further, the preamble is comprised of a code sequence, and the code sequence is further comprised of orthogonal or quasi-orthogonal which represent good correlation properties.

[0004] For example, a Hadamard matrix of 128x128 is used in a portable internet (PI) to insert the code sequence to the frequency domain. In so doing, 127 types of code sequences are used.

ZTE/SAMSUNG/HTC 1002-0041

[0005] Although the Hadmard code sequence and a poly-phase Constant Amplitude Zero Auto-Correlation (CAZAC) code sequence are orthogonal codes, a number of codes used to maintain orthogonality is limited. For example, a number of N orthogonal codes in a NxN Hadamard matrix is N, and a number of N orthogonal codes that can be expressed by the CAZAC codes is N and a prime number smaller than N (David C. Chu, "Polyphase Codes with Good Periodic Correlation Properties," *Information Theory IEEE Transaction on*, vol. 18, issue 4, pp. 531-532, July 1972). With respect to CAZAC sequence types, GCL CAZAC and Zadoff-Chu CAZAC are often used.

[0006] If the code sequence is generated using the Hadamard codes, N number of sequence types corresponding to the entire length of the codes is generated. However, the if the code sequence is generated using the CAZAC codes, only half or N/2 number of sequence types are generated.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to a method and apparatus for generating and transmitting code sequence in a wireless communication system that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0008] An object of the present invention is to provide a method of generating a code sequence in a wireless communication system.

ZTE/SAMSUNG/HTC 1002-0042

[0009] Another object of the present invention is to provide an apparatus for generating a code sequence in a wireless communication system.

[0010] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0011] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of generating a code sequence in a wireless communication system includes recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length. Here, the step of modifying includes discarding at least one element of the generated code sequence or inserting at least one null element to the generated code sequence.

[0012] In another aspect of the present invention, method of generating a code sequence in a wireless communication system includes a recognizing a desired length of a first code sequence, generating a second code sequence having a length different from the desired length of the first code sequence, and modifying the length of the second code sequence to equal the desired length of the first code sequence. Here, the step of modifying

ZTE/SAMSUNG/HTC 1002-0043

includes discarding at least one element of the modified code sequence if the length of the modified code sequence is longer than the desired length of the first code sequence or inserting at least one null element to the modified code sequence if the length of the modified second code sequence is shorter than the desired length of the first code sequence.

[0013] In a further aspect of the present invention, an apparatus for generating a code sequence in a wireless communication system includes a sequence selection unit for recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length, wherein the sequence selection unit discards at least one element of the generated code sequence or inserts at least one null element to the generated code sequence in modifying the length of the generated code sequence, and a transmitting unit for transmitting the modified generated code sequence via at least one antenna.

[0014] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this

application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings;

[0016] FIG. 1 illustrates a structure of an apparatus for transmitting data using Orthogonal Frequency Division Multiplexing (OFDM) or OFDM Access (OFDMA) scheme;

[0017] FIG. 2 illustrates a structure of an apparatus for receiving data using OFDM/OFDMA scheme;

[0018] FIG. 3 is a flow diagram illustrating adjusting a code sequence;

[0019] FIG. 4 illustrates cross-correlation properties of the generated code sequence;

[0020] FIG. 5 illustrates a generated CAZAC sequence $a_{N_{seq_N}xN}$ using N (=1024);

[0021] FIG. 6 illustrates a cross-correlation properties cumulative distribution function (CDF) of the code sequences that can be generated according to the code sequence $a_{N_{seq_M}xN}$ and the CAZAC sequence $a_{N_{seq_N}xN}$ when $N = 1024$;

[0022] FIG. 7 illustrates the cross-correlation properties CDF of the code sequences that can be generated based on the CAZAC sequence generated using the prime number of N=1031 and a code sequence set $a_{N_{seq_M}xN}$ having length of 1024 (seven (7) elements removed);

[0023] FIG. 8 illustrates a method of generating CAZAC sequence using a length required by a communication system;

ZTE/SAMSUNG/HTC 1002-0045

[0024] FIG. 9 illustrates a method of generating a CAZAC sequence using a padding portion;

[0025] FIG. 10 illustrates an exemplary application of circular shift;

[0026] FIG. 11 is an exemplary diagram illustrating application of circular shift to the generated code sequence after the elements of the code sequence are removed;

[0027] FIG. 12 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to removing the elements of the code sequence;

[0028] FIG. 13 is an exemplary diagram illustrating application of circular shift to the generated code sequence after a padding portion is attached;

[0029] FIG. 14 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to attaching a padding portion;

[0030] FIG. 15 is an exemplary diagram of a padding portion of the code sequence in which the padding portion is used as a lower bandwidth guard interval;

[0031] FIG. 16 is a structural diagram for transmitting the code sequence. Depending on whether the transmission of the code sequence is made in a downlink direction or an uplink direction, the structure can be in different form;

[0032] FIG. 17 is a structural diagram illustrating a basic code sequence generation unit and a code sequence length adjustment unit;

[0033] FIG. 18 illustrates cross-correlation characteristics of the code sequence;

[0034] FIG. 19 illustrates cross-correlation characteristics of the code sequence; and

[0035] FIG. 20 is an exemplary diagram illustrating boosting the power of the generated code sequence.

DETAILED DESCRIPTION OF THE INVENTION

[0036] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0037] Figure 1 illustrates a structure of an apparatus for transmitting data using Orthogonal Frequency Division Multiplexing (OFDM) or OFDM Access (OFDMA) scheme. Figure 2 illustrates a structure of an apparatus for receiving data using OFDM/OFDMA scheme.

[0038] In Figure 1, traffic data and control data are multiplexed at a muxer 11. Here, the traffic data is used to provide service from a transmitting end to a receiving end, and the control data is used to facilitate transmission from the transmitting end to the receiving end. The discussion relating to the present invention regarding the code sequence which relates to a type of a code sequence of the control data. The code sequence can be used for initial synchronization, cell search, or channel estimation.

[0039] Depending on the communication system, the code sequence can be used in various forms. For example, the code sequence in an IEEE 802.16 wideband wireless access

ZTE/SAMSUNG/HTC 1002-0047

system can be used in a preamble or a pilot signal format, and in a multi-input, multi-output (MIMO) system, the code sequence can be used as a midamble format.

[0040] After being processed at the muxer 11, the multiplexed traffic and control data is then channel coded by a channel coding module 12. Channel coding is used to allow the receiving end to correct error that can occur during transmission by adding parity bits. Examples of channel coding include convolution coding, turbo coding, and low density parity check (LDPC) coding.

[0041] Thereafter, the channel coded data is modulated by a digital modulation module 13 in which data symbols are mapped using algorithms such as a quadrature phase shift keying (QPSK) or a 16-quadrature amplitude modulation (16QAM). The mapped data symbols are then processed by a subchannel modulation module 14 through which the data symbols are mapped to each subcarrier of the OFDM system or OFDMA system. Then, the data symbols mapped to subcarriers are processed by an inverse fast Fourier transform (IFFT) module 15 which transform the data symbols into a signal in a time domain. The transformed data symbols are then processed through a filter 16 and further processed through a digital-to-analog conversion (DAC) module 17 where the filtered data symbols are converted to analog signals. Lastly, the analog signals are converted into a radio frequency (RF) by a RF module 18 which is then transmitted via an antenna 19 to the receiving end.

[0042] Based on the type of generated code (e.g., CAZAC code), the steps of channel coding and/or symbol mapping can be omitted. Figure 2 illustrates a receiving end whose processes are inverse to those of the transmitting end.

[0043] A code sequence is used for transmitting control information, which includes identification (ID) and synchronization information, to classify types of sequences in a communication system. In order for more effective reception of the control information using code sequence, the code sequence can be adjusted or modified. Further, the code sequence can be applied to all of the channels that use code sequence for control signaling such as a random access channel (RACH), downlink/uplink reference symbol, channel quality information (CQI), and Acknowledgement (ACK)/Negative Acknowledgement (NACK).

[0044] Figure 3 is a flow diagram illustrating adjusting a code sequence. More specifically, a length of the code sequence is defined as N, a number of codes in the code sequence is defined as N_{seq_N}, and a code sequence set defined as $a_{N_{seq_N}xN}$. In operation, the code sequence set $a_{N_{seq_N}xN}$ having N_{seq_N} number of codes can be extended to a code sequence set $a_{N_{seq_M}xN}$ having N_{seq_M} number of codes.

[0045] Equation $a_{N_{seq_N}xN}$ is a matrix of $N_{seq_N}xN$ of $a_{N_{seq_N}xN} = \left[a^0_{N_{seq_N}xN}\ a^1_{N_{seq_N}xN} \cdots a^{N_{seq}-1}_{N_{seq_N}xN}\right]^T$, and $a^k_{N_{seq_N}xN}$ is a row vector of $a^k_{N_{seq_N}xN} = \left[a^k_{N_{seq_N}xN}(0)\, a^k_{N_{seq_N}xN}(1) \cdots a^k_{N_{seq_N}xN}(N-1)\right]$. Furthermore, $a^k_{N_{seq_N}xN}(n)$ indicates $n(=0,1,2,\cdots,N-1)$ element of $k(=0,1,2,\cdots,N_{seq_N}-1)$ code sequence.

ZTE/SAMSUNG/HTC 1002-0049

[0046] Referring to Figure 3, a code sequence set $a_{N_{seq_M}xM}$, having N_{seq_M} number of code sequence(s) where each code sequence has length *M*, can be generated based on the code generation algorithm based on code type in which a value of length *M* is a natural number greater than a value of length *N* (S301). Here, the code types include Hadamard code, Pseudo Noise (PN) code, and a Constant Amplitude Zero Auto-Correlation (CAZAC) code, among others to be used for initial synchronization, cell search, and channel estimation in the wireless communication system. The code sequence set having length *M* per each code type can be generated by various schemes as discussed. As for the CAZAC code, the value of length *M* is a smallest prime number greater than the value of length *N*, preferably.

[0047] Subsequently, a code sequence set $a_{N_{seq_M}xN}$, having N_{seq_M} number of code sequences, can be generated where a resulting length of the code sequence is length N. More specifically, the code sequence set $a_{N_{seq_M}xM}$, having N_{seq_M} number of code sequences where each code sequence has length *M* (from step S301), can have elements of the code sequence removed. That is, elements which comprise each code sequence can be removed from the code sequence allowing the length of the code sequence to be adjusted or shortened. Here, $M - N$ number of elements can be removed from the code sequence whose length corresponds to length *M*. By removing elements from the code sequence with length *M*, a code sequence having length *N* can be generated. As discussed, *N* is smaller than *M*.

ZTE/SAMSUNG/HTC 1002-0050

Consequently, a code sequence set $a_{N_{seq_M} xN}$, having N_{seq_M} number of code sequences in which each code sequence has length *N*, can be generated (S302).

[0048] A code sequence is used for transmitting control information, which includes identification (ID) and synchronization information, to classify types of sequences in a communication system. Currently in 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), a CAZAC sequence is being considered.

[0049] The CAZAC sequence can be used by channels to output various IDs and information. The channels include channels for downlink synchronization (e.g., primary synchronization channel, secondary synchronization channel, and broadcast channel), uplink synchronization (e.g., random access channel), and pilot channels (e.g., data pilot and channel quality pilot). Further, the CAZAC sequence can be used in scrambling as well as channels that use code sequence such as RACH.

[0050] Although there are various types of the CAZAC sequences, there are two types of often used CAZAC sequences – GCL CAZAC and Zadoff-Chu CAZAC. The Zadoff-Chu CAZAC sequence can be defined by the following equations.

[Equation 1]

$$c(k;N,M) = \exp\left(\frac{j\pi Mk(k+1)}{N}\right) \quad (for\ odd\ N)$$

[Equation 2]

$$c(k;N,M) = \exp\left(\frac{j\pi Mk^2}{N}\right) \quad (for\ even\ N)$$

[0051] Here, k denotes sequence index, N denotes a length of CAZAC to be generated, and M denotes sequence ID.

[0052] If the Zadoff-Chu CAZAC sequence and the GCL CAZAC sequence are expressed by $c(k;N,M)$ as shown in Equations 1 and 2, then the sequences have the following three (3) characteristics as presented in following equations.

[Equation 3]

$$\left|c(k;N,M)\right| = 1 \quad (for\ all\ k,N,M)$$

[Equation 4]

$$R_{M:N}(d) = \begin{cases} 1, & (for\ d = 0) \\ 0, & (for\ d \neq 0) \end{cases}$$

[Equation 5]

$$R_{M_1,M_2;N}(d) = p \quad (for\ all\ M_1, M_2\ and\ N)$$

[0053] According to Equation 3, the CAZAC sequence always has a size of 1, and the CAZAC sequence of Equation 4 has an auto-correlation function denoted by a delta function. Here, the auto-correlation is based on circular correlation. Further, Equation 5 is a cross-correlation which is constant if N is a prime number.

[0054] If the length to be applied in the wireless communication system for generating the CAZAC sequence is denoted by L, a method for generating the CAZAC sequence sets N of Equations 1 and 2 to equal L ($N = L$) – identified as step (1). Step (2) can

ZTE/SAMSUNG/HTC 1002-0052

be identified by a method where a value of N is set to be a prime number greater than a value of length L for generating the CAZAC sequence.

[0055] Referring to the characteristics of the generated CAZAC sequence having a specified length of L, if L is not a prime number, the generated CAZAC sequence can include $M = 1, 2, \ldots L\text{-}1$ number of codes, some of which are repeated codes. In other words, the number of different codes is less than L-1 number of codes. On the contrary, if L is a prime number, there is L-1 number of different codes. The above descriptions may also be applied to other types of code sequences and are not limited to Zadoff-Chu CAZAC sequence.

[0056] Further, the following technique has been considered. More specifically, if the length of code to be applied to the system is not a prime number, and there are a large number of codes to be used, a smallest prime number greater than L was selected. Using the selected prime number, the CAZAC sequence was generated, and discards or removes at least one element of the generated CAZAC sequence for use. This technique is different than the technique introduced with respect to step 1.

[0057] For example, assume that a number of codes of a CAZAC code sequence (N) is 1024. The following equation can be used to express an algorithm for generating a Zadoff-Chu CAZAC code.

[Equation 6]

ZTE/SAMSUNG/HTC 1002-0053

$$a^{index(A)}(n) = \begin{cases} \exp\left(i\frac{A\pi n(n+1)}{M}\right), when\ M\ is\ odd \\ \exp\left(i\frac{A\pi n^2}{M}\right), when\ M\ is\ even \end{cases}$$

$$where\ \ n = 0,1,2,\cdots,M-1$$

[0058] In Equation 6, A and M are natural numbers, and $index(A)(= 0,1,2,\cdots,N_{seq_M}-1)$ is an index of A in ascending order. In order to extend the CAZAC sequence where N=1024, a smallest prime number greater than 1024 is used. That is, the smallest prime number greater than 1024 is 1031. As such, the code sequence set $a_{N_{seq_M}xM}$ where M=1031 is applied to Equation 6.

[0059] Since M (=1031) is a prime number, N_{seq_M} =1030. Furthermore, A can be referred to as a seed value used to generate a code sequence maintaining CAZAC properties. If M is a prime number, a total of M – 1 number of code sequences can be generated. In other words, for example, if M = 1024, a total of 512 (=1024/2 or N/2) number of code sequences are generated. However, if M = 1031, a total of 1030 number of code sequences (M – 1) are generated. Moreover, the cross-correlation properties of the generated code sequence are better if M is a prime number than a composite number.

[0060] In order to adjust or modify the CAZAC code sequence set $a_{N_{seq_M}xM}$ where M = 1031 to a code sequence set $a_{N_{seq_M}xM}$ whose length is N = 1024, M – N number of elements can be removed from index $n = N,\cdots,M-1$, generating a code sequence set $a_{N_{seq_M}xN}$.

ZTE/SAMSUNG/HTC 1002-0054

[0061] In determining the value of *M*, although the number of code sequences can increase with increase in value of *N*, it is preferable to determine the value of *M* based on the code sequence whose length is *N* that promotes maintenance of good correlation properties. In case of the CAZAC code, optimum correlation properties can be attained if the value of length *M* is the smallest prime number greater than the value of length *N*.

[0062] If the code sequence set $a_{N_{seq_N}xN}$ generated using length N=1024 is compared with the code sequence set $a_{N_{seq_M}xN}$, a total number code sequences of the former can be represented by *N*/2 or 512 (=1024/2) code sequences having an index $0,1,2,\cdots,N/2-1(N=1024)$, and a total number of code sequences of the latter can be represented by M – 1 or 1030 having an index $0,1,2,\cdots,M-2(M=1031)$.

[0063] Figure 4 illustrates cross-correlation properties of the generated code sequence. More specifically, the cross-correlation properties of $a^{k}_{N_{swq_M}xN}(k=1,2,\cdots,N_{seq_M}-1)$ associated with the remaining $N_{seq_M}(1029)$ code sequences for $a^{0}_{N_{seq_M}xN}$ code sequence of the code sequence set $a_{N_{seq_M}xN}$. The figure illustrates this with respect to amplitude, code index, and time index.

[0064] Further, Figure 5 illustrates a generated CAZAC sequence $a_{N_{seq_N}xN}$ using *N* (=1024). More specifically, the figures illustrate cross-correlation properties of $a^{k}_{N_{swq_M}xN}(k=1,2,\cdots,N_{seq_M}-1)$ regarding the remaining $N_{seq_N}(511)$ code sequences. The figure illustrates this with respect to amplitude, code index, and time index. Between Figure

ZTE/SAMSUNG/HTC 1002-0055

4 and Figure 5, the cross-correlation properties of the generated code sequence of Figure 4 are better.

[0065] Figure 6 illustrates a cross-correlation properties cumulative distribution function (CDF) of the code sequences that can be generated according to the code sequence $a_{N_{seq_M}xN}$ and the CAZAC sequence $a_{N_{seq_N}xN}$ when $N = 1024$.

[0066] Figure 7 illustrates the cross-correlation properties CDF of the code sequences that can be generated based on the CAZAC sequence generated using the prime number of N=1031 and a code sequence set $a_{N_{seq_M}xN}$ having length of 1024 (seven (7) elements removed). The performance lines of Figures 4 – 7 indicate that the code sequence set with seven (7) elements removed has equivalent cross-correlation properties compared to the original code sequence set.

[0067] As discussed, the codes in addition to the CAZAC code are available, such as the PN code and the Hadamard code. The discussion with respect to the CAZAC code sequence can also be applied to the PN code and the Hadamard code. With respect to the PN code, a modular shift register generator is used to generate the code sequences. If a number of shift registers generated is represented by N, a code sequence having a length of $2^N - 1$ is generated. Thereafter, a value "1" is added to the shift register, resulting in a length $2^{N+1} - 1$, and then, adjust the length to equal 2^N.

[0068] With respect to the Hadamard codes, a number of code sequences, which equal the length of the code sequence, make up a code sequence. However, for example, if

ZTE/SAMSUNG/HTC 1002-0056

M number of code sequences having length N is required ($M > N$), then M number of code sequences having length M are generated, followed by removing a specified number of elements to make the length of the code sequence equal length N.

[0069] Figure 8 illustrates a method of generating CAZAC sequence using a length required by a communication system. That is, the required (or desired) length of the CAZAC sequence can be represented by length L. Further, the codes types can be extended. However, since a generated code sequence can be truncated or have elements discarded to correspond to the desired length L, the auto-correlation and cross-correlation properties of the truncated code sequence can experience deterioration. Similarly, even if a code sequence portion is added/attached to the generated code sequence (e.g., zero-padding or cyclic prefix) to correspond to the desired length L, the auto-correlation and cross-correlation properties can experience deterioration. Here, auto-correlation properties relate to the auto-correlation value being 1 when the delay is 0. Otherwise, the auto-correlation value is 0 when the delay is a value other than 0. Further, the cross-correlation properties having a constant value is negatively affected.

[0070] Assuming that the code sequence having poor auto-correlation and cross-correlation properties are removed, the remaining number of code sequences may be less than L – 1.

[0071] In order to attain a desired length and a maximum number of CAZAC sequence types corresponding to the desired length, a smallest prime number, X, greater

than the desired length, L, ($X > L$) can be selected. Although the CAZAC sequence can be generated using X, due to deterioration of the correlation properties, the correlations properties of CAZAC sequence as shown in Equations 4 and 5 cannot be attained. Further, when selecting a length of the generated code sequence, the length that is nearest to the desired length L which is between a smallest prime number larger than the desired length or a largest prime number smaller than the desired length can be selected.

[0072] Referring to Figure 8, the generated CAZAC sequence has length X. Thereafter, the generated CAZAC sequence having length X has elements of the code sequence removed (or truncated) so as to make the length of the generated CAZAC sequence correspond to the desired length L.

[0073] Figure 9 illustrates a method of generating a CAZAC sequence using a padding portion. As discussed, the generated CAZAC sequence is truncated. With respect to auto-correlation and cross correlation properties, delay of 0 indicates an auto-correlation value of 1, as shown in Equation 4, and a delay not equaling 0 indicates a value of 0. Moreover, the properties where the cross-correlation value is always a prime number is not deteriorated whereby effective correlation is maintained. Further, additional control information can be transmitted by using the information inputted to the fading unit.

[0074] Referring to Figure 9, the generated CAZAC sequence has length X. Here, the value of X is a largest prime number less than the value of L. In other words, X is a prime number less than L. Thereafter, the generated CAZAC sequence having length X has

elements added or a padding portion added to the CAZAC sequence in order to make the length of the generated CAZAC sequence correspond to the desired length *L*. Here, C1 represents the length of the CAZAC sequence having length *X*, and C2 represents the padding portion. By combining C1 and C2 (C1 + C2), the generated CAZAC sequence can have a length corresponding to the desired length *L*.

[0075] Figure 10 illustrates an exemplary application of circular shift. The circular shift is typically applied to increase an amount of control information transmitted to the communication system. For example, a back portion of the sequence is re-allocated to a front portion of the sequence, and the remaining sequence is shifted in the direction of the back portion of the sequence in an amount (or length) corresponding to the re-allocated back portion, as illustrated in Figure 10. Further, if specified control information is applied the circular shift as described above, the amount of control information that can be transmitted via a corresponding sequence increases.

[0076] Discussions of above relate to the methods of generating the sequence using the desired length *L*, and of increasing transmitted control information using the circular shift. If these methods are applied in generating the sequence, the following processes take place. First, select a smallest prime number greater than *L* or a largest prime number less than *L*, which is referred to as *X*. Second, remove or add a sequence unit having a length corresponding to *X*-*L* or *L*-*X*. Third, apply the circular shift to the resulting sequence.

[0077] Figure 11 is an exemplary diagram illustrating application of circular shift to the generated code sequence after the elements of the code sequence are removed. Referring to Figure 11, the code sequence 1102 is generated based on length X which is the smallest prime number greater than length L. In other words, the generated code sequence 1102 has a length equaling length X which is longer than the desired length L. From the generated code sequence 1102, a portion having a length corresponding to length $X - L$ is removed, resulting in a code sequence having length L 1103. Thereafter, the result of the generated code sequence 1103 having length L is applied circular shift thereto, resulting in the code sequence 1104.

[0078] Figure 12 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to removing the elements of the code sequence. In other words, circular shift is performed to the generated CAZAC sequence having length X, and after circular shift is performed, the elements of the code sequence are removed.

[0079] Referring to Figure 12, the code sequence 1202 is generated based on length X which is the smallest prime number greater than length L. In other words, the generated code sequence 1202 has a length equaling length X which is longer than the desired length L. A circular shift is then performed to the generated code sequence 1203 having length X. Thereafter, a portion of the generated code sequence having a length corresponding to length $X - L$ is removed, resulting in a code sequence 1204 having length L.

[0080] Figure 13 is an exemplary diagram illustrating application of circular shift to the generated code sequence after a padding portion is attached. Referring to Figure 13, the code sequence 1302 is generated based on length X which is the largest prime number smaller than the value of length L. To the generated CAZAC sequence 1302, a padding portion is added 1303. The length of the padding portion corresponds to a length $L - X$. As discussed, the padding portion can be comprised of zeroes or cyclic prefix/postfix. With the addition of the padding portion, the length of the CAZAC sequence equals the desired length L. Thereafter, the result of the generated code sequence having length L 1303 is applied circular shift thereto, resulting in the CAZAC sequence 1304.

[0081] Figure 14 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to attaching a padding portion. In other words, circular shift is performed to the generated CAZAC sequence having length X, and after circular shift is performed, the padding portion is attached.

[0082] Referring to Figure 14, the code sequence 1402 is generated based on length X which is the largest prime number smaller than the value of the desired length L. To the generated CAZAC sequence 1402, circular shift is performed. The circularly-shifted CAZAC sequence 1403 still has length X. To the CAZAC sequence 1403, a padding portion is added, resulting in the CAZAC sequence 1404. The length of the padding portion corresponds to a length $L - X$. As discussed, the padding portion can be comprised of zeroes

or cyclic prefix/postfix. With the addition of the padding portion, the length of the CAZAC sequence 1404 equals the desired length *L*.

[0083] Between Figures 11 and 12, the difference is that circular shift is performed either before or after the elements of the CAZAC sequence are removed. By performing circular shift before removing the elements (or adjusting the length to equal the desired length), correlation deterioration can be reduced. To put differently, the CAZAC sequence does not have discontinuous codes.

[0084] Between Figures 13 and 14, the difference is that circular shift is performed either before or after the padding portion is added to the generated CAZAC sequence. By attaching the padding portion after performing circular shift, better correlation properties can be attained, especially since the padding portion is placed at the end of the code sequence.

[0085] Further, according to the discussion above, the desired length *L* (or required length) is first recognized. As illustrated with respect to Figures 11 – 14, the generated code sequence is adjusted/modified based on the desired length *L*. Based on that, after the desired length L recognized, a determination can be made as to whether the generated length *X* should be shortened or extended. In other words, the determination can be made whether to remove or discard at least one element of the generated code sequence or to add or insert at least one element to the generated code sequence. As discussed, the elements to be inserted can be a null (0) element (e.g., zero padding) or cyclic prefix/postfix, for example. In order

ZTE/SAMSUNG/HTC 1002-0062

to make the determination between discarding the element(s) or adding the element(s), the system can choose to select the length closest to the desired length *L*.

[0086] For example, if the desired length L is 75, the value of the smallest prime number greater than 75 is 79, and the value of the largest prime number smaller than the 75 is 73. Here, the prime number 73 can be selected since 73 is closer to 75 than 79 is to 75.

[0087] Although the illustration above selects the prime number closest to the desired length L, selection regarding removal or addition of the element(s) is not limited to the example of above and other implementations may be applied.

[0088] Regarding padding, there are five (5) schemes by which padding can be accomplished. As a first padding scheme, the padding portion can be comprised of a constant number (e.g., 0s). Although the padding portion is used to fill the portion of the code sequence so that the length of the code sequence coincides with the desired length, it is possible for the padding portion to be less then completely full. In other words, it is possible for that the length of the code sequence with padded portion is not equal to or is shorter than the code sequence with the desired length. That is, when the code sequence is used for functions deemed less important, such as for cell search or random access, it is not necessary to use the entire length of the code sequence, and as such, the padding portion does not need to be completely occupied to correspond to the desired length of the code sequence.

ZTE/SAMSUNG/HTC 1002-0063

[0089] As a second padding scheme, the padding portion can be comprised of a repeated portion. In other words, the portion corresponding to $L - X$ of the code sequence 1204 can be duplicated and inserted/attached to the end of the code sequence 1204. This can be referred to as cyclic postfix. Here, the code sequence uses the entire length L. When determining the identification (ID) of the code sequence, the entire length L is used to facilitate identifying of the code sequence ID. At the same time, the generated code sequence does not experience distortion by using the entire length L. In the discussion above, the cyclic postfix is used. Alternatively, cyclic prefix can also be used.

[0090] As a third padding scheme, the padding portion can be comprised of additional information through which different messages can be delivered. More specifically, the desired length L of the code sequence can be used to generate a supplemental code sequence whose length equals the desired length L ($N = L$). The code sequence portion corresponding to $L - X$ is extracted from the supplemental code sequence and inserted/attached to the generated code sequence as the padded portion.

[0091] As a fourth padding scheme, a portion corresponding to length $L - X$ is extracted from the code sequence and inserted as the padding portion. Here, the code sequence inserted to the padding portion may be a different code sequence than the code sequence 1204. Put differently, the code sequence inserted to the padding portion may be a CAZAC sequence having a length of M, for example, which is different from the code sequence 1204 having a length of L. Further, the code sequence inserted to the padding

portion can be a different code sequence other than the CAZAC sequence. By using different code sequence, additional information can be delivered including information related to type of code sequence adjustments.

[0092] As a fifth padding scheme, the padding portion can be used as lower bandwidth guard interval. During transmission of control information using a prescribed sequence, the following possible scenarios can occur such as transmitting data without establishing synchronization with an access channel, transmitting data by a plurality of users within a communication system, and distortion of frequency of the received data.

[0093] Furthermore, the padding portions can be placed at both ends of the code sequence to use the padding portions as guard intervals of the lower bandwidth. Consequently, a more reliable acquisition of control information from the received data can take place despite distorted frequency signals. In the padding portions used as guard intervals, constant numbers (e.g., 0s) can be used or cyclic prefix or postfix of the generated code sequence can be used.

[0094] If the padding portions are placed at both ends of the code sequence and used as guard intervals of the lower bandwidth, the code sequences can be protected from frequency signal distortions. Moreover, if 0s are inserted between the guard intervals or put differently, within the code sequence, interference to neighboring codes can be reduced. Alternatively, if cyclic prefix/postfix is used as guard intervals, the code sequences can be

ZTE/SAMSUNG/HTC 1002-0065

protected from frequency distortions and can be used to transmit the control information containing the sequence ID if there is no frequency distortion.

[0095] Figure 15 is an exemplary diagram of a padding portion of the code sequence in which the padding portion is used as a lower bandwidth guard interval. Referring to Figure 15, the code sequence 1501 can be divided into three (3) parts – a portion (C1), which is generated based on length *X*, and the other two portions (C2 and C3) are attached to both ends of the code sequence 1501.

[0096] In the discussions above, five (5) padding schemes are introduced. However, the padding schemes are not limited to the discussed schemes, and there can be other types of padding schemes.

[0097] Besides the first padding scheme in which no information is inserted, the other four padding schemes insert additional information in the padding portions to allow expansion of the code sequence and/or transmission of message(s). Various information can be inserted into the padding portion including, for example, initial access information, timing update information, resource request information, user ID information, channel quality information (CQI), user group ID information related to a random access channel (RACH). Furthermore, the information can include cell ID information, multi-input multi-output (MIMO) information, and synchronization channel information of a synchronization channel (SCH), for example. In addition, the padding portion can be used for transmitting

ZTE/SAMSUNG/HTC 1002-0066

data for message transmission as well as arbitrary information using a code sequence having a length of $L - X$.

[0098] Figure 16 is a structural diagram for transmitting the code sequence. Depending on whether the transmission of the code sequence is made in a downlink direction or an uplink direction, the structure can be in different form. With that, Figure 16 is described with respect to a general transmitting end for transmitting the control signal.

[0099] Referring to Figure 16, the transmitting end 1601 comprises a sequence selection unit 1602 and a transmitting unit 1603. The sequence selection unit 1602 is used to generate the code sequence for transmitting the control information. More specifically, the sequence selection unit 1602 performs an operation to select a code sequence having a desired length of L. In other words, the sequence selection unit 1602 stores the value of the desired length L, and then selects an appropriate code sequence for expressing the control information to be transmitted where the code sequence has a length of L.

[00100] The code sequence that can be selected by the sequence selection unit 1602 has a length of L as illustrated in Figures 12 and 14 (e.g., code sequence 1204 and code sequence 1404). Moreover, the code sequence is applied circular shift (e.g., code sequences 1203 and 1403) to which a padded portion corresponding to lengths $L - X$ or $X - L$ is removed or inserted/added. As a result, discontinuous parts are not formed within or in the code sequence to promote superior correlation characteristics.

[00101] Although it is preferable to use length *X* which is a smallest prime number greater than the length of L or a largest prime number smaller than the length of *L*, as long as the value of length *X* is a prime number, different or other prime numbers can be used as the value of length *X*.

[00102] Figure 17 is a structural diagram illustrating a basic code sequence generation unit and a code sequence length adjustment unit. In Figure 17, the basic code sequence generation unit 1701 further comprises a code sequence generation unit 1701a and a circular shift application unit 1701b. The code sequence generation unit 1701a is used to generate a first code sequence (C1). Here, C1 can be defined as a code sequence having a length of *X* where the value of length *X* is a smaller prime number larger than the value of length *L* or a code sequence having a length of *X* where the value of length *X* is a larger prime number smaller than the value of length *L*. C1 is then applied circular shift by the circular shift application unit 1701b. More specifically, the circular shift application unit 1701b receives C1 having length of *X*, applies circular shift, and outputs a second code sequence (C2) to the code sequence length adjustment unit 1702.

[00103] The code sequence length adjustment unit 1702 further comprises a control unit 1702a, a code sequence removing unit 1702b, and a padding unit 1702c. More specifically, the control unit 1702a receives C2 as well as the value of length *L*. The control unit 1702a determines whether to remove a portion/section of C2 or insert/add a portion/section to C2. Based on the determination from the control unit 1702a, C2 is

ZTE/SAMSUNG/HTC 1002-0068

delivered to the sequence removing unit 1702b in which a portion/section of C2 corresponding to a length of $X - L$ is removed. Alternatively, C2 can be delivered to the padding unit 1702c for inserting/adding a portion/section of C2 whose length corresponds to the length of $L - X$.

[00104] If C2 and the value of length L are provided to the control unit 1702a, the control unit 1702a compares the value of length X which identifies the length of C2 with the value of the length L. Here, if X is greater than L, then C2 is inputted into the sequence removing unit 1702b. From C2, the portion length of C2 corresponding to length $X - L$ is removed, resulting in C3. However, if X is less than L, then C2 is inputted into the padding unit 1702c. From C2, the padding portion length corresponding to length $L - X$ is inserted/added to C2, resulting in C4. Here, the padding portion can be inserted to either end or both ends of C2.

[00105] Figures 18 and 19 illustrate cross-correlation characteristics of the code sequence. The illustrations of Figures 18 and 19 is based on the value of length X being the smallest prime number greater than the value of the desired length L; however, the illustrations are not limited to the smallest prime number greater than length L but can have a prime number value of length X smaller than the value of length L.

[00106] Referring to Figures 18 and 19, the x-axis represents values of circular shift while the y-axis represents un-normalized cross-correlation values. Furthermore, a thinner line represents the value of cross-correlation of the code sequence with circular shift applied

thereto after a code sequence portion having the length $X - L$ is removed. A darker/thicker line represents values of code sequence to which circular shift is applied prior to removing the code sequence portion corresponding to the length $X - L$. More specifically, Figure 7 illustrates a graph where L is 75 and X is 79 which is the smallest prime number greater than 75. Moreover, Figure 8 illustrates a graph where L 8 is 225 and X is 227 which is the smallest prime number greater than 225.

[00107] In Figures 18 and 19, if the value of circular shift is 0 or put differently, if there is no shift, then high correlation value is indicated only when the auto-correlation value of the code sequence corresponds and in other cases, moderate correlation is maintained. On the contrary, if the code sequence has a section corresponding to length $X - L$ is removed and thereafter applied circular shift, severe fluctuations occur with correlation values, resulting in deteriorated correlation characteristics. As such, if cross-correlation is used to analyze the code sequence, the code sequence according to the embodiments of the present invention shows superior performance and outcome to that of the conventional code sequence.

[00108] Figure 20 is an exemplary diagram illustrating boosting the power of the generated code sequence. As discussed, the code sequence is generated based on length X, and a padding portion, whose length corresponds to length $L - X$, is attached to the code sequence (e.g., CAZAC sequence). Thereafter, the portion of the code sequence corresponding to length X is used where length L is divided by length X (L/X). The result of

the division is the amount of power that can be boosted. Moreover, the amount of power that can be boosted can be applied to the code sequence whose length is length *X*. When the receiving end receives power boosted code sequence, more effective detection performance can be achieved since interference is reduced.

[00109] However, regarding a code sequence generated with a padding portion with cyclic prefix/postfix attached thereto, there is no need to power boost since all of the code sequences corresponding to length *L* are used for acquiring sequence ID information.

[00110] In the receiving end, information related to the generated code sequence and length *X* used to generate the code sequence is received. From the code sequence, a portion corresponding to length *X* is processed to acquire the control information. To this end, it is important to first receive synchronization information of the received data. Equation 7 and Equation 8 can be used to acquire synchronization information. Here, Equation 7 relates to auto-correlation, and Equation 8 relates to cross-correlation.

[Equation 7]

$$R_{M:N}(d) = \sum_{k=0}^{X-1} c(k, M, X) \bullet c^{*}(\mathrm{mod}(k+d), X); M, X)$$

[Equation 8]

$$R_{M_1:M_2:N}(d) = \sum_{k=0}^{X-1} c(k, M_1, X) \bullet c^{*}(\mathrm{mod}(k+d), X); M_2, X)$$

[00111] Equation 7 is used to acquire auto-correlation value(s) from the received code sequence whose sequence ID is *M*. Further, the acquired auto-correlation value *d*, which is a value other than 0, is used to achieve synchronization.

[00112] Equation 8 is used to acquire cross-correlation value(s) of a code sequence whose ID is M_2 from the received code sequence whose sequence ID is M_1. Through the acquired value, synchronization can be achieved.

[00113] Typically, if the wireless communication system is a synchronous network, auto-correlation is used to acquire synchronization information, and if the system is an asynchronous network, cross-correlation is used to acquire synchronization information. However, according to the embodiments of the present invention, synchronization information can be acquired using any one or at least one of the correlation schemes.

[00114] After the synchronization information of the received code sequence is acquired, the receiving end analyzes the received code sequence to acquire the sequence ID, as shown in Equations 9 and 10.

[Equation 9]

$$\sigma c(k;M,X) = c(k+1;M,X) \bullet c^*(k;M,X) \quad (for\ k = 0,1,\cdots,L-1)$$

[Equation 10]

$$\sigma c(k;M,X) = c(k+1;M,X) \bullet c^*(k;M,X) \quad (for\ k = 0,1,\cdots,X-1)$$

[00115] In Equations 9 and 10, $\sigma c(k;M,X)$ denotes difference sequence of the received sequences. Equation 9 is used to acquire the ID information of the received sequence using the differential sequence corresponding to the total length of the received sequence. Equation 9 can also be used to acquire the ID information of the code sequence which has been generated with the cyclic prefix/postfix padded portion. Equation 10 is used

ZTE/SAMSUNG/HTC 1002-0072

to acquire the ID information of the received sequence using the smallest prime number corresponding to length *X*.

[00116] As discussed, if the differential sequence of the CAZAC sequence is calculated using Equations 9 or 10, *k* of the sequence index is generated, and the result therefrom is transformed by the Fourier transform scheme, to show a single peak value. Thereafter, by detecting the peak value, the ID information of the sequence can be acquired.

[00117] The discussion of above regarding a code sequence or a code sequence set can be applied to 3rd Generation Partnership Project (3GPP) system or 3GPP2 system as well as a Wibro system or a Wimax system.–

[00118] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

ZTE/SAMSUNG/HTC 1002-0073

Electronic Acknowledgement Receipt

EFS ID:	7592809
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Sevan Savsa/Nicolette Dolas
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3280
Receipt Date:	11-MAY-2010
Filing Date:	28-NOV-2006
Time Stamp:	18:50:10
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	Miscellaneous Incoming Letter	2101-3280_Transmittal_for_Sub_Spec.pdf	444837 e21b528be18d20193cb40a7e50d5205c2cd5bf38	no	2

Warnings:	
Information:	

2	Specification	2101-3280_Sub_Spec.pdf	638029 699d386751bc5e316786b457fae161fa47639e26	no	34
Warnings:					
Information:					
			Total Files Size (in bytes):	1082866	

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.

Customer No. 035884 **Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee Han et al. Serial No: 11/563,909 Filed: November 28, 2006 For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: 2611 Examiner: Dsouza, Joseph Francis A. Confirmation No.: 1721

AMENDMENT UNDER 37 CFR § 1.312

Mail Stop: ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please amend the above-identified application as follows. Please charge any additional fees and credit any overpayment to **Deposit Account No. 502290**.

ZTE/SAMSUNG/HTC 1002-0076

Amendment to the Claims:

Please amend the claims as follows:

1-23. (Canceled).

24. (Currently amended) A method for transmitting a code sequence from a transmitting party to a receiving party in a wireless communication system, the method comprising:

acquiring a code sequence having a second length by a cyclic extension of a code sequence having a first length;

performing a circular shift to the code sequence having the second length; and

transmitting the circular shifted code sequence having the second length to the receiving party,

wherein the first length is a largest prime number smaller than the second length, and

wherein the cyclic extension of the code sequence having the first length is performed such that a part of the code sequence having the first length, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the code sequence having the first length, and

wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length.

25. (Previously presented) The method according to claim 24, wherein the part of the code sequence having the first length comprises at least a cyclic prefix or a cyclic postfix.

26. (Previously presented) The method according to claim 24, wherein the cyclic extension is performed such that a cyclic postfix of the code sequence having the first length, having the length corresponding to the difference between the first length and the second length, is added to the end of the code sequence having the first length.

ZTE/SAMSUNG/HTC 1002-0077

27 - 28. (Canceled).

29. (Previously presented) The method according to claim 24, wherein the code sequence having the first length is a Zadoff-Chu (ZC) sequence.

30. (Previously presented) The method according to claim 24, wherein the code sequence having the second length is transmitted as a reference signal sequence.

31. (Currently amended) An apparatus for transmitting a code sequence in a wireless communication system, the apparatus comprising:

a code sequence generator for generating a code sequence having a second length by cyclic extension of a code sequence having a first length, and performing a circular shift to the code sequence having the second length; and

a transmitting unit for transmitting the circular shifted code sequence having the second length,

wherein the first length is a largest prime number smaller than the second length,

wherein the cyclic extension of the code sequence having the first length is performed such that a part of the code sequence having the first length, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the code sequence having the first length, and

wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length.

32. (Previously presented) The apparatus according to claim 31, wherein the part of the code sequence having the first length comprises at least a cyclic prefix or a cyclic postfix.

ZTE/SAMSUNG/HTC 1002-0078

33. (Previously presented) The apparatus according to claim 31, wherein the cyclic extension is performed such that a cyclic postfix of the code sequence having the first length, having the length corresponding to the difference between the first length and the second length, is added to the end of the code sequence having the first length.

34 - 35. (Canceled).

36. (Previously presented) The apparatus according to claim 31, wherein the code sequence having the first length is a Zadoff-Chu (ZC) sequence.

37. (Previously presented) The apparatus according to claim 31, wherein the code sequence having the second length is transmitted as a reference signal sequence.

38. (Previously presented) A method for transmitting a code sequence in a wireless communication system, the method comprising:

performing a circular shift to a code sequence having a first length to produce a circularly-shifted code sequence having the first length;

performing a cyclic extension of the circularly-shifted code sequence having the first length, to produce a code sequence having a second length; and

transmitting the code sequence having the second length,

wherein the first length is a largest prime number smaller than the second length,

wherein performing the circular shift comprises either moving a rear portion of the code sequence having the first length to a start of the code sequence having the first length, or moving a front portion of the code sequence having the first length to an end of the code sequence having the first length, and

wherein performing the cyclic extension comprises adding a portion of the circularly-shifted code sequence having the first length, having a length corresponding to a difference between the first length and the second length, to either a start or an end of the circularly-shifted code sequence having the first length.

ZTE/SAMSUNG/HTC 1002-0079

REMARKS

Claims 24-26, 29-33 and 36-38 are currently pending in this application. Claims 24, 31 and 38 are the only independent claims. The claim amendments are limited to claims 24 and 31, which have been amended to clarify antecedent basis for the code sequence term. No new matter has been added as the amendments have support in the specification as originally filed. See, for example, at least Figs. 11 and 17 and accompanying portions of the specification. In accordance with MPEP 714.16, Applicant provides the following remarks.

The amendment is needed to clarify that the claimed "transmitting" refers to the circular shifted code sequence. No additional search or examination is believed necessary. The claims are still believed to be patentable for at least the reasons set forth in the previously filed response. The need to amend the identified claims was not detected until a recent review of the allowed claims was conducted. Thus, the foregoing amendment to claims 24 and 31 could not have been presented earlier as this issue had not yet been identified.

It is understood that no amendment may be made as a matter of right in an application after the mailing of the notice of allowance. However, Applicant's representative, Jeffrey Lotspeich, spoke with Examiner Dsouza via telephone on April 20, 2010. During this conversation Examiner Dsouza indicated that such amendments would be entered provided that it was included in the appropriate amendment under 37 CFR 1.132. Applicant and the undersigned gratefully appreciate the Examiner's efforts in this regard.

Accordingly, entry of the present amendment is believed proper, and is respectfully requested. If for any reason the Examiner has any concerns with regard to the present application, the Examiner is requested to call the undersigned attorney at the Los Angeles, California, telephone number (213) 623-2221.

Customer No. 035884

Date: April 21, 2010

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

/Jeffrey Lotspeich/

Jeffrey J. Lotspeich
Registration No. 45,737
Attorney for Applicant

ZTE/SAMSUNG/HTC 1002-0080

Electronic Acknowledgement Receipt

EFS ID:	7462868
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Harry Sung Lee/Melissa Sanchez
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3280
Receipt Date:	21-APR-2010
Filing Date:	28-NOV-2006
Time Stamp:	20:31:28
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	Miscellaneous Incoming Letter	2101-3280-Transmittal-312Amendment.pdf	61179 797d33f60d684ae7ed01c94bc895f7cdd69f136f	no	1
Warnings:					
Information:					

2	Amendment after Notice of Allowance (Rule 312)	2101-3280-Amend-after-NOA-312-FINAL-TO-PTO-JJL.pdf	83378 a9dea04e1fe7eca4ac75023e9af7be45a477c540	no	5
Warnings:					
Information:					
			Total Files Size (in bytes):	144557	

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.

Customer No. 035884 **Docket: 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Art Unit: 2611
Seung Hee Han et al.	Examiner: Dsouza, Joseph Francis A.
Serial No: 11/563,909	Confirmation No.: 1721
Filed: November 28, 2006	
For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:
Transmitted herewith is an AMENDMENT AFTER NOTICE OF ALLOWANCE in the above-identified application.

☐ A petition for extension of time for _ month(s) is enclosed.
☒ No additional fee is required.

The fee has been calculated as shown below:

	(Col. 1) CLAIMS REMAINING AFTER AMENDMENT		(Col. 2) HIGHEST NUMBER PREVIOUSLY PAID FOR		(Col. 3) PRESENT EXTRA*	LG/SM $ ENTITY FEE		ADD'L FEE DUE
TOTAL CLAIMS FEE	11	-	23	**	0	LG=$52 SM=$26	$52	$ 0
INDEPENDENT CLAIMS FEE	3	-	3	***	0	LG=$220 SM=$110	$220	$ 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIMS						LARGE ENTITY FEE = $390 SMALL ENTITY FEE = $195		$ 0
							TOTAL	$ 0

* If the entry in Col. 1 is less than the entry in Col. 2, write "0" in Col. 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, write "20" in this space.
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, write "3" in this space. The "Highest Number Previously Paid For" (Total or Independent) is the highest number found from the equivalent box on Col. 1 of a prior amendment or the number of claims originally filed.

☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to **Deposit Account No. 502290**:
- ☐ Excess claim(s) fee in the amount of $___.
- ☐ RCE fee in the amount of $___.
- ☐ Extension fees in the amount of $___.
- ☐ Petition fee in the amount of $___.
- ☐ Terminal Disclaimer fee in the amount of $___.
- ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
- ☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: April 21, 2010

By: /Sevan Savsa/
Sevan Savsa
Registration No. 61,718
Attorney for Applicant(s)

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

35884 7590 03/19/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 03/19/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	06/21/2010

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 SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

ZTE/SAMSUNG/HTC 1002-0084

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)

35884 7590 03/19/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

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.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	06/21/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
DSOUZA, JOSEPH FRANCIS A	2611	375-142000

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 credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information 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.

ZTE/SAMSUNG/HTC 1002-0085

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

35884 7590 03/19/2010

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 03/19/2010

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

The Patent Term Adjustment to date is 456 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 456 day(s).

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 Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

ZTE/SAMSUNG/HTC 1002-0086

Notice of Allowability	Application No.	Applicant(s)	
	11/563,909	HAN ET AL.	
	Examiner	Art Unit	
	ADOLF DSOUZA	2611	

-- 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 _____.

2. ☐ The allowed claim(s) is/are _____.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   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.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ 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. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Adolf DSouza Examiner Art Unit: 2611	/David C. Payne/ Supervisory Patent Examiner, Art Unit 2611

ZTE/SAMSUNG/HTC 1002-0087

1. As requested by the Applicant in Remarks (9/24/2009) Examiner has accepted the drawings submitted on 4/9/2009 and 11/28/2006.

2. Claims have been renumbered as shown below:

- Claims 24 – 26 have been renumbered as claims 1 - 3 respectively.
- Claims 29 - 33 have been renumbered as claims 4 - 8 respectively.
- Claims 36 - 38 have been renumbered as claims 9 - 11 respectively.

Response to Amendment

3. Applicant's amendment filed 9/24/2009 has been fully considered and as a result claims 24 – 26, 29 – 33, 36 - 38 are now allowed.

4. Claims 24 – 26, 29 – 33, 36 - 38 are allowed.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADOLF DSOUZA whose telephone number is (571)272-

1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID PAYNE can be reached on 571-272-3024. 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.

Adolf DSouza
Examiner
Art Unit 2611

AD

/David C. Payne/
Supervisory Patent Examiner, Art Unit 2611

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11563909	HAN ET AL.
	Examiner	Art Unit
	ADOLF DSOUZA	2611

ORIGINAL		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
375	142	H 0 4 B 1 / 00 (2006.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	203	208			
375	131	140	146	148	

☐ 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
1	24														
2	25														
3	26														
-	27														
-	28														
4	29														
5	30														
6	31														
7	32														
8	33														
-	34														
-	35														
9	36														
10	37														
11	38														

/ADOLF DSOUZA/ Examiner.Art Unit 2611	3/12/2010	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	11	
/DAVID C PAYNE/ Supervisory Patent Examiner.Art Unit 2611	03/14/2010	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

ZTE/SAMSUNG/HTC 1002-0090

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11563909	HAN ET AL.
	Examiner	Art Unit
	ADOLF DSOUZA	2611

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/15/2009	03/12/2010							
1	24	✓	=							
2	25	✓	=							
3	26	✓	=							
-	27	✓	-							
-	28	✓	-							
4	29	✓	=							
5	30	✓	=							
6	31	✓	=							
7	32	✓	=							
8	33	✓	=							
-	34	✓	-							
-	35	✓	-							
9	36	✓	=							
10	37	✓	=							
11	38		=							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11563909	HAN ET AL.
	Examiner	Art Unit
	ADOLF DSOUZA	2611

SEARCHED			
Class	Subclass	Date	Examiner
370	203	6/15/2009	AD
375	131,142	6/15/2009	AD

SEARCH NOTES		
Search Notes	Date	Examiner
See EAST search attached	6/15/2009	AD
Inventor Nme Search (in EAST & PALM)a	6/15/2009	AD
See EAST search attached	3/12/2010	AD

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
370	all	3/12/2010	AD
375	all	3/12/2010	AD
455	all	3/12/2010	AD

/ADOLF DSOUZA/ Examiner.Art Unit 2611	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	WO-2005104412-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:07
S4	0	WO-2003075500-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:08
S3	1	(US-7426175-$).did.	USPAT	OR	ON	2009/06/15 15:08
S2	2	("7426175").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 15:08
S6	1	WO-03075500-A2.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:09
S5	0	WO-03075500-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:09
S8	1	(US-7483367-$).did.	USPAT	OR	ON	2009/06/15 15:10
S7	2	("7483367").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 15:10
S9	35	(han and noh and kwon and park and lee and kim).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:12

ZTE/SAMSUNG/HTC 1002-0093

S10	0	((code adj2 sequence) and (extend$3 or increas $3 or length$6) and (cyclic adj2 exten$3) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:13
S14	1	S9 and S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S13	42	((code adj2 sequence)and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S12	0	((code adj2 sequence) and (cyclic adj2 exten$5) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S11	0	((code adj2 sequence) and (extend$3 or increas $3 or length$6) and (cyclic adj2 exten$5) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S15	1211195	(han or noh or kwon or park or lee or kim).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:15
S16	2	S13 and S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:17
S17	118790	(lg adj electron$3).as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:18
S18	1	S13 and S17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:19

ZTE/SAMSUNG/HTC 1002-0094

S19	2	(US-7426175-$ or US-7483367-$).did.	USPAT	OR	ON	2009/06/15 15:30
S20	1	S19 and (extend$3 or extens$4) and cyclic	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:40
S22	1	S21 and (prefix or post$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:41
S21	1	S20 and prime	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:41
S23	1	(US-7426175-$).did.	USPAT	OR	ON	2009/06/15 15:54
S25	5	S24 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:56
S24	185	zadoff adj2 Chu adj2 sequence	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:56
S26	1	(US-20030156624-$).did.	US-PGPUB	OR	ON	2009/06/15 15:59
S27	1280	((pilot or training or preamble) near2 sequence) and (autocorrelation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:38
S28	990	S27 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:39

ZTE/SAMSUNG/HTC 1002-0095

S29	67	S28 and (zero with autocorrelation) and ((peak or maximum) with autocorrelation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:40
S32	4	S29 and S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:48
S31	1373	S30 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:48
S30	1639	((375/131,142) or (370/203)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 16:48
L2	0	(wireless and code and parity and (circular near2 shift) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/03/12 14:59

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	336767	(("375") or ("340") or ("455")).CLAS.	US-PGPUB; USPAT; UPAD	OR	OFF	2010/03/12 14:58
L3	1	(wireless and code and parity and (circular near2 shift)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2010/03/12 14:59
L4	0	L1 and L3	US-PGPUB; USPAT; UPAD	OR	ON	2010/03/12 15:00

3/12/2010 3:00:44 PM
C:\Documents and Settings\Adsouza\My Documents\EAST\Workspaces\11563909.wsp

ZTE/SAMSUNG/HTC 1002-0096

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (07-09)
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	11563909
Filing Date	2006-11-28
First Named Inventor	Han, Seung Hee
Art Unit	2611
Examiner Name	Dsouza, Joseph Francis A
Attorney Docket Number	2101-3280

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20060050799	A1	2006-03-09	Hou, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	10-2007-0103917	KR		2007-10-25	LG Electronics, Inc.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

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]

EFS Web 2.1.16

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./

Receipt date: 01/15/2010	Application Number	11563909 11563909 - GAU: 2611
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2006-11-28
	First Named Inventor	Han, Seung Hee
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Adolf DSouza/	Date Considered	03/12/2010

*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. /A.D./

Receipt date: 03/02/2010 11563909 - GAU: 2611

Doc code: IDS PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

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	11563909
	Filing Date	2006-11-28
	First Named Inventor	Seung Hee Han
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050036481		2005-02-17	Chayat, Naftali et al	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2003049295	WO		2003-06-12	Samsung Electronics Co., Ltd.		☐
	2	1065855	EP		2001-01-03	Sony International		☐
	3	9605668	WO		1996-02-22	Ericsson, Inc.		☐

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./

Receipt date: 03/02/2010	Application Number	11563909 11563909 - GAU: 2611
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2006-11-28
	First Named Inventor	Seung Hee Han
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

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		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Adolf DSouza/	Date Considered	03/12/2010

*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. /A.D./

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	11563909
Filing Date	2006-11-28
First Named Inventor	Seung Hee Han
Art Unit	2611
Examiner Name	Dsouza, Joseph Francis A
Attorney Docket Number	2101-3280

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050036481		2005-02-17	Chayat, Naftali et al	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2003049295	WO		2003-06-12	Samsung Electronics Co., Ltd.		☐
	2	1065855	EP		2001-01-03	Sony International		☐
	3	9605668	WO		1996-02-22	Ericsson, Inc.		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11563909
	Filing Date	2006-11-28
	First Named Inventor	Seung Hee Han
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

If you wish to add additional Foreign Patent Document citation information please click the Add button			Add
NON-PATENT LITERATURE DOCUMENTS			Remove
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		☐
If you wish to add additional non-patent literature document citation information please click the Add button			Add

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11563909
	Filing Date	2006-11-28
	First Named Inventor	Seung Hee Han
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

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.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

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	/ROLANDO GONZALEZ/	Date (YYYY-MM-DD)	2010-03-02
Name/Print	ROLANDO GONZALEZ	Registration Number	63,191

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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, 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.**

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.

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 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.

Electronic Acknowledgement Receipt

EFS ID:	7122008
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Rolando Gonzalez/Helen Min-Poyet
Filer Authorized By:	Rolando Gonzalez
Attorney Docket Number:	2101-3280
Receipt Date:	02-MAR-2010
Filing Date:	28-NOV-2006
Time Stamp:	14:31:49
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	Information Disclosure Statement (IDS) Filed (SB/08)	2101-3280-IDSform.pdf	611706 8d89279fb01bf361e345e8ff45aceb331586db81	no	4

Warnings:	
Information:	

2	Foreign Reference	WO-2003-049295.pdf	1599503 d358095b8140b0094f4f1a9f09880d18f32f00a3	no	35
Warnings:					
Information:					
3	Foreign Reference	EP-1065855.pdf	185168 7b2921af014c8d9be602a658bdd3f5519fed38f1	no	17
Warnings:					
Information:					
4	Foreign Reference	WO-1996-005668.pdf	2044712 e1557952b0819fd9786bdcb2a0f1a400a05fdee6	no	54
Warnings:					
Information:					
			Total Files Size (in bytes):	4441089	

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.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (07-09)
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	11563909
	Filing Date	2006-11-28
	First Named Inventor	Han, Seung Hee
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20060050799	A1	2006-03-09	Hou, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	10-2007-0103917	KR		2007-10-25	LG Electronics, Inc.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

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]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11563909
	Filing Date	2006-11-28
	First Named Inventor	Han, Seung Hee
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11563909
	Filing Date	2006-11-28
	First Named Inventor	Han, Seung Hee
	Art Unit	2611
	Examiner Name	Dsouza, Joseph Francis A
	Attorney Docket Number	2101-3280

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.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

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	/Rolando Gonzalez/	Date (YYYY-MM-DD)	2010-01-15
Name/Print	Rolando Gonzalez	Registration Number	63,191

This collection of information is required by 37 CFR 1.97 and 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 1 hour 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, 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.**

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.

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 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.

Electronic Acknowledgement Receipt

EFS ID:	6819599
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Rolando Gonzalez/Dana Gim
Filer Authorized By:	Rolando Gonzalez
Attorney Docket Number:	2101-3280
Receipt Date:	15-JAN-2010
Filing Date:	28-NOV-2006
Time Stamp:	14:01:53
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	Information Disclosure Statement (IDS) Filed (SB/08)	2101-3280_IDS1449Form.pdf	608064 585cf03a8cdf524db68c8cecc0c85226be491e4a	no	4

Warnings:	
Information:	

2	Foreign Reference	KR1020070103917.pdf	431384 2aafeee5828a131ed699896692a084dd6f7479b7	no	19

Warnings:	
Information:	
Total Files Size (in bytes):	1039448

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.

Customer No. 035884 **Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Seung Hee Han et al.	Art Unit:	2611
Serial No:	11/563,909	Examiner:	Dsouza, Joseph Francis A.
Filed:	November 28, 2006		
For:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Confirmation No.:	1721

AMENDMENT

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

Dear Sir:

This paper is in response to the Office Action dated June 26, 2009, in connection with the above-identified application, the response to which is due September 26, 2009. It is believed that no fee is due in connection with this paper. Please charge any fees and credit any overpayment to our deposit account No. 502290. Please enter and consider the following amendments and remarks:

ZTE/SAMSUNG/HTC 1002-0113

Amendment to the Claims:

Please: amend claims 24-26, 29-33, 36 and 37; cancel claims 27, 28, 34 and 35; and add claim 38, as follows:

1-23. (Canceled).

24. (Currently Amended) A method for ~~generating~~ transmitting a code sequence from a transmitting party to a receiving party in a wireless communication system, the method comprising:

~~generating the~~ acquiring a code sequence having a ~~first~~ second length by a cyclic extension of a code sequence having a first length; [[and]]

~~extending the generated code sequence to have a second length by a cyclic extension of the generated code sequence~~

performing a circular shift to the code sequence having the second length; and

transmitting the code sequence having the second length to the receiving party,

wherein the first length is a largest prime number smaller than the second length, and

wherein the cyclic extension of the ~~generated~~ code sequence having the first length is performed such that a part of the ~~generated~~ code sequence having the first length, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the ~~generated~~ code sequence having the first length, and

wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length.

ZTE/SAMSUNG/HTC 1002-0114

25. (Currently Amended) The method according to claim 24, wherein the part of the ~~generated~~ code sequence having the first length comprises at least a cyclic prefix or a cyclic postfix.

26. (Currently Amended) The method according to claim 24, wherein the cyclic extension is performed such that a cyclic postfix of the ~~generated~~ code sequence having the first length, having the length corresponding to the difference between the first length and the second length, is added to the end of the ~~generated~~ code sequence having the first length.

27 - 28. (Canceled).

29. (Currently Amended) The method according to claim 24, wherein the code sequence having the first length is a Zadoff-Chu (ZC) sequence.

30. (Currently Amended) The method according to claim 24, wherein the ~~generated~~ code sequence having the second length is [[used]] transmitted as ~~reference~~ a reference signal sequence.

31. (Currently Amended) An apparatus for transmitting a code sequence in a wireless communication system, the apparatus comprising:

a code sequence generator for generating [[the]] a code sequence having a second length by cyclic extension of a code sequence having a first length, and ~~extending the generated code sequence to have a second length by a cyclic extension of the generated code sequence~~ performing a circular shift to the code sequence having the second length; and

a transmitting unit for transmitting the ~~generated~~ code sequence ~~extended to have~~ having the second length,

wherein the first length is a largest prime number smaller than the second length, [[and]]

ZTE/SAMSUNG/HTC 1002-0115

wherein the cyclic extension of the ~~generated~~ code sequence having the first length is performed such that a part of the ~~generated~~ code sequence having the first length, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the ~~generated~~ code sequence having the first length, and

wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length.

32. (Currently Amended) The apparatus according to claim 31, wherein the part of the ~~generated~~ code sequence having the first length comprises at least a cyclic prefix or a cyclic postfix.

33. (Currently Amended) The apparatus according to claim 31, wherein the cyclic extension is performed such that a cyclic postfix of the ~~generated~~ code sequence having the first length, having the length corresponding to the difference between the first length and the second length, is added to the end of the ~~generated~~ code sequence having the first length.

34 - 35. (Canceled).

36. (Currently Amended) The apparatus according to claim 31, wherein the code sequence having the first length is a Zadoff-Chu (ZC) sequence.

37. (Currently Amended) The apparatus according to claim 31, wherein the ~~generated~~ code sequence having the second length is [[used]] transmitted as ~~reference~~ a reference signal sequence.

38. (New) A method for transmitting a code sequence in a wireless communication system, the method comprising:

performing a circular shift to a code sequence having a first length to produce a circularly-shifted code sequence having the first length;

performing a cyclic extension of the circularly-shifted code sequence having the first length, to produce a code sequence having a second length; and

transmitting the code sequence having the second length,

wherein the first length is a largest prime number smaller than the second length,

wherein performing the circular shift comprises either moving a rear portion of the code sequence having the first length to a start of the code sequence having the first length, or moving a front portion of the code sequence having the first length to an end of the code sequence having the first length, and

wherein performing the cyclic extension comprises adding a portion of the circularly-shifted code sequence having the first length, having a length corresponding to a difference between the first length and the second length, to either a start or an end of the circularly-shifted code sequence having the first length.

ZTE/SAMSUNG/HTC 1002-0117

REMARKS

Claims 24-26, 29-33 and 36-38 are currently pending in this application. Claims 24-26, 29-33, 36 and 37 are amended. Claims 27, 28, 34 and 35 are canceled without prejudice or disclaimer. Claim 38 is newly added to claim disclosed embodiments more completely. Claims 24, 31 and 38 are the only independent claims. No new matter is added.

Claims 24-28, 30, 31-35 and 37 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Zhuang et al. (U.S. Pat. No. 7,426,175). Claims 29 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhuang in view of Koslar (U.S. Pat. Pub. No. 2003/0156624).

The cancellation of claims 27, 28, 34 and 35 renders the rejection of these claims moot. The rejections of the pending claims are respectfully traversed. Applicant requests reconsideration and allowance of the pending claims in view of the following remarks.

Claim for foreign priority under 35 U.S.C. § 119

As a preliminary matter, Applicant notes that the Office Action did not indicate whether or not the originally filed drawings have been accepted. Applicant respectfully requests such an indication on the next communication from the USPTO regarding this application.

Applicant notes with appreciation that the IDS papers have been signed and acknowledged by the Examiner, that Applicant's claim for foreign priority under 35 U.S.C. § 119 has been acknowledged, and that the certified copies of the priority documents have been received.

ZTE/SAMSUNG/HTC 1002-0118

Rejection of claims 24-28, 30, 31-35 and 37 under § 102

Claims 24-28, 30, 31-35 and 37 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Zhuang. The rejection of the cancelled claims is rendered moot since these claims are no longer pending.

With regard to the pending claims, amended claim 24 is directed to a method of transmitting a code sequence to a receiving party at a transmitting party in a wireless communication system and recites features including features of canceled claim 28.

For example, amended claim 24 recites: "acquiring a code sequence having a second length by a cyclic extension of a code sequence having a first length[,]" "performing a circular shift to the code sequence having the second length[,]" and "transmitting the code sequence having the second length to the receiving party[.]" Moreover, amended claim 24 recites: "wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length."

Applicant respectfully submits that the cited portions of Zhuang do not teach or suggest such features.

With respect to now-canceled claim 28, the Examiner asserted that Zhuang disclosed the features of that claim. On page 4 of the Office Action, the Examiner asserted: "Zhuang discloses circular shifting the generated code sequence extended to have the second length (column 4, lines 18-21; wherein the circular shifting is done on the N_G length sequence to give a N_p length sequence)." These assertions are respectfully traversed.

In the above-cited portion (i.e., col. 4, lines 18-21), Zhuang discloses: "Choose N_G to be the largest prime number that is smaller than N_p and generate the sequence set. Repeat the beginning elements of each sequence in the set to append at the end to reach the desired length N_p." (Emphasis added.)

Zhuang's disclosure regarding repeating beginning elements of each sequence to append such elements at the end of the sequence does not teach or suggest

ZTE/SAMSUNG/HTC 1002-0119

performing a circular shift. In more detail, the repeating and appending of elements in order to reach the desired **greater** length N_p does not teach or suggest "performing a circular shift to the code sequence having the second length[,]" as recited in claim 24. Moreover, such disclosure does not teach or suggest "wherein the circular shift is performed to the code sequence having the second length such that either a rear portion of the code sequence having the second length moves to a start of the code sequence having the second length, or a front portion of the code sequence having the second length moves to an end of the code sequence having the second length[,]" as also recited in claim 24.

In view of the foregoing, Applicant respectfully submits that the cited portions of Zhuang fail to disclose or suggest features of independent claim 24. At least for the reasons explained, independent claim 24 is believed to be patentable over Zhuang.

As amended, independent claim 31 recites features similar to those of independent claim 24. At least for reasons similar to those explained with respect to independent claim 24, independent claim 31 is believed to be patentable over Zhuang.

Dependent claims 25-28, 30, 32-35 and 37 are believed to be patentable over Zhuang at least by virtue of their respective dependence from the patentable independent claims.

Rejection of claims 29 and 36 under § 103

Claims 29 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhuang in view of Koslar. The rejection of these claims is respectfully traversed.

Applicant respectfully submits that Koslar does not address the above-explained distinctions between independent claim 24 and the cited portions of Zhuang. Therefore, it is believed that independent claim 24 is patentable over Zhuang in view of Koslar. Dependent claim 29 is believed to be patentable over Zhuang and Koslar at least by virtue of its dependence from independent claim 24.

For similar reasons, it is believed that independent claim 31 is patentable over Zhuang in view of Koslar. Dependent claim 36 is believed to be patentable over Zhuang and Koslar at least by virtue of its dependence from independent claim 24.

ZTE/SAMSUNG/HTC 1002-0120

New independent claim 38

New independent claim 38 recites features similar to those discussed above with regard to claims 24 and 31, and thus, is believed to be patentable for reasons similar to those set out above with regard to claims 24 and 31.

CONCLUSION

In view of the above remarks, Applicant submits that the pending claims of the present application are in condition for allowance. Reexamination and reconsideration of the application, as originally filed, are requested.

No amendment made was related to the statutory requirements of patentability unless expressly stated herein; and no amendment made was for the purpose of narrowing the scope of any claim, unless Applicant has argued herein that such amendment was made to distinguish over a particular reference or combination of references.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 623-2221 to discuss the steps necessary for placing the application in condition for allowance.

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & WAIMEY

/Jeffrey Lotspeich/

Date: September 24, 2009 By:_____

Jeffrey J. Lotspeich
Registration No. 45,737
Attorney for Applicants

ZTE/SAMSUNG/HTC 1002-0121

Electronic Acknowledgement Receipt

EFS ID:	6136902
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Jeffrey John Lotspeich/Martha Martinez
Filer Authorized By:	Jeffrey John Lotspeich
Attorney Docket Number:	2101-3280
Receipt Date:	24-SEP-2009
Filing Date:	28-NOV-2006
Time Stamp:	13:05:23
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		Amendment-2101-3280.pdf	601307 ee84490a5e97ee4a93400dfa1c50702d6583aaeb	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Miscellaneous Incoming Letter	1	1
	Amendment/Req. Reconsideration-After Non-Final Reject	2	2
	Claims	3	6
	Applicant Arguments/Remarks Made in an Amendment	7	10
Warnings:			
Information:			
	Total Files Size (in bytes):	601307	

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.

Customer No. 035884 **Docket: 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee Han et al. Serial No: 11/563,909 Filed: November 28, 2006 For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: 2611 Examiner: Dsouza, Joseph Francis A. Confirmation No.: 1721

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

Sir:
Transmitted herewith is an AMENDMENT in the above-identified application.

☐ A petition for extension of time for _ month(s) is enclosed.
☒ No additional fee is required.

The fee has been calculated as shown below:

	(Col. 1) CLAIMS REMAINING AFTER AMENDMENT		(Col. 2) HIGHEST NUMBER PREVIOUSLY PAID FOR		(Col. 3) PRESENT EXTRA*	LG/SM $ ENTITY FEE		ADD'L FEE DUE
TOTAL CLAIMS FEE	11	-	23	**	0	LG=$52 SM=$26	$52	$ 0
INDEPENDENT CLAIMS FEE	3	-	3	***	0	LG=$220 SM=$110	$220	$ 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIMS						LARGE ENTITY FEE = $390 SMALL ENTITY FEE = $195		$ 0
							TOTAL	$ 0

* If the entry in Col. 1 is less than the entry in Col. 2, write "0" in Col. 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, write "20" in this space.
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, write "3" in this space. The "Highest Number Previously Paid For" (Total or Independent) is the highest number found from the equivalent box on Col. 1 of a prior amendment or the number of claims originally filed.

☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to **Deposit Account No. 502290**:

☐ Excess claim(s) fee in the amount of $_____.
☐ RCE fee in the amount of $_____
☐ Extension fees in the amount of $___.
☐ Petition fee in the amount of $_____ .
☐ Terminal Disclaimer fee in the amount of $_____ .
☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: September 24, 2009

By: /Jeffrey J. Lotspeich/
Jeffrey J. Lotspeich
Registration No. 45,737
Attorney for Applicant

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/563,909	11/28/2006	Seung Hee Han	2101-3280	1721

35884 7590 06/26/2009

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
DSOUZA, JOSEPH FRANCIS A	
ART UNIT	PAPER NUMBER
2611	

NOTIFICATION DATE	DELIVERY MODE
06/26/2009	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):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

ZTE/SAMSUNG/HTC 1002-0125

Office Action Summary	Application No.	Applicant(s)	
	11/563,909	HAN ET AL.	
	Examiner	Art Unit	
	ADOLF DSOUZA	2611	

-- 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 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 *28 November 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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

4)☒ Claim(s) *24 - 37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *24 - 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ 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).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

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).

a)☒ All b)☐ Some * c)☐ None of:

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) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Priority

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d).

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 –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for 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.

3. Claims 24 – 28, 30, 31 – 35, 37 are rejected under 35 U.S.C. 102(e) as being anticipated by Zhuang (US 7,426,175 corresponding to WO 2005104412 A1, which the Applicant has provided in his IDS).

Regarding clam 24, Zhuang discloses a method for generating a code sequence in a wireless communication system (Abstract; column 2, lines 20 – 28; Fig. 1; wherein the code sequence is interpreted as the pilot sequence and the wireless system is as shown in Fig. 1), the method comprising:

generating the code sequence having a first length (column 4, lines 10 – 14; wherein the first length is N_G);

and extending the generated code sequence to have a second length by a cyclic extension of the generated code sequence (column 4, lines 18 - 21; wherein the second length is N_P and the cyclic extension is done by repeating the beginning elements of each sequence),

wherein the first length is a largest prime number smaller than the second length (column 4, lines 18 - 19),

and wherein the cyclic extension of the generated code sequence is performed such that a part of the generated code sequence, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the generated code sequence (column 4, lines 19 – 21; wherein the appending is done at the end).

Regarding clam 25, Zhuang discloses the part of the generated code sequence comprises at least a cyclic prefix or a cyclic postfix (column 4, lines 19 – 21; wherein the appending is done at the end to give a postfix).

Regarding clam 26, Zhuang discloses the cyclic extension is performed such that a cyclic postfix of the generated code sequence, having the length corresponding to the difference between the first length and the second length, is added to the end of the generated code sequence (column 4, lines 18 – 21; wherein the length added is N_P - N_G).

Regarding clam 27, Zhuang discloses circular shifting the generated code sequence having the first length (column 4, lines 18 - 21; wherein the circular shifting is done by repeating the beginning elements of each sequence).

Regarding clam 28, Zhuang discloses circular shifting the generated code sequence extended to have the second length (column 4, lines 18 - 21; wherein the circular shifting is done on the N_G length sequence to give a N_P length sequence).

Regarding clam 30, Zhuang discloses the generated code sequence is used as reference signal sequence (Abstract; column 2, lines 20 – 28; wherein the reference signal sequence is interpreted as the pilot sequence).

Claims 31- 35, 37 are directed to apparatus of the same subject matter claimed in method/steps claims 24 – 28, 30 respectively and therefore, are rejected as explained in the rejections of claims 24 – 28, 30 above.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 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.

Claims 29, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhuang (US 7,426,175 corresponding to WO 2005104412 A1, which the Applicant has provided in his IDS) in view of Koslar (US 20030156624).

Regarding clam 29, Zhuang does not disclose the code sequence is a Zadoff-Chu (ZC) sequence.

In the same field of endeavor, however, Koslar discloses the code sequence is a Zadoff-Chu (ZC) sequence ([0012], last 9 lines).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the ZC sequence, as taught by Koslar, in the system of Zhuang because this would provide an pilot sequence that is close to ideal, namely a peak at zero time shift with very low values at other time shifts, as disclosed by Koslar ([0012]).

Claim 36 is directed to apparatus of the same subject matter claimed in method/steps claim 29 and therefore, is rejected as explained in the rejection of claim 29 above.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to pilot sequences:

Guidoux (US 4,621,173) discloses a method of reducing the convergence time of an echo canceller using training sequences.

Park (US 5,363,144) discloses television ghost canceling device using training sequences.

Malkamaki et al. (US 5,479,444) discloses training sequence in digital cellular radio telephone system.

Hudson (US 20030043887) discloses communication system and methods of estimating channel impulse responses using training sequences.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADOLF DSOUZA whose telephone number is (571)272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on 571-272-3036. 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.

Adolf DSouza
Examiner
Art Unit 2611

AD

/Shuwang Liu/

Supervisory Patent Examiner, Art Unit 2611

Notice of References Cited	Application/Control No. 11/563,909	Applicant(s)/Patent Under Reexamination HAN ET AL.	
	Examiner ADOLF DSOUZA	Art Unit 2611	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0156624 A1	08-2003	Koslar	375/131
*	B	US-7,426,175 B2	09-2008	Zhuang et al.	370/203
	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	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.

ZTE/SAMSUNG/HTC 1002-0133

PTO/SB/08A (01-08)
Approved for use through 04/30/2008. 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.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	11/563,909
Filing Date	November 28, 2006
First Named Inventor	Seung Hee Han
Art Unit	2611
Examiner Name	Ghayour, Mohammad H.
Attorney Docket Number	2101-3280

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
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

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]
AD		WO 2005/104412	11-03-2005	Motorola Inc.		
AD		WO 2003/075500	09-12-2003	Alvarion Ltd.		

Examiner Signature	/A DSouza/	Date Considered	6/15/2009

*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 Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.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.

This collection of information is required by 37 CFR 1.97 and 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.

PTO/SB/08B (01-08)
Approved for use through 04/30/2008. 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.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

	Complete if Known
Application Number	11/563,909
Filing Date	November 28, 2006
First Named Inventor	Seung Hee Han
Art Unit	2611
Examiner Name	Ghayour, Mohammad H.
Attorney Docket Number	2101-3280

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]
AD		TEXAS INSTRUMENTS "On allocation of Uplink Pilot Sub-Channels in EUTRA SC-FDMA", 3GPP TSG-RAN WG1, E1-050922, August 29, 2005.	

Examiner Signature	/A DSouza/	Date Considered	6/15/2009

*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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11563909	HAN ET AL.
	Examiner	Art Unit
	ADOLF DSOUZA	2611

SEARCHED			
Class	Subclass	Date	Examiner
370	203	6/15/2009	AD
375	131,142	6/15/2009	AD

SEARCH NOTES		
Search Notes	Date	Examiner
See EAST search attached	6/15/2009	AD
Inventor Nme Search (in EAST & PALM)a	6/15/2009	AD

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/ADOLF DSOUZA/ Examiner.Art Unit 2611	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11563909	HAN ET AL.
	Examiner	Art Unit
	ADOLF DSOUZA	2611

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/15/2009								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								
	29	✓								
	30	✓								
	31	✓								
	32	✓								
	33	✓								
	34	✓								
	35	✓								
	36	✓								
	37	✓								

ZTE/SAMSUNG/HTC 1002-0137

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

BIB DATA SHEET

CONFIRMATION NO. 1721

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/563,909	11/28/2006 RULE	375	2611	2101-3280

APPLICANTS

Seung Hee Han, Seoul, KOREA, REPUBLIC OF;
Min Seok Noh, Seoul, KOREA, REPUBLIC OF;
Yeon Hyeon Kwon, Suwon-si, KOREA, REPUBLIC OF;
Hyun Hwa Park, Anyang-si, KOREA, REPUBLIC OF;
Hyun Woo Lee, Anyang-si, KOREA, REPUBLIC OF;
Dong Cheol Kim, Uiwang-si, KOREA, REPUBLIC OF;

**** CONTINUING DATA **************************

**** FOREIGN APPLICATIONS **************************

REPUBLIC OF KOREA 10-2005-0114306 11/28/2005
REPUBLIC OF KOREA 10-2006-0062467 07/04/2006
REPUBLIC OF KOREA 10-2006-0064091 07/07/2006

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

01/12/2007

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No	☑ Yes ☐ No	/ADOLF DSOUZA/ Examiner's Signature	☐ Initials	KOREA, REPUBLIC OF	18	14	2

ADDRESS

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017
UNITED STATES

TITLE

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1280	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	WO-2005104412-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:07
S2	2	("7426175").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 15:08
S3	1	(US-7426175-$).did.	USPAT	OR	ON	2009/06/15 15:08
S4	0	WO-2003075500-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:08
S5	0	WO-03075500-A1.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:09
S6	1	WO-03075500-A2.DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:09
S7	2	("7483367").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 15:10
S8	1	(US-7483367-$).did.	USPAT	OR	ON	2009/06/15 15:10
S9	35	(han and noh and kwon and park and lee and kim).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:12

ZTE/SAMSUNG/HTC 1002-0139

S10	0	((code adj2 sequence) and (extend$3 or increas $3 or length$6) and (cyclic adj2 exten$3) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:13
S11	0	((code adj2 sequence) and (extend$3 or increas $3 or length$6) and (cyclic adj2 exten$5) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S12	0	((code adj2 sequence) and (cyclic adj2 exten$5) and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S13	42	((code adj2 sequence)and prime).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S14	1	S9 and S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:14
S15	1211195	(han or noh or kwon or park or lee or kim).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:15
S16	2	S13 and S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:17
S17	118790	(lg adj electron$3).as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:18
S18	1	S13 and S17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:19

ZTE/SAMSUNG/HTC 1002-0140

S19	2	(US-7426175-$ or US-7483367-$).did.	USPAT	OR	ON	2009/06/15 15:30
S20	1	S19 and (extend$3 or extens$4) and cyclic	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:40
S21	1	S20 and prime	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:41
S22	1	S21 and (prefix or post$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:41
S23	1	(US-7426175-$).did.	USPAT	OR	ON	2009/06/15 15:54
S24	185	zadoff adj2 Chu adj2 sequence	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:56
S25	5	S24 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 15:56
S26	1	(US-20030156624-$).did.	US-PGPUB	OR	ON	2009/06/15 15:59
S27	1280	((pilot or training or preamble) near2 sequence) and (autocorrelation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:38
S28	990	S27 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:39

ZTE/SAMSUNG/HTC 1002-0141

S29	67	S28 and (zero with autocorrelation) and ((peak or maximum) with autocorrelation)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:40
S30	1639	((375/131,142) or (370/203)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/06/15 16:48
S31	1373	S30 and @ad<"20051128"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:48
S32	4	S29 and S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/06/15 16:48

6/15/2009 4:52:23 PM
C:\Documents and Settings\Adsouza\My Documents\EAST\Workspaces\11563909.wsp

ZTE/SAMSUNG/HTC 1002-0142

Customer No. 035884 Attorney Docket No. 2101-3280

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Seung Hee Han et al.

Serial No: 11/563,909

Filed: November 28, 2006

FOR: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Art Unit: 2611

Examiner: GHAYOUR, MOHAMMAD H.

Conf. No.: 1721

PRELIMINARY AMENDMENT

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

Dear Sir:

Prior to initial examination on the merits, please amend the above-identified application as follows below. If you have any questions, please direct further correspondence to Customer Number 035884 and the undersigned attorney.

IN THE SPECIFICATION

Please replace paragraph 0074 with the following paragraph:

[0074] Referring to Figure 9, the generated CAZAC sequence has length X. Here, the value of X is a largest prime number less than the value of L. In other words, X is a prime number less than L. Thereafter, the generated CAZAC sequence having length X has elements added or a padding portion added to the CAZAC sequence ~~so as~~in order to make the length of the generated CAZAC sequence corresponding ~~go~~ to the desired length L. Here, C1 represents the length of the CAZAC sequence having length X, and C2 represents the padding portion. By combining C1 and C2 (C1 + C2), the generated CAZAC sequence can have a length corresponding to the desired length L.

Please replace paragraph 0075 with the following paragraph:

[0075] Figure 10 illustrates an exemplary application of circular shift. The circular shift is typically applied to increase an amount of control information transmitted to the communication system. ~~That is, for~~For example, a back portion of the sequence is re-allocated to a front portion of the sequence, and ~~accordingly,~~ the remaining sequence is shifted in the direction of the back portion of the sequence in an amount (or length) corresponding to the re-allocated back portion, as illustrated in Figure ~~2~~10. Further, if specified control information is applied the circular shift as described above, ~~then~~ the amount of control information ~~amount~~ that can be transmitted via a corresponding sequence increases.

ZTE/SAMSUNG/HTC 1002-0144

IN THE DRAWINGS:

A Substitute drawing sheet is enclosed for FIG. 3 to replace the original drawing sheet filed with the application. Specifically, the following amendment has been made:

"N>M" in step "S302" has been replaced by "M>N."

AMENDMENTS TO THE CLAIMS:

Please cancel claims 1-23 without prejudice and add new claims 24-37 as follows:

1-23. Canceled.

24. (New) A method for generating a code sequence in a wireless communication system, the method comprising:

generating the code sequence having a first length; and

extending the generated code sequence to have a second length by a cyclic extension of the generated code sequence,

wherein the first length is a largest prime number smaller than the second length, and

wherein the cyclic extension of the generated code sequence is performed such that a part of the generated code sequence, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the generated code sequence.

25. (New) The method according to claim 24, wherein the part of the generated code sequence comprises at least a cyclic prefix or a cyclic postfix.

26. (New) The method according to claim 24, wherein the cyclic extension is performed such that a cyclic postfix of the generated code sequence, having the length corresponding to the difference between the first length and the second length, is added to the end of the generated code sequence.

27. (New) The method according to claim 24, further comprising:

circular shifting the generated code sequence having the first length.

28. (New) The method according to claim 24, further comprising:

circular shifting the generated code sequence extended to have the second length.

ZTE/SAMSUNG/HTC 1002-0146

29. (New) The method according to claim 24, wherein the code sequence is a Zadoff-Chu (ZC) sequence.

30. (New) The method according to claim 24, wherein the generated code sequence is used as reference signal sequence.

31. (New) An apparatus for transmitting a code sequence in a wireless communication system, the apparatus comprising:

a code sequence generator for generating the code sequence having a first length, and extending the generated code sequence to have a second length by a cyclic extension of the generated code sequence; and

a transmitting unit for transmitting the generated code sequence extended to have the second length,

wherein the first length is a largest prime number smaller than the second length, and

wherein the cyclic extension of the generated code sequence is performed such that a part of the generated code sequence, having a length corresponding to a difference between the first length and the second length, is added to either a start or an end of the generated code sequence.

32. (New) The apparatus according to claim 31, wherein the part of the generated code sequence comprises at least a cyclic prefix or a cyclic postfix.

33. (New) The apparatus according to claim 31, wherein the cyclic extension is performed such that a cyclic postfix of the generated code sequence, having the length corresponding to the difference between the first length and the second length, is added to the end of the generated code sequence.

34. (New) The apparatus according to claim 31, wherein the code sequence generator is configured to further perform a circular shift of the generated code sequence having the first length.

35. (New) The apparatus according to claim 31, wherein the code sequence generator is configured to further perform a circular shift of the generated code sequence extended to have the second length.

36. (New) The apparatus according to claim 31, wherein the code sequence is a Zadoff-Chu (ZC) sequence.

37. (New) The apparatus according to claim 31, wherein the generated code sequence is used as reference signal sequence.

ZTE/SAMSUNG/HTC 1002-0148

REMARKS

With this paper, claims 1-23 have been canceled without prejudice and new claims 24-37 have been added. Applicant submits that support for the new claims is found in the specification as originally filed and that no new matter has been added.

Amendments to Specification

Amendments have been made to the specification at paragraphs 0074 and 0075 in order to correct typographical and grammatical errors. No new matter has been added as the amendments have support in the specification and drawings as originally submitted.

Amendments to Drawings

With this paper, amended Figure 3 has been submitted in order to correct a typographical error. No new matter has been added as the amendment has support in the application as originally filed at paragraph 0047.

Applicant respectfully requests a prompt examination and allowance by the Examiner. If the Examiner has any questions regarding the subject matter submitted herein, please contact the undersigned attorney at the phone number listed below.

Applicant requests that all deficits and credits in regards to this filing be referenced to Deposit Account No. 502290 order 2101-3280.

ZTE/SAMSUNG/HTC 1002-0149

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & WAIMEY

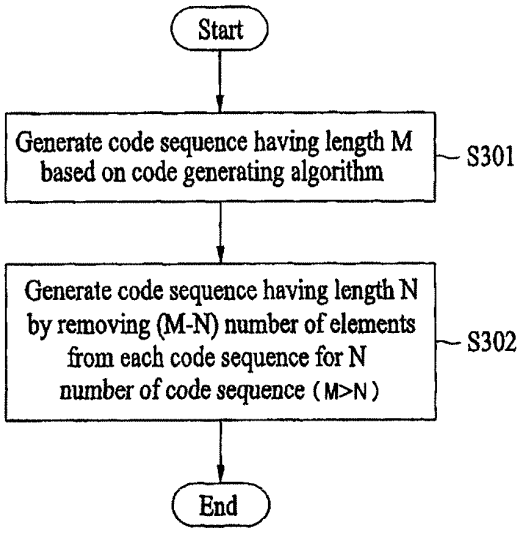
By: /Richard C. Salfelder/
Richard C. Salfelder
Registration No. 51,127
Attorney for Applicant(s)

Date: April 9, 2009

Customer No. 035884

Enclosure: Replacement Sheet for FIG 3.

FIG. 3


Start
Generate code sequence having length M based on code generating algorithm
S301
Generate code sequence having length N by removing (M-N) number of elements from each code sequence for N number of code sequence (M>N)
S302
End

Electronic Acknowledgement Receipt

EFS ID:	5131918
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Richard C. Salfelder/Maggie Wen
Filer Authorized By:	Richard C. Salfelder
Attorney Docket Number:	2101-3280
Receipt Date:	09-APR-2009
Filing Date:	28-NOV-2006
Time Stamp:	20:59:33
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		2101-3280_PA_filed_04092009_toPTO.pdf	353254 13afadc8fb465b575b19cb58895c44a030e30c46	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Miscellaneous Incoming Letter	1	1
	Preliminary Amendment	2	2
	Specification	3	3
	Applicant Arguments/Remarks Made in an Amendment	4	4
	Claims	5	7
	Applicant Arguments/Remarks Made in an Amendment	8	9
	Drawings-only black and white line drawings	10	10
Warnings:			
Information:			
	Total Files Size (in bytes):	353254	

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.

Customer No. 035884

PATENT
Attorney Docket: 2101-3280

In re application of:
Seung Hee HAN et al.
Serial No: 11/563,909
Filed: November 28, 2006
For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Art Unit: 2611
Examiner: Ghayour, Mohammad H.
Confirmation No. 1721

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

Sir:
Transmitted herewith is a Preliminary Amendment in the above-identified application.

☐ A petition for extension of time for __ month(s) is enclosed.
☐ A Request for Continued Examination (RCE) is enclosed.
☒ __1__ sheet(s) of replacement drawing(s) is/are enclosed.
☐ An information disclosure statement in accordance with 37 CFR 1.56 and 1.97 is enclosed.
☐ No additional fee is required.

The fee has been calculated as shown below:

	(Col. 1) CLAIMS REMAINING AFTER AMENDMENT		(Col. 2) HIGHEST NUMBER PREVIOUSLY PAID FOR		(Col. 3) PRESENT EXTRA*	LG/SM $ ENTITY FEE		ADD'L FEE DUE
TOTAL CLAIMS FEE	14	-	23	**	0	LG=$52 SM=$26	$52	$ 0
INDEPENDENT CLAIMS FEE	2	-	3	***	0	LG=$220 SM=$110	$220	$ 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIMS						LARGE ENTITY FEE = $390 SMALL ENTITY FEE = $195		$ 0
							TOTAL	$ 0

* If the entry in Col. 1 is less than the entry in Col. 2, write "0" in Col. 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, write "20" in this space.
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, write "3" in this space. The "Highest Number Previously Paid For" (Total or Independent) is the highest number found from the equivalent box on Col. 1 of a prior amendment or the number of claims originally filed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.
☐ A check in the amount of $_____ to cover the extension fee is enclosed.
☐ A check in the amount of $_____ to cover the information disclosure statement fee is enclosed.
☐ A check in the amount of $_____ to cover the petition fee is enclosed.
☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 502290.
  ☐ The amount of $____ for the filing fee.
  ☐ The amount of $____ for the extension fee.
  ☐ The amount of $____ for the RCE fee.
  ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
  ☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Schmadeka

Date: April 9, 2009

By: /Richard C. Salfelder/
Richard C. Salfelder, Esq.
Registration No. 51,127
Attorney for Applicant(s)

Customer #035884

USPTO
RECEIPTS ACCOUNTING
DIVISION
2008 SEP 26 AM 11: 15

PTO

Customer No. 35884 **Attorney Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Seung Hee Han

Serial No: 11/563,909
Filed: November 28, 2006
FOR: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Art Unit: 2611

Examiner: GHAYOUR, MOHAMMAD H.

Conf. No.: 1721

TRANSMITTAL OF REQUEST FOR REFUND

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

Dear Sir:

Applicant respectfully requests for a refund of the $180.00 IDS fee paid on September 25, 2008 to the deposit account 502290. As stated in the IDS letter submitted on September 25, 2008, each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application and that the communication is dated not more than three months prior to the filing of the information disclosure statement. 37 C.F.R. § 1.97(e)(1). Therefore, Applicant submits that the $180.00 fee was erroneously paid and requests a refund.

Respectfully submitted,

Lee, Hong, Degerman, Kang & Schmadeka

Date: September 25, 2008

By: _____
Puya Pazow-Navid
Registration No. 59,657
Attorney for Applicant

Customer No. 35884

ZTE/SAMSUNG/HTC 1002-0156

Electronic Patent Application Fee Transmittal

Application Number:	11563909
Filing Date:	28-Nov-2006
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Filer:	Craig W. Schmoyer./Carl Alvarado
Attorney Docket Number:	2101-3280

Adjustment date: 09/29/2008 HDESTA1
09/26/2008 INTEFSW 00000020 502290 11563909
01 FC:1806 180.00 CR

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

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**

PTO

Customer No. 35884 **Attorney Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee Han Serial No: 11/563,909 Filed: November 28, 2006 FOR: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: 2611 Examiner: Ghayour, Mohammad H. Conf. No.: 1721

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT

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

Dear Sir:

In accordance with 37 CFR § 1.56 and 1.97, enclosed please find a copy of Form PTO-1449 listing the attached references which might be deemed material to the examination of the above-identified application.

1. Non-English Language References

☒ Enclosed is/are reference(s) cited in a foreign search report for a counterpart application.

☐ The specification incorporates comments on the relevancy of Non-English language references.

☐ Set forth below are comments provided by the applicant's home country counsel on the relevancy of non-English language references:

ZTE/SAMSUNG/HTC 1002-0159

2. ☒ The information disclosure statement submitted herewith is being filed within three months of the filing date of the national application other than a continued prosecution application (CPA) or date of entry into the national stage of an international application or before the mailing date of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a request for continued examination under 1.114 whichever event occurs last. 37 C.F.R. § 1.97(b) (as amended September 2000).

3. ☐ The information disclosure statement transmitted herewith is being filed *after* three months of the filing date of this national application or the date of entry of the national stage as set forth in § 1.491 in an international application or after the mailing date of the first Office Action on the merits, whichever event occurred last but *before* the mailing date of either: 37 C.F.R. § 1.97(c) (as amended September 2000).

(1) a final action under § 1.113 or

(2) a notice of allowance under § 1.311, whichever occurs first.

STATEMENT OR FEE

A. Included with this transmittal is

i. ☐ a certification (set forth below) in accordance with 37 C.F.R. § 1.97(e). (If for any reason the certificate set forth below should be unsatisfactory, the Commissioner is provisionally authorized to charge the $180 fee (37 C.F.R. § 1.17(p)) to Deposit Account No. 502290. A copy of this sheet is enclosed.)

OR

ii. ☐ the attached fee set forth in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under § 1.97(c). ($180.00).

4. ☐ The information disclosure statement transmitted herewith is being filed *after* a final action under § 1.113 or a notice of allowance under § 1.311, whichever occurs first, but before, or simultaneously with the payment of the issue fee. 37 C.F.R. § 1.97(d) (as amended September 2000).

STATEMENT AND FEE

A. In accordance with the requirements of 37 C.F.R. § 1.97(d):

i. Set forth below is a certification as specified in 37 C.F.R. § 1.97(e); **AND**

ii. Applicant submits the petition fee set forth in § 1.17(p). ($180.00).

STATEMENT

(Required if 3Ai or 4 above is marked)

5. I, the person signing below, certify

☐ that each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application and that the communication is dated not more than three months prior to the filing of the information disclosure statement. 37 C.F.R. § 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 disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the statement. 37 C.F.R. § 1.97(e)(2).

6. If it should be determined that for any reason either an insufficient fee or an excessive fee has been paid, please charge any insufficiency or credit any overpayment necessary to ensure consideration of the information disclosure statement for the above-identified application to Deposit Account No. 502290. A copy of this petition is enclosed.

Respectfully submitted,

Lee, Hong, Degerman, Kang & Schmadeka

Date: September 22, 2008

By: _____
Craig W. Schmoyer
Registration No. 51,007
Attorney for Applicant

Customer No. 35884

PTO/SB/08A (01-08)
Approved for use through 04/30/2008. 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.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	11/563,909
Filing Date	November 28, 2006
First Named Inventor	Seung Hee Han
Art Unit	2611
Examiner Name	Ghayour, Mohammad H.
Attorney Docket Number	2101-3280

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
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

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]
		WO 2005/104412	11-03-2005	Motorola Inc.		
		WO 2003/075500	09-12-2003	Alvarion Ltd.		

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] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.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.

This collection of information is required by 37 CFR 1.97 and 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.

PTO/SB/08B (01-08)
Approved for use through 04/30/2008. 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.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	11/563,909
Filing Date	November 28, 2006
First Named Inventor	Seung Hee Han
Art Unit	2611
Examiner Name	Ghayour, Mohammad H.
Attorney Docket Number	2101-3280

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]
		TEXAS INSTRUMENTS "On allocation of Uplink Pilot Sub-Channels in EUTRA SC-FDMA", 3GPP TSG-RAN WG1, E1-050922, August 29, 2005.	

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.

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.

Electronic Patent Application Fee Transmittal

Application Number:	11563909
Filing Date:	28-Nov-2006
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Filer:	Craig W. Schmoyer./Carl Alvarado
Attorney Docket Number:	2101-3280

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

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:	4005262
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Craig W. Schmoyer./Carl Alvarado
Filer Authorized By:	Craig W. Schmoyer.
Attorney Docket Number:	2101-3280
Receipt Date:	25-SEP-2008
Filing Date:	28-NOV-2006
Time Stamp:	14:49:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	20
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SignedTransmittalPTO1449.pdf	423486 282fe6224165c5a3b25d50ab2473410195587156	yes	5
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Information Disclosure Statement Letter		1	3	
	Information Disclosure Statement (IDS) Filed (SB/08)		4	5	
Warnings:					
Information:					
2	Foreign Reference	Ref1WO05104412A1.pdf	733960 04590a25b7d23395f38bf3f49c5e1b562136356f	no	25
Warnings:					
Information:					
3	Foreign Reference	Ref2WO03075500.pdf	508745 9c7729523f4c23a5a578394b918a24b1debe45b7	no	18
Warnings:					
Information:					
4	Foreign Reference	Npl1Allocationofuplink.pdf	295616 18a2622620fb0a704452604be1abb7c522938ce7	no	7
Warnings:					
Information:					
5	Fee Worksheet (PTO-06)	fee-info.pdf	30532 b46f1188d07262f2a611fbab76936e7c47bcd6b7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1992339		

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

Customer No. 35884 **Attorney Docket No. 2101-3280**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee Han Serial No: 11/563,909 Filed: November 28, 2006 FOR: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: 2611 Examiner: GHAYOUR, MOHAMMAD H. Conf. No.: 1721

TRANSMITTAL OF REQUEST FOR REFUND

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

Dear Sir:

Applicant respectfully requests for a refund of the $180.00 IDS fee paid on September 25, 2008 to the deposit account 502290. As stated in the IDS letter submitted on September 25, 2008, each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application and that the communication is dated not more than three months prior to the filing of the information disclosure statement. 37 C.F.R. § 1.97(e)(1). Therefore, Applicant submits that the $180.00 fee was erroneously paid and requests a refund.

ZTE/SAMSUNG/HTC 1002-0169

Respectfully submitted,

Lee, Hong, Degerman, Kang & Schmadeka

Date: September 25, 2008

By: _____

Puya Partow-Navid
Registration No. 59,657
Attorney for Applicant

Customer No. 35884

ZTE/SAMSUNG/HTC 1002-0170

Electronic Acknowledgement Receipt

EFS ID:	4007672
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Puya Partow-Navid/Carl Alvarado
Filer Authorized By:	Puya Partow-Navid
Attorney Docket Number:	2101-3280
Receipt Date:	25-SEP-2008
Filing Date:	28-NOV-2006
Time Stamp:	16:50:38
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	Refund Request	RequestforRefund11563909.pdf	80230 ad78658f4d582301d3f7c18c651a488735d2f7b1	no	2

Warnings:	
Information:	

Total Files Size (in bytes):	80230

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.

OIPE MAP21
SEP 27 2007
PATENT & TRADEMARK OFFICE

JFW

PATENT DOCKET NO. 2101-3280
CUSTOMER NO. 035884

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Seung Hee HAN et al.
Serial No: 11/563,909
Filed: November 28, 2006
For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Art Unit: 2611

Examiner:

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450, on
September 21, 2007
Date of Deposit
Lew Edward V. Macapagal
Name
Signature 09/21/2007
Date

TRANSMITTAL OF PRIORITY DOCUMENTS

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

Dear Sir:

Enclosed herewith are certified copies of Korean Patent Application Nos. 10-2005-0114306 filed on November 28, 2005, and 10-2006-0064091 filed on July 7, 2006, and 10-2006-0062467 filed on July 4, 2006, and from which priority is claimed under 35 U.S.C. Section 119 and Rule 55.

Acknowledgment of the priority document(s) is respectfully requested to ensure that the subject information appears on the printed patent.

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & SCHMADEKA

Date: September 21, 2007

By:

Lew Edward V. Macapagal
Registration No. 55,416
Attorney for Applicant(s)

Customer No. 035884

Issue Number : 5-5-2006-057887250

대한민국특허청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

출 원 번 호 : Application Number	10-2006-0064091
출 원 년 월 일 : Date of Application	2006년 07월 07일 JUL 07, 2006
출 원 인 : Applicant(s)	엘지전자 주식회사 LG Electronics Inc.

2006년 11월 09일

특 허 청
COMMISSIONER

◆ This certificate was issued by Korean Intellectual Property Office. Please confirm any forgery or alteration of the contents by an issue number or a barcode of the document below through the KIPOnet- Online Issue of the Certificates' menu of Korean Intellectual Property Office homepage (www.kipo.go.kr). But please notice that the confirmation by the issue number is available only for 90 days.

Issue Date : 2006.11.09

ZTE/SAMSUNG/HTC 1002-0174

【서지사항】

【서류명】 특허출원서

【권리구분】 특허

【수신처】 특허청장

【참조번호】 0013

【제출일자】 2006.07.07

【국제특허분류】 H04B

【발명의 국문명칭】 통신 시스템에서의 코드 시퀀스와 이를 전송, 생성하는 방법 및 장치

【발명의 영문명칭】 Code Sequence In The Communication System, Method And Apparatus For Transmiting and Generating The Same

【출원인】

【명칭】 엘지전자 주식회사

【출원인코드】 1-2002-012840-3

【대리인】

【성명】 김용인

【대리인코드】 9-1998-000022-1

【포괄위임등록번호】 2006-037573-8

【대리인】

【성명】 심창섭

【대리인코드】 9-1998-000279-9

【포괄위임등록번호】 2006-037574-5

【발명자】

【성명】 권영현

【성명의 영문표기】 KWON,Yeong Hyeon

【주민등록번호】 740611-1533118

【우편번호】 440-824

【주소】 경기 수원시 장안구 율전동 103-6 스마일빌 402호

ZTE/SAMSUNG/HTC 1002-0175

【국적】 KR

【발명자】

【성명】 한승희

【성명의 영문표기】 HAN,Seung Hee

【주민등록번호】 761128-1261917

【우편번호】 122-071

【주소】 서울 은평구 역촌1동 42-35

【국적】 KR

【발명자】

【성명】 박현화

【성명의 영문표기】 PARK,Hyun Hwa

【주민등록번호】 800803-2357323

【우편번호】 431-050

【주소】 경기 안양시 동안구 비산동 1115번지 신안 메트로칸 1133호

【국적】 KR

【발명자】

【성명】 김동철

【성명의 영문표기】 KIM,Dong Cheol

【주민등록번호】 781009-1632216

【우편번호】 437-080

【주소】 경기 의왕시 내손동 763 대명 스위트빌 401호

【국적】 KR

【발명자】

【성명】 이현우

【성명의 영문표기】 LEE,Hyun Woo

【주민등록번호】 770601-1063313

【우편번호】 431-080

【주소】 경기 안양시 동안구 호계동 1103-3 네오빌 204호

ZTE/SAMSUNG/HTC 1002-0176

【국적】 KR

【발명자】

【성명】 노민석

【성명의 영문표기】 NOH,Min Seok

【주민등록번호】 770911-1558611

【우편번호】 152-053

【주소】 서울 구로구 구로3동 오피스텔 미래지오 2층 211호

【국적】 KR

【취지】 특허법 제42조의 규정에 의하여 위와 같이 출원합니다.

대리인 김용인 (인)

대리인 심창섭 (인)

【수수료】

【기본출원료】	0 면	38,000 원
【가산출원료】	41 면	0 원
【우선권주장료】	0 건	0 원
【심사청구료】	0 항	0 원
【합계】	38,000 원	

ZTE/SAMSUNG/HTC 1002-0177

【요약서】

【요약】

본 발명은 통신 시스템에서의 코드 시퀀스와 이를 전송, 생성하는 방법 및 장치에 대한 것으로, 본 발명에 따른 코드 시퀀스는 소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연(circular shift)이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서, 이 코드 시퀀스는 기초 시퀀스열의 말단부에서 기초 시퀀스열의 길이와 통신 시스템에서 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거되거나, 통신 시스템에서 요구되는 길이와 기초 시퀀스열의 길이의 차이에 해당하는 패딩부가 말단에 삽입된 코드 시퀀스이다. 이러한 코드 시퀀스를 이용함으로써 순환지연을 적용하는 과정에서 발생하는 상관 특성의 열화를 방지할 수 있다.

【대표도】

도 4a

【색인어】

CAZAC 시퀀스, 순환지연, 상관 특성

ZTE/SAMSUNG/HTC 1002-0178

【명세서】

【발명의 명칭】

통신 시스템에서의 코드 시퀀스와 이를 전송, 생성하는 방법 및 장치{Code Sequence In The Communication System, Method And Apparatus For Transmiting and Generating The Same}

【도면의 간단한 설명】

<1> 도 1a 및 도 1b는 종래 통신 시스템에서 요구되는 길이를 가지는 CAZAC 시퀀스 및 이의 생성 방법의 일례를 설명하는 도.

<2> 도 2 는 종래 순환지연(Circular Shift)을 적용하는 방법을 설명하는 도.

<3> 도 3a 및 도 3b는 종래 통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 시퀀스 및 이의 생성 방법의 일례를 설명하는 도.

<4> 도 4a 및 도 4b는 본 발명의 일 실시형태에 따라 통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 시퀀스 및 이의 생성 방법의 일례를 설명하는 도.

<5> 도 5는 본 발명의 일 실시형태에 따른 코드 시퀀스를 송신하는 장치의 구성을 도시한 도.

<6> 도 6은 본 발명의 일 실시형태에 따른 코드 시퀀스 생성 장치의 구성을 도시한 도.

<7> 도 7 및 도 8은 본 발명의 일 실시형태에 따른 코드 시퀀스의 교차상관 특성

ZTE/SAMSUNG/HTC 1002-0179

을 설명하기 위한 그래프.

【발명의 상세한 설명】

【발명의 목적】

【종래기술의 문헌 정보】

<8> 1. 특허출원 제 2006-0062467 호(2006년 7월 4일 출원),

【발명이 속하는 기술분야 및 그 분야의 종래기술】

<9> 본 발명은 통신 시스템에 대한 것으로서, 특히 통신 시스템에서의 코드 시퀀스 및 이 코드 시퀀스를 전송, 생성하는 방법 및 장치에 대한 것이다.

<10> 통신시스템에서 시퀀스의 종류를 구분하기 위한 ID 및 동기정보 등을 포함하는 제어정보를 전송하기 위해 이용되는 시퀀스로는 여러 가지가 있으나, 현재 3GPP LTE 의 경우 CAZAC(Constant Amplitude Zero Auto-Correlation) 시퀀스가 그 기본을 이루고 있다. 이러한 CAZAC 시퀀스를 사용할 수 있는 곳은 이 시퀀스를 이용하여 각종 ID 나 정보를 추출하는 채널들이다. 이러한 채널들로는 하향링크의 동기화를 위한 동기채널들(예를 들어, primary-SCH, secondary-SCH, BCH), 상향링크 동기화를 위한 동기채널들(예를 들어, RACH), 파일럿 채널(예를 들어, 데이터 파일럿, 채널 품질 파일럿) 등이 있다. 또한, 상술한 CAZAC 시퀀스는 혼합화(scrambling)에도 사용될 수 있다.

<11> CAZAC 시퀀스의 종류로는 GCL CAZAC 과 Zadoff-Chu CAZAC 두 종류가 많이 사용되고 있다. 이들은 서로 공액복소수 관계에 있으며, GCL CAZAC 는 Zadoff-Chu 의

ZTE/SAMSUNG/HTC 1002-0180

공액복소수를 취함으로써 획득할 수 있다. Zadoff-Chu CAZAC 은 다음과 같이 주어진다.

【수학식 1】

<12>
$$c(k;N,M)=\exp\left(\frac{j\pi Mk(k+1)}{N}\right) \qquad (for\ odd\ N)$$

【수학식 2】

<13>
$$c(k;N,M)=\exp\left(\frac{j\pi Mk^2}{N}\right) \qquad (for\ even\ N)$$

<14> 여기서, k 는 시퀀스 인덱스를, N 은 생성될 CAZAC 시퀀스의 길이를, M 은 시퀀스 ID 를 나타낸다.

<15> 상기 수학식 1 및 수학식 2 와 같이 주어지는 Zadoff-Chu CAZAC 시퀀스 및 이의 공액복소수 관계에 있는 GCL CAZAC 시퀀스를 c(k;N,M) 로 나타낼 때, 모두 다음과 같은 세 가지 특징을 가진다.

【수학식 3】

<16>
$$|\,c(k;N;M)\,| = 1 \qquad (for\ all\ k, N, M)$$

【수학식 4】

<17>
$$R_{M,N}(d) = \begin{cases} 1, & (for\ \ d=0) \\ 0, & (for\ \ d\neq 0) \end{cases}$$

ZTE/SAMSUNG/HTC 1002-0181

【수학식 5】

<18> $$R_{M_1,M_2;N}(d) = p \qquad (for\,all\,M_1, M_2\,\mathrm{and}\,N)$$

<19> 상기 수학식 3 은 CAZAC 시퀀스는 언제나 그 크기가 1을 의미하고, 수학식 4 는 CAZAC 시퀀스의 자기상관(Auto-Correlation) 함수가 델타 함수로 표시됨을 보여준다. 여기에서 자기상관은 순환 상관(circular correlation) 에 기반한다. 또한, 수학식 5 는 교차상관함수(Cross-Correlation) 가 언제나 상수임을 보여준다. 이하에서는 설명의 편의를 위해, 상기 수학식 3 과 같은 시퀀스 특성을 "CA 특성" 이라 하고, 상기 수학식 4 및 수학식 5 와 같은 특성을 "상관 특성"으로 지칭하기로 한다.

<20> 종래에 CAZAC 시퀀스를 적용하는 시스템에서 적용하고자 하는 길이를 L 이라 할 때, CAZAC 시퀀스를 생성하는 방법은 (1) L 값에 관계없이 상기 수학식 1 또는 수학식 2 의 N 을 N = L 로 설정하여 CAZAC 시퀀스를 사용하는 방법과, (2) N 을 L 보다 큰 소수로 설정하여 생성하는 방법이 고려된다.

<21> 특정 길이 L로 생성된 CAZAC 시퀀스의 특징을 잠시 언급하면, L이 소수(prime number)가 아닌 경우 생성된 CAZAC 시퀀스는 M=1,2,...,L-1 까지 넣을 수는 있으나, 이 중에서 중복되는 코드가 발생한다. 즉, 실제 서로 다른 코드의 개수는 L-1개보다 작다. 반면 L이 소수인 경우에는 L-1개의 서로 다른 코드가 생성된다. 따라서 시스템에 적용하고자 하는 코드의 길이가 소수가 아니고, 사용해야 되는 코드의 개수가 많은 경우, 상기 방법 (1)과 같은 방법보다는 L 보다 큰 제일 작은 소

ZTE/SAMSUNG/HTC 1002-0182

수를 선택하여 이로부터 CAZAC 시퀀스를 생성하고 이의 일부 잘라내고 쓰는 방법을 고려했다.

<22> 도 1a는 상술한 바와 같은 종래 통신 시스템에서 요구되는 길이를 가지는 CAZAC 시퀀스 및 이를 생성하는 방법의 일례를 설명하기 위한 도면이다.

<23> 도 1a에 도시된 바와 같은 방법은 코드 종류를 확장시킬 수 있으나, 상술한 방법에 의해 생성된 코드 시퀀스는 시퀀스의 일부를 잘라내기 때문에 자기상관 및 교차상관 특성에 있어 상기 수학식 4 와 같이 지연이 0인 경우에만 1의 값을 가지고, 그 밖의 경우에는 0의 값을 가지는 특성 및 수학식 5와 같이 교차상관값이 항상 상수를 가지는 특성이 악화된다. 또한, 실제로 상관 특성이 좋지 못한 시퀀스를 제거할 경우 그 시퀀스의 개수가 L-1보다 많다고 장담할 수 없다.

<24> 상술한 바와 같이 종래 기술에서는 원하는 길이를 얻고 그 길이에 해당하는 최대한 많은 종류의 CAZAC 시퀀스를 얻기 위하여, 요구되는 길이 L이 소수가 아닌 경우에 L보다 큰 최소 소수 X를 선택하여 그로부터 CAZAC 시퀀스를 만들었지만, 이럴 경우 상관 특성이 악화되어, CAZAC 시퀀스의 특징인 수학식 4 및 수학식 5 와 같은 상관 특성을 가지지 못하는 단점이 있다.

<25> 한편, 상술한 바와 같은 문제점을 해결하기 위해, 본 출원인에 의해 2006년 7월 4일자로 출원되어, 본원과 동시계류 중인 특허출원 제 2006-0062467 호(이하 "62467 출원발명"이라 함)에서는 통신 시스템에서 요구되는 길이(L) 이하의 최대 소수 길이(X)를 선택하여 CAZAC 시퀀스를 생성하고, L-X의 길이를 가지는 부분에 패딩부를 삽입하는 기술에 대해 기재하고 있다.

ZTE/SAMSUNG/HTC 1002-0183

<26> 도 1b는 상술한 62467 출원발명에 따른 CAZAC 시퀀스 및 이의 생성 방법을 도시하는 도면이다.

<27> 상기 62467 출원발명에 의할 경우, 도 1a에 도시된 바와 같이 생성된 시퀀스의 일부를 잘라내기 때문에 자기상관 및 교차상관 특성에 있어 상기 수학식 4와 같이 지연이 0인 경우에만 1의 값을 가지고, 그 밖의 경우에는 0의 값을 가지는 특성 및 수학식 5와 같이 교차상관값이 항상 상수를 가지는 특성이 악화되지 않으며, 우수한 상관 특성을 유지할 수 있다. 아울러, 패딩부에 삽입되는 정보를 통해 추가적인 제어 정보를 전달할 수 있다.

<28> 한편, 도 2는 종래 순환지연을 적용하는 방법을 설명하는 도면이다.

<29> 통신 시스템에서 사용할 수 있는 코드의 수를 증가시키기 위해 순환지연을 적용하며, 그 결과 도 2에 도시된 바와 같이 시퀀스의 후방에 위치한 부분의 일부가 전방으로 이동하게 되며, 이에 따라 나머지 시퀀스 부분 역시 해당 길이만큼 후방으로 이동하게 된다. 이러한 방식으로 적용되는 순환지연량에 따라 특정 시퀀스들간에 구별될 수 있도록 설정하는 경우, 해당 시퀀스를 통해 전달될 수 있는 제어 정보의 양은 증가하게 된다.

<30> 상기에서는 종래에 통신 시스템에서 요구되는 길이(L)를 가지는 시퀀스를 생성하는 방법 및 순환지연을 적용하여 사용할 수 있는 코드 수를 증가시키는 방법에 대하여 살펴보았으며, 이와 같은 방법을 모두 적용하여 시퀀스를 생성할 경우 다음과 같은 과정을 통해 이루어진다.

ZTE/SAMSUNG/HTC 1002-0184

<31> (a) L이상의 최소 소수길이 또는 L이하의 최대 소수길이 X를 선택하고, (b) X-L 또는 L-X에 해당하는 길이를 가지는 시퀀스부를 제거 또는 삽입하며, (c) 그 결과적인 시퀀스에 순환지연을 적용한다.

<32> 도 3a 및 도 3b는 상술한 종래 통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 시퀀스 및 이의 생성 방법의 일례를 설명하는 도면이다.

<33> 그러나, 도 3a 및 도 3b와 같은 방식에 의해 생성된 CAZAC 시퀀스(304)의 경우, 순환지연의 적용과정에서 자기상관 및/또는 교차상관에 있어서의 상관 특성, 특히 교차상관에 대한 상기 수학식 5와 같은 특성에 열화가 발생하며, 따라서 통신 시스템에서 요구되는 길이를 가지는 시퀀스에 순환지연을 적용하는 경우에도 상관 특성의 열화가 발생하지 않는 코드 시퀀스 및 이를 생성하기 위한 기술이 요구되고 있다.

【발명이 이루고자 하는 기술적 과제】

<34> 상기와 같은 문제점을 해결하기 위해서 본 발명의 목적은 통신 시스템에서 요구되는 시퀀스의 길이를 가지며, 사용할 수 있는 코드의 수를 증가시키기 위한 순환지연이 적용된 시퀀스로서 양호한 상관 특성을 유지하는 시퀀스 및 이를 송신하는 방법 및 장치를 제공하는 데 있다.

<35> 본 발명의 다른 목적은 상술한 바와 같이 통신 시스템에서 요구되는 시퀀스의 길이를 가지며, 사용할 수 있는 코드의 수를 증가시킴으로써 제어 정보 전달 용량을 증가하기 위한 순환지연이 적용된 시퀀스 생성하기 위해 순차적 단계 구성에

ZTE/SAMSUNG/HTC 1002-0185

있어 특징을 가지는 방법을 제공하는 데 있다.

<36> 본 발명의 또 다른 목적은 상술한 바와 같은 코드 시퀀스를 생성하기 위한 장치구성을 가지는 코드 시퀀스 생성 장치를 제공하는 데 있다.

【발명의 구성】

<37> 상기 목적을 달성하기 위한 본 발명의 일 실시형태에 따른 코드 시퀀스는, 소수 길이를 가지며 전송 용량의 증가를 위한 순환 지연(circular shift)이 적용된 기초 시퀀스열(basic sequence stream)로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서, 이러한 코드 시퀀스는 기초 시퀀스열의 말단부에서 기초 시퀀스열의 길이와 통신 시스템에서 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된 것이다.

<38> 이 경우, 상술한 소수 길이는 통신 시스템에서 요구되는 길이 이상의 최소 소수 길이인 것이 바람직하다.

<39> 상기 목적을 달성하기 위한 본 발명의 다른 일 실시형태에 따른 코드 시퀀스는, 소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서, 이러한 코드 시퀀스는 기초 시퀀스열의 말단부에 통신 시스템에서 요구되는 길이와 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 것이다.

<40> 이 경우, 상술한 소수 길이는 통신 시스템에서 요구되는 길이 이하의 최대

ZTE/SAMSUNG/HTC 1002-0186

소수 길이인 것이 바람직하다.

<41> 또한, 상술한 실시형태들에서 언급하는 코드 시퀀스는 CAZAC 시퀀스로 예시될 수 있으나, 소수가 아닌 길이를 가지는 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되는 경우 생성된 코드 시퀀스들 사이에 중복된 코드 시퀀스들이 존재하는 시퀀스인한 임의의 다른 시퀀스가 될 수 있으며, 반드시 CAZAC 시퀀스에 한정되는 것은 아니다.

<42> 한편, 본 발명의 또 다른 일 실시형태에 따른 신호 전송 방법은 통신 시스템에서 요구되는 길이를 가지며, 순환 지연이 적용된 코드 시퀀스를 선택하는 단계; 및 상술한 바와 같이 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법으로서, 여기서 코드 시퀀스는, 코드 시퀀스 내부에 시퀀스의 불연속을 포함하지 않는 것을 특징으로 한다.

<43> 여기서, 상기 코드 시퀀스는 소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고; 기초 시퀀스열의 말단부에서 기초 시퀀스열의 길이와 통신 시스템에서 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된 것일 수 있다. 또한, 이와 다른 실시형태에 따른 신호 전송 방법에서는 상기 코드 시퀀스가 소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서, 이러한 코드 시퀀스는 기초 시퀀스열의 말단부에 통신 시스템에서 요구되는 길이와 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 것일

ZTE/SAMSUNG/HTC 1002-0187

수 있다.

<44> 본 발명의 또 다른 일 실시형태에 따른 신호 전송 장치는 통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 코드 시퀀스를 선택하는 시퀀스 선택부; 및 이 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치로서, 여기서 코드 시퀀스가, 소수 길이를 가지며 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고; 기초 시퀀스열의 말단부에서 기초 시퀀스열의 길이와 통신 시스템에서 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된 것을 특징으로 한다. 한편, 이와 다른 실시형태에 따른 신호 전송 장치는 상술한 코드 시퀀스가 소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서, 이러한 코드 시퀀스는 기초 시퀀스열의 말단부에 통신 시스템에서 요구되는 길이와 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 것을 특징으로 한다.

<45> 또한, 본 발명의 일 실시형태에 따른 코드 시퀀스 생성 방법은, 통신 시스템에서 요구되는 길이 이상의 최소 소수 길이를 가지는 시퀀스열를 생성하는 단계; 상술한 바와 같이 생성된 시퀀스열에 순환지연을 적용하여 기초 시퀀스열을 생성하는 단계; 및 최소 소수 길이와 통신 시스템에서 요구되는 길이의 차이에 해당하는 시퀀스부를 제거하는 단계를 포함한다. 한편, 이와 다른 실시형태에 따른 코드 시퀀스 생성 방법은, 통신 시스템에서 요구되는 길이 이하의 최대 소수 길이를 가지

ZTE/SAMSUNG/HTC 1002-0188

는 시퀀스열를 생성하는 단계; 상술한 바와 같이 생성된 시퀀스열에 순환지연을 적용하여 기초 시퀀스열을 생성하는 단계; 및 통신 시스템에서 요구되는 길이와 상기 최대 소수 길이의 차이에 해당하는 부분에 패딩부를 삽입하는 단계를 포함한다.

<46> 여기서, 패딩부를 삽입하는 실시형태의 경우, 상기 패딩부에 소정의 상수만으로 구성된 시퀀스를 삽입하는 단계를 더 포함하거나; 상기 패딩부에 생성된 코드 시퀀스의 순환 후치부를 삽입하는 단계를 더 포함하거나; 통신 시스템에서 요구되는 시퀀스 길이에 기초하여, DL 길이를 가지는 보조 시퀀스열를 생성하는 단계, 및 상기 패딩부에 상술한 보조 시퀀스열로부터 상기 차이에 해당하는 길이의 시퀀스열를 추출하여 삽입하는 단계를 더 포함하거나; 상기 패딩부에 상술한 바와 같이 선택된 최대 소수 길이를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이에 해당하는 길이의 시퀀스열을 추출하여 삽입하는 단계를 더 포함할 수 있다. 아울러, 상기 패딩부를 상기 기초 시퀀스열의 양측에 분할하여 삽입함으로써 하위 대역 보호구간으로 이용할 수도 있으며, 이 경우 상술한 보호구간에 소정의 상수 또는 상술한 바와 같이 생성된 시퀀스의 순환 후치부 중 어느 하나를 삽입할 수도 있다.

<47> 또한, 본 발명의 일 실시형태에 따른 코드 시퀀스 생성 장치는 통신 시스템에서 요구되는 길이 이상의 최소 소수 길이를 가지는 시퀀스열를 생성하고, 생성된 상기 시퀀스열에 순환지연을 적용하는 기초 시퀀스열 생성부; 및 상술한 최소 소수 길이와 통신 시스템에서 요구되는 길이의 차이에 해당하는 시퀀스부를 제거하는 시퀀스길이조정부를 포함한다. 또한 이와 다른 실시형태에 따른 코드 시퀀스 생성 장

ZTE/SAMSUNG/HTC 1002-0189

치는 통신 시스템에서 요구되는 길이 이하의 최대 소수 길이를 가지는 시퀀스열를 생성하고, 생성된 상기 시퀀스열에 순환지연을 적용하는 기초 시퀀스열을 생성부; 및 통신 시스템에서 요구되는 길이와 상기 최대 소수 길이의 차이에 해당하는 부분에 패딩부를 삽입하는 시퀀스길이조정부를 포함한다.

<48> 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다. 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

<49> 도 4a 및 도 4b는 본 발명의 일 실시형태에 따라 통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 시퀀스 및 이의 생성 방법의 일례를 설명하는 도면이다.

<50> 도 4a의 경우, 통신 시스템에서 요구되는 시퀀스열의 길이 L 이상의 최소 소수 길이 X에 기초하여 생성된 시퀀스열을 이용하는 방식을 도시하고 있다. 이와 동일하게 L 이상의 최소 소수 길이 X에 기초하여 생성된 시퀀스열을 이용하는 종래도 3a에 도시된 방식과 비교할 경우, 도 3a에서는 (a) 길이 X에 기초하여 생성된

ZTE/SAMSUNG/HTC 1002-0190

시퀀스열(302)에서 (b) X-L에 해당하는 시퀀스부를 제거하고, (c) 그 후 그 결과 생성된 길이가 L인 시퀀스열(303)에 순환지연을 적용하였던데 반해, 도 4a의 경우 (a) 길이 X에 기초하여 생성된 시퀀스열(402)에 (c) 순환지연을 적용하여 기초 시퀀스열(403)을 생성하고, (b) 그 후, 상술한 기초 시퀀스열(403)에서 X-L에 해당하는 시퀀스부를 제거하는 방식을 이용하여 코드 시퀀스(404)를 생성하게 된다. 즉 종래 코드 시퀀스 생성 방식을 도시한 도 3a의 경우 상기 (a)->(b)->(c)의 순서로 코드 시퀀스를 생성하였던데 반해, 본 발명의 일 실시형태에 따른 코드 시퀀스 생성 방법은 (a)->(c)->(b)의 순서로 코드 시퀀스를 생성하는 것을 그 특징으로 한다. 이를 통해 생성된 코드 시퀀스(404)의 경우, 종래 순환지연을 적용하는 과정에서 발생하는 상관 특성의 열화, 특히 교차상관에 있어서의 특성 열화를 저감시킬 수 있으며, 이하에서는 종래의 시퀀스 생성 방법에 의해 생성된 코드 시퀀스(304)와 본 발명의 일 실시형태에 따른 방법에 의해 생성된 코드 시퀀스(404)를 비교하여 살펴봄으로써, 이와 같은 상관 특성 열화가 저감되는 이유에 대해 구체적으로 살펴보기로 한다.

<51> 도 3a와 같이 종래의 코드 시퀀스 생성 방법에 의해 생성된 코드 시퀀스(304)의 경우, 길이 X에 기초하여 생성된 시퀀스(302), 구체적 예로서 CAZAC 시퀀스(302)에서 X-L의 길이를 가지는 시퀀스부를 제거하는 과정(상술한 과정(b))에서 첫 번째 상관 특성의 열화가 발생한다. 또한, X-L의 길이를 가지는 시퀀스부가 제거된 상태에서 순환지연이 적용되는 경우(즉, 상술한 과정 (b) 이후에 과정(c)가 수행되는 경우), 순환지연값이 0이 아닌 한 제거된 시퀀스부의 위치가 최종 코드

ZTE/SAMSUNG/HTC 1002-0191

시퀀스의 말단부가 아닌 부분에 형성되게 됨에 따라 두 번째 상관 특성의 열화가 발생한다. 이에 반하여, 본 발명의 일 실시형태에 따른 도 4a의 방식에 의할 경우, 순환지연을 적용하는 과정(b)은 길이 X에 기초하여 CAZAC 시퀀스(402)를 생성한 후, 시퀀스의 일부를 제거하는 과정 없이, 길이 X에 기초하여 생성된 CAZAC 시퀀스 전체를 이용하여 수행되기 때문에, 순환지연을 적용하는 과정(b) 자체에서 발생하는 상관 특성의 열화는 방생하지 않는다. 즉, 상술한 바와 같은 종래 방식에 의할 경우 발생하는 2 가지 상관 특성의 열화 중 두 번째 상관 특성의 열화를 방지할 수 있어 전체적인 상관 특성을 향상시키는 결과를 가진다.

<52> 상술한 바와 같이 본 발명의 일 실시형태에 따라 X-L의 길이를 가지는 부분을 제거하지 않은 상태에서 순환지연을 적용하고, 그 후 최종적으로 X-L의 길이를 가지는 부분을 제거하는 경우, 그 결과적인 코드 시퀀스(404)는 X-L의 길이가 제거된 부분이 순환지연 단계까지 적용된 시퀀스열(403)의 말단부인바, 코드 시퀀스(404) 내부에는 이에 따른 불연속 부분이 존재하지 않는다. 이에 반해, 종래 방법에 의해 생성된 코드 시퀀스(304)의 경우, X-L의 길이 부분이 제거된 상태의 시퀀스열(303)에 순환지연이 적용된 것이므로, X-L의 길이를 가지는 제거된 시퀀스열에 따른 불연속 부분이 최종 코드 시퀀스(304)의 내부에 존재하게 된다. 이에 따라 교차상관 등 시퀀스의 상관 특성을 이용하는 경우, 종래의 시퀀스(304) 내부에 형성된 불연속 부분에 의해 성능의 열화가 발생하는 반면, 본 발명에 의한 코드 시퀀스(404)의 경우 그 내부에 불명속 부분이 없어 양호한 상관 특성을 나타내게 된다.

<53> 도 4b의 경우 도 4a와 통신 시스템에서 요구되는 시퀀스의 길이 L 이하의 최

ZTE/SAMSUNG/HTC 1002-0192

대 소수길이 X에 기초하여 시퀀스열(402')을 생성하는 것에 있어서만 차이를 가지며, 그 이외의 과정은 동일하게 수행된다. 이 경우 역시 최종적으로 생성된 코드 시퀀스(404')에 패딩부가 삽입됨으로써 발생할 수 있는 시퀀스의 불연속 부분이 최종 코드 시퀀스(404')의 말단에 위치시킬 수 있으므로, 도 3b와 같은 종래의 코드 시퀀스 생성 방법에 의해 생성된 코드 시퀀스(304')와 비교할 경우, 더 우수한 상관 특성을 나타내게 된다. 다만, 도 3b의 경우 패딩부에 삽입되는 정보의 종류에 따라 결과적으로 생성된 코드 시퀀스(304')의 내부에 시퀀스의 불연속 지점이 존재할 수도, 존재하지 않을 수도 있는 점에서 도 3a 및 도 4a 의 경우와 다를 수 있으며, 구체적인 사항은 이하에서 상세히 설명할 도 4b의 코드 시퀀스(404')에 존재하는 패딩부를 처리하는 방법과 관련하여 살펴 보기로 한다.

<54> 도 4b에 도시된 바와 같은 패딩부를 처리하는 방법에는 여러 가지가 있을 수 있다. 첫째, 상술한 패딩부에 소정의 상수, 예를 들어 0 을 삽입하는 방법이 있을 수 있다. 이는 상술한 패딩부가 중요하지 않은 경우, 즉 셀 탐색을 하거나 임의 접속(random access)을 할 경우에 총 길이 L에 해당하는 부분을 모두 사용하지 않아도 문제가 없는 경우에 적용할 수 있다. 둘째, 코드 시퀀스(404')에서 초기 L-X 에 해당하는 부분을 복사하여 코드 시퀀스(404')의 말단부에 삽입함으로써, 패딩부에 순환 후치부(Cyclic Postfix)를 삽입하는 방법이 있을 수 있다. 이 경우는 L에 해당하는 길이를 모두 사용하는 방식으로서, 생성된 시퀀스의 ID 를 결정하는 경우에 있어서도 길이 L을 모두 이용하여 시퀀스의 ID를 구분할 수 있는 장점이 있으며, 생성된 시퀀스에 왜곡을 주지 않는 방법으로 볼 수 있다. 한편, 상술한 실시예에서

ZTE/SAMSUNG/HTC 1002-0193

는 패딩부에 시퀀스열(404')의 순환후치부를 삽입하는 경우를 예로서 설명하였으나, 코드 시퀀스(404')와 패딩부의 상대적 위치에 따라 패딩부에 코드 시퀀스(404')의 순환전치부(Cyclic Prefix)가 삽입될 수도 있음은 당업자에게 자명하다.

<55> 한편, 상기 패딩부를 처리하는 세번째 방법으로, 통신 시스템에서 요구되는 시퀀스 길이 L을 가지는 시퀀스, 즉 N = L을 이용하여 보조 시퀀스를 생성한 후, 이 보조 시퀀스로부터 상기 차이, 즉 L - X에 해당하는 길이의 시퀀스를 추출하여 상기 패딩부에 삽입하는 방법이 있을 수 있다. 이 경우 패딩부에 추가정보를 삽입하는 형태를 가지게 되며, 추가되는 값을 통해 다른 추가 메시지를 전달할 수 있다.

<56> 네번째로, 상기 패딩부에 상술한 바와 같이 선택된 최대 소수 길이 X를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이, 즉 L - X에 해당하는 길이의 시퀀스를 추출하여 삽입하는 방법이 있을 수 있다. 이 경우 패딩부에 삽입되는 시퀀스는 상술한 코드 시퀀스(404')와는 다른 M값을 가지는 CAZAC 시퀀스가 될 수도 있으며, M값과 L값 중 적어도 하나가 다른 CAZAC의 일부가 삽입될 수 있다. 또한, 패딩부에 삽입되는 시퀀스는 CAZAC 시퀀스가 아닌 다른 형태의 시퀀스가 삽입될 수도 있다. 이 경우 상술한 바와 같이 코드 시퀀스(404')와 상이한 유형의 시퀀스로서 패딩부에 삽입되는 시퀀스는 부가 정보를 나타내며, 시퀀스의 조합을 통한 시퀀스 종류의 확장 및 메시지 전달에도 이용할 수 있으며, 상기 패딩부에 삽입될 수 있는 정보의 구체적인 예는 이하에서 보다 상세히 서술하기로 한다.

ZTE/SAMSUNG/HTC 1002-0194

<57> 마지막으로, 상기 패딩부를 하위대역 보호구간으로 이용하는 방법이 있을 수 있다. 특정 시퀀스를 이용하여 제어정보를 전송하는 경우 중 임의접속 채널과 같이 서로 동기를 맞추지 않고 데이터를 전송하는 경우, 통신 시스템 내의 다수의 사용자가 데이터를 전송하는 경우, 수신된 데이터의 주파수가 왜곡되는 경우가 존재한다. 따라서, 본 발명의 일 실시형태에 따른 시퀀스 생성방법은 도 4b에 도시된 바와 같은 패딩부를 시퀀스의 양측면에 위치시켜, 이를 하부대역 보호구간으로 이용함으로써, 상술한 바와 같이 수신 주파수 왜곡이 있는 경우에도 보다 용이하게 수신 데이터로부터 제어정보를 획득할 수 있도록 한다. 이 경우, 상술한 바와 같이 보호구간으로 이용되는 패딩부에는 소정의 상수, 예를 들어 0 을 삽입하거나, 또는 상술한 바와 같이 양측에 분리된 보호구역에 생성된 시퀀스의 순환 후치부 (및/또는 순환 후치부; 이하 동일함)를 삽입할 수 있다. 상술한 바와 같이 패딩부를 시퀀스의 양측에 배치하여 하위대역 보호구간으로 이용하는 경우, 해당 시퀀스 내부가 주파수 왜곡으로부터 보호될 수 있으며, 특히 이 보호구간에 0 을 삽입하는 경우, 해당 시퀀스에 인접한 시퀀스에 간섭을 주는 것을 저감시킬 수 있다. 한편, 상술한 바와 같이 시퀀스의 양측에 분리된 보호구역에 생성된 시퀀스의 순환 후치부를 삽입하는 경우, 해당 시퀀스 내부를 주파수 왜곡으로부터 보호할 수 있을 뿐만 아니라, 주파수 왜곡이 없는 경우, 순환 후치부가 삽입된 부분 역시 시퀀스 ID 를 포함하는 제어정보를 전송하는데 이용할 수 있는 장점이 있다.

<58> 상술한 바와 같이 패딩부를 처리하는 방법으로서 보다 명확한 이해를 위해 5 가지 실시예를 살펴보았으나, 당업자는 본 발명의 사상 및 영역으로부터 벗어나지 않는

ZTE/SAMSUNG/HTC 1002-0195

범위에서 이를 변형하여 이용할 수도 있음을 알며, 본 발명은 상술한 5 가지 실시예에 한정되는 것은 아니다.

<59> 한편, 상술한 5 가지 실시예 중 패딩부에 정보를 삽입하지 않는 첫 번째 방법을 제외하고, 나머지 방법들의 경우 모두 패딩부에 부가정보를 삽입함으로써, 시퀀스의 조합의 확장 및 메시지 전달에 이용될 수 있다. 상기 패딩부에 삽입될 수 있는 정보로서, 예를 들어 임의접속 채널(RACH)의 개시접속(initial access)정보, 타이밍 갱신(timing updata)정보, 자원 요청(resource request) 정보, 사용자 ID 정보, 채널품질표시자(CQI), 사용자 그룹 ID 등을 포함할 수 있으며, 동기 채널(SCH) 의 셀 ID 정보, MIMO 정보, 동기 채널의 프레임 내의 위치 등을 가지는 동기 채널 정보 등을 포함할 수 있고, 아울러 메시지 전달을 위한 전송 데이터를 삽입할 수도 있으나 이에 한정되지 않으며, 당업자는 패딩부의 길이인 L - X의 길이를 가지는 시퀀스를 이용하여 전달할 수 있는 한 임의의 정보를 전달하는 시퀀스가 삽입될 수 있음을 안다.

<60> 또한, 상술한 5 가지 실시예 중 패딩부에 순환후치부를 삽입하는 경우 등 패딩부를 통해 전체 코드 시퀀스의 불연속이 발생하지 않는 경우, 종래의 도 3a에 대해 설명한 부분에서 최종 코드 시퀀스(304')의 내부에 패딩부가 위치하여 시퀀스 내부에 시퀀스의 불연속이 발생함으로써 발생하는 상관 특성의 저하를 방지할 수 있는 효과 역시 가질 수 있음은 앞에서 언급한 바와 같다.

<61> 이하에서는 본 발명의 일 실시형태에 따른 코드 시퀀스를 송신하는 장치에 대해 살펴 보기로 한다.

ZTE/SAMSUNG/HTC 1002-0196

<62> 도 5는 본 발명의 일 실시형태에 따른 코드 시퀀스를 송신하는 장치의 구성을 도시한 도면이다.

<63> 이러한 시퀀스를 전송하기 위한 신호 전송 장치는 통신 시스템에서 제어 신호 등의 송신이 이루어지는 것이 상향 링크인지, 하향 링크인지에 따라 기지국, 사용자 기기를 포함하여 다양한 장치가 될 수 있음은 자명하다. 따라서, 도 5에서는 제어 신호를 전송할 수 있는 장치를 일반적인 송신측(501)으로 도시하였다.

<64> 송신측(501)에 해당하는 장치는 시퀀스 선택부(502) 및 송신부(503)를 포함한다. 여기서 시퀀스 선택부(502)는 통신 시스템에서 요구되는 길이, 즉 L 을 가지는 코드 시퀀스를 선택하는 기능을 수행한다. 이 시퀀스 선택부(502)는 일반적으로 통신 시스템에서 요구되는 길이에 해당하는 L 값에 대한 정보를 저장하고, 이에 기초하여 길이가 L인 시퀀스 중 전달하고자 하는 제어 정보를 표현하기 위한 적절한 코드 시퀀스를 선택하게 된다.

<65> 다만, 상술한 시퀀스 선택부(502)가 선택할 수 있는 코드 시퀀스는 도 4a의 코드 시퀀스(404) 및 도 4b의 코드 시퀀스(404')와 같이 통신 시스템에서 요구되는 길이 L을 가지며, 순환지연이 적용된 코드 시퀀스로서 기초 시퀀스들(403, 403')의 말단부에 길이 L-X 또는 X-L에 해당하는 절단부 또는 패딩부를 제거 또는 삽입한 구조를 가지는 시퀀스인 것을 특징으로 하며, 이러한 코드 시퀀스들(404, 404')은 시퀀스 내부에 불연속 부분이 존재하지 않는 시퀀스로서 우수한 상관 특성을 가진다.

<66> 한편, 길이 X가 L이상의 최소 소수 길이 또는 L이하의 최대 소수 길이인 것

ZTE/SAMSUNG/HTC 1002-0197

이, 보다 많은 제어 정보를 전송할 수 있는 측면에서 바람직하나, X가 소수인 한 반드시 L이상의 최소 소수 길이 또는 L이하의 최대 소수 길이일 필요는 없느며, 통신 시스템에서 요구되는 제어 정보의 양 및 시퀀스의 개수를 고려하여 필요한 경우 이와 다른 소수 길이를 나타낼 수도 있음은 당업자라면 충분히 알 수 있을 것이다.

<67> 이하에서는 본 발명의 일 실시형태에 따른 코드 시퀀스를 생성하기 위한 장치에 대해 살펴 보기로 한다.

<68> 도 6은 본 발명의 일 실시형태에 따른 코드 시퀀스 생성 장치의 구성을 도시한 도면이다.

<69> 도 6 에 도시된 바와 같이 본 발명의 일 실시형태에 따른 코드 시퀀스를 생성하는 장치는 크게 기초 시퀀스 생성부(601) 및 시퀀스 길이 조정부(602)를 포함한다.

<70> 기초 시퀀스 생성부(601)는 다시 L 이상의 최소 소수 길이 X를 가지는 시퀀스열를 생성하거나, L 이하의 최대 소수 길이 X를 가지는 시퀀스열(C1)을 생성하는 제 1 시퀀스열 생성부(601a), 및 제 1 시퀀스열 생성부(601a)에 의해 생성된 상기 시퀀스열에 순환지연을 적용하는 순환지연 적용부(601b)를 포함할 수 있다.

<71> 순환지연 적용부(601b)는 도시된 바와 같이 제 1 시퀀스열 생성부(601a)에 의해 출력된 길이 X를 가지는 제 1 시퀀스열(C1)을 입력받아, 이에 순환지연을 적용한 후 제 2 시퀀스열(C2)를 출력한다. 그 후, 제 2 시퀀스열(C2)은 시퀀스 길이 조정부(602)에 입력된다.

ZTE/SAMSUNG/HTC 1002-0198

<72> 다음으로, 시퀀스 길이 조정부(602)는 상술한 바와 같은 제 2 시퀀스열(C2) 및 통신 시스템에서 요구되는 길이 L을 입력받아 시퀀스 길이를 조정하기 위해 필요한 동작을 선택하기 위한 제어부(602a), 이 제어부(602a)의 판정에 따라 제 2 시퀀스열(C2)에서 X-L의 길이를 가지는 시퀀스부를 제거하는 동작을 수행하는 시퀀스 제거부(602b), 및 시퀀스 제거부(602b)와 달리 제 2 시퀀스열(C2)에 L-X의 길이를 가지는 패딩부를 삽입하기 위한 패딩 삽입부(602c)를 포함할 수 있다.

<73> 제어부(602a)에 제 2 시퀀스열(C2) 및 L값이 입력되는 경우, 제어부(602a)는 제 2 시퀀스열(C2)의 길이에 해당하는 X와 L의 크기를 비교한다. 그 비교 결과 X가 큰 경우 제 2 시퀀스열(C2)은 시퀀스 제거부(602b)에 입력되고, X가 작은 경우 패딩 삽입부(602c)에 입력된다. 제 2 시퀀스열(C2)이 시퀀스 제거부(602b)에 입력되는 경우, 제 2 시퀀스열(C2)의 말단에서 X-L의 길이를 가지는 시퀀스열이 제거되어 최종적인 코드 시퀀스(C3)가 생성된다. 한편, 제 2 시퀀스열(C2)이 패딩 삽입부(602c)에 입력되는 경우, 제 2 시퀀스열(C2)의 말단에 L-X의 길이를 가지는 패딩부를 삽입하여 최종적인 코드 시퀀스(C4)가 생성된다. 이 경우 패딩 삽입부(602c)가 삽입하는 패딩부는 제 2 시퀀스열(C2)의 말단 양 측에 분할하여 삽입할 수도 어느 일측에 삽입할 수도 있으며, 패딩부에 삽입될 수 있는 정보는 L-X의 길이를 이용하여 전달할 수 있는 정보인 한 임의의 데이터 정보를 포함하여 임의의 정보일 수 있음은 상술한 바와 같다.

<74> 다음으로, 본 발명의 일 실시형태에 따른 코드 시퀀스의 상관 특성 개선에 대해 보다 구체적 예를 들어 살펴보기로 한다.

ZTE/SAMSUNG/HTC 1002-0199

<75> 도 7 및 도 8은 본 발명의 일 실시형태에 따른 코드 시퀀스의 교차상관 특성을 설명하기 위한 그래프이다.

<76> 도 7 및 도 8은 L이상의 최소 소수 길이 X에 기초하여 시퀀스열을 생성하는 경우의 상관특성을 도시하고 있으나, L이하의 최대 소수 길이를 선택하여 시퀀스를 생성하는 경우 역시 이와 유사한 결과를 얻을 수 있다.

<77> 도 7 및 도 8에서 가로축은 적용될 수 있는 순환지연값을 나타내며, 세로축은 정규화되지 않은 교차 상관값을 나타낸다. 또한, 얇은 실선을 이용하여 도시한 선은 종래 X-L의 길이를 가지는 시퀀스부를 제거한 후 순환지연을 적용한 코드 시퀀스의 교차 상관값을 나타내며, 굵은 실선을 이용하여 도시한 선은 본 발명의 일 실시형태에 따라 순환지연을 적용한 후, X-L의 길이를 가지는 시퀀스부를 제거한 경우의 교차상관값을 나타낸다. 한편, 도 7은 L이 75인 경우 75이상의 최소 소수로서 79를 X로 선택한 경우를, 도 8은 L이 225인 경우 225이상의 최소 소수로서 227을 X로 선택한 경우를 도시하고 있다.

<78> 도 7 및 도 8에 도시된 바와 같이 본 발명의 일 실시형태에 따른 코드 시퀀스의 경우, 순환지연치가 0인 지점, 즉 상관 연산에 있어 지연이 없다면 코드 시퀀스의 자기 상관값에 해당하는 경우에만 높은 상관값을 나타내고, 그 이외에는 양호한 상관 특성을 유지하는데 반해, 종래와 같이 X-L부분이 제거된 상태에서 순환지연이 적용된 경우 도 7 및 도 8에 도시된 바와 같이 상관값의 기복이 심하게 되어 열악한 상관 특성을 가지게 된다. 이러한 특성차이로 인하여 상관, 특히 교차상관을 이용하여 시퀀스의 분석이 이루어지는 경우, 본 발명의 일 실시형태에 따른 코

ZTE/SAMSUNG/HTC 1002-0200

드 시퀀스는 종래에 비해 우수한 성능을 나타내게 된다.

<79> 상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

【발명의 효과】

<80> 상기와 같은 본 발명의 일 실시형태에 따르면, 길이 X를 이용하여 시퀀스를 생성하고, 순환지연을 적용함으로써 생성가능한 시퀀스의 개수를 확장할 수 있을 뿐만 아니라, 순환지연 적용으로 인한 상관 특성의 열화를 방지할 수 있는 효과를 가져올 수 있다.

<81> 또한, 통신 시스템에서 요구되는 시퀀스 길이 이하의 최대 소수 길이를 가지는 시퀀스에 기초하여 최종 코드 시퀀스를 생성할 경우, 각 길이의 차이에 해당하는 패딩부에 삽입되는 정보를 다양하게 하여 전송 가능한 정보량의 확장 및 상관 특성 열화 방지 등의 효과를 얻을 수 있다.

ZTE/SAMSUNG/HTC 1002-0201

【특허청구범위】

【청구항 1】

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연(circular shift)이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서,

상기 코드 시퀀스는 상기 기초 시퀀스열의 말단부에서 상기 기초 시퀀스열의 길이와 상기 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된, 코드 시퀀스.

【청구항 2】

제 1 항에 있어서,

상기 소수 길이는 상기 요구되는 길이 이상의 최소 소수 길이인, 코드 시퀀스.

【청구항 3】

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연(circular shift)이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성된 코드 시퀀스로서,

상기 코드 시퀀스는 상기 기초 시퀀스열의 말단부에 상기 요구되는 길이와 상기 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된, 코드 시퀀스.

ZTE/SAMSUNG/HTC 1002-0202

【청구항 4】

제 3 항에 있어서,

상기 소수 길이는 상기 요구되는 길이 이하의 최대 소수 길이인, 코드 시퀀스.

【청구항 5】

제 1 항 내지 제 4 항 중 어느 한 항에 있어서,

상기 코드 시퀀스는 소수가 아닌 길이를 가지는 기초 시퀀스열로부터 상기 요구되는 길이를 가지도록 생성되는 경우 생성된 코드 시퀀스들 사이에 중복된 코드 시퀀스들이 존재하는 시퀀스인, 코드 시퀀스.

【청구항 6】

통신 시스템에서 요구되는 길이를 가지며, 순환 지연이 적용된 코드 시퀀스를 선택하는 단계; 및

상기 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법에 있어서,

상기 코드 시퀀스는, 상기 코드 시퀀스 내부에 시퀀스의 불연속이 존재하지 않는 것을 특징으로 하는 신호 전송 방법.

【청구항 7】

제 6 항에 있어서,

상기 코드 시퀀스는,

ZTE/SAMSUNG/HTC 1002-0203

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고;

상기 기초 시퀀스열의 말단부에서 상기 기초 시퀀스열의 길이와 상기 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된 것을 특징으로 하는 신호 전송 방법.

【청구항 8】

제 6 항에 있어서,

상기 코드 시퀀스는,

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고;

상기 기초 시퀀스열의 말단부에 상기 요구되는 길이와 상기 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 것을 특징으로 하는 신호 전송 방법.

【청구항 9】

통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 코드 시퀀스를 선택하는 시퀀스 선택부; 및

상기 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치에 있어서,

상기 코드 시퀀스는,

ZTE/SAMSUNG/HTC 1002-0204

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고;

상기 기초 시퀀스열의 말단부에서 상기 기초 시퀀스열의 길이와 상기 요구되는 길이 사이의 차이에 해당하는 길이를 가지는 시퀀스부가 제거된 것을 특징으로 하는 신호 전송 장치.

【청구항 10】

통신 시스템에서 요구되는 길이를 가지며, 순환지연이 적용된 코드 시퀀스를 선택하는 시퀀스 선택부; 및

상기 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치에 있어서,

상기 코드 시퀀스는,

소수 길이를 가지며, 전송 용량의 증가를 위한 순환 지연이 적용된 기초 시퀀스열로부터 통신 시스템에서 요구되는 길이를 가지도록 생성되고;

상기 기초 시퀀스열의 말단부에 상기 요구되는 길이와 상기 기초 시퀀스열의 길이와의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 것을 특징으로 하는 신호 전송 장치.

【청구항 11】

통신 시스템에서 요구되는 길이 이상의 최소 소수 길이를 가지는 시퀀스열를 생성하는 단계;

ZTE/SAMSUNG/HTC 1002-0205

생성된 상기 시퀀스열에 순환지연을 적용하여 기초 시퀀스열을 생성하는 단계; 및

상기 최소 소수 길이와 상기 통신 시스템에서 요구되는 길이의 차이에 해당하는 시퀀스부를 제거하는 단계를 포함하는, 코드 시퀀스 생성 방법.

【청구항 12】

통신 시스템에서 요구되는 길이 이하의 최대 소수 길이를 가지는 시퀀스열를 생성하는 단계;

생성된 상기 시퀀스열에 순환지연을 적용하여 기초 시퀀스열을 생성하는 단계; 및

상기 통신 시스템에서 요구되는 길이와 상기 최대 소수 길이의 차이에 해당하는 부분에 패딩부를 삽입하는 단계를 포함하는, 코드 시퀀스 생성 방법.

【청구항 13】

제 12 항에 있어서,

상기 패딩부에 소정의 상수만으로 구성된 시퀀스를 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 14】

제 12 항에 있어서,

상기 패딩부에 상기 생성된 코드 시퀀스의 순환 후치부를 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

ZTE/SAMSUNG/HTC 1002-0206

【청구항 15】

제 12 항에 있어서,

상기 통신 시스템에서 요구되는 시퀀스 길이에 기초하여, 상기 요구되는 길이를 가지는 보조 시퀀스열를 생성하는 단계; 및

상기 패딩부에 상기 보조 시퀀스열로부터 상기 차이에 해당하는 길이의 시퀀스열를 추출하여 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 16】

제 12 항에 있어서,

상기 패딩부에 상기 선택된 최대 소수 길이를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이에 해당하는 길이의 시퀀스열을 추출하여 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 17】

제 12 항에 있어서,

상기 패딩부를 상기 기초 시퀀스열의 양측에 분할하여 삽입함으로써 하위대역 보호구간으로 이용하는, 코드 시퀀스 생성 방법.

【청구항 18】

제 17 항에 있어서,

상기 보호구간에 소정의 상수 또는 상기 생성된 시퀀스의 순환 후치 중 어느 하나를 삽입하는, 코드 시퀀스 생성 방법.

ZTE/SAMSUNG/HTC 1002-0207

【청구항 19】

통신 시스템에서 요구되는 길이 이상의 최소 소수 길이를 가지는 시퀀스열를 생성하고, 생성된 상기 시퀀스열에 순환지연을 적용하는 기초 시퀀스열 생성부; 및

상기 최소 소수 길이와 상기 통신 시스템에서 요구되는 길이의 차이에 해당하는 시퀀스부를 제거하는 시퀀스길이조정부를 포함하는, 코드 시퀀스 생성 장치.

【청구항 20】

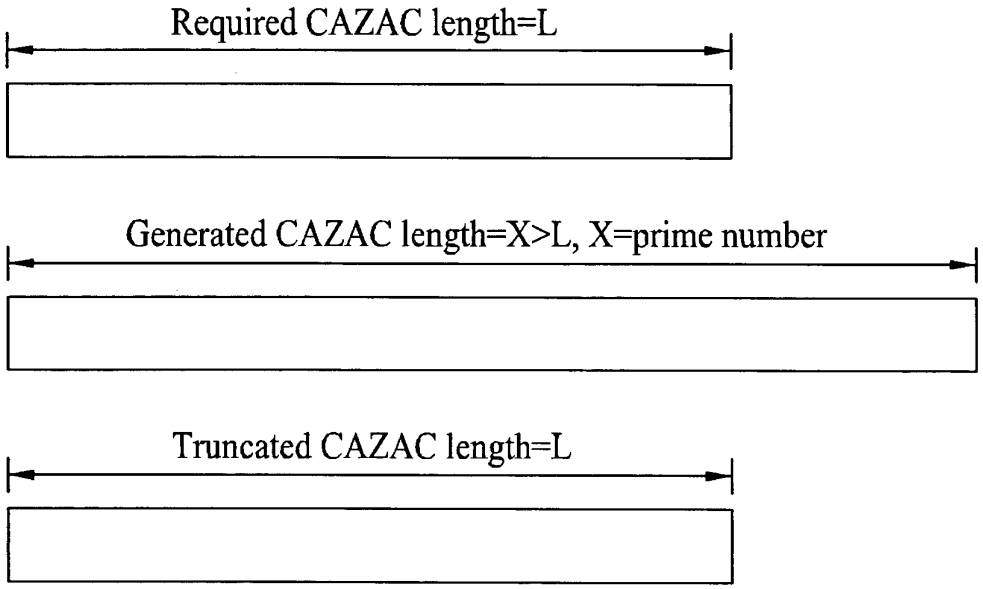
통신 시스템에서 요구되는 길이 이하의 최대 소수 길이를 가지는 시퀀스열를 생성하고, 생성된 상기 시퀀스열에 순환지연을 적용하는 기초 시퀀스열을 생성부; 및

상기 통신 시스템에서 요구되는 길이와 상기 최대 소수 길이의 차이에 해당하는 부분에 패딩부를 삽입하는 시퀀스길이조정부를 포함하는, 코드 시퀀스 생성 장치.

ZTE/SAMSUNG/HTC 1002-0208

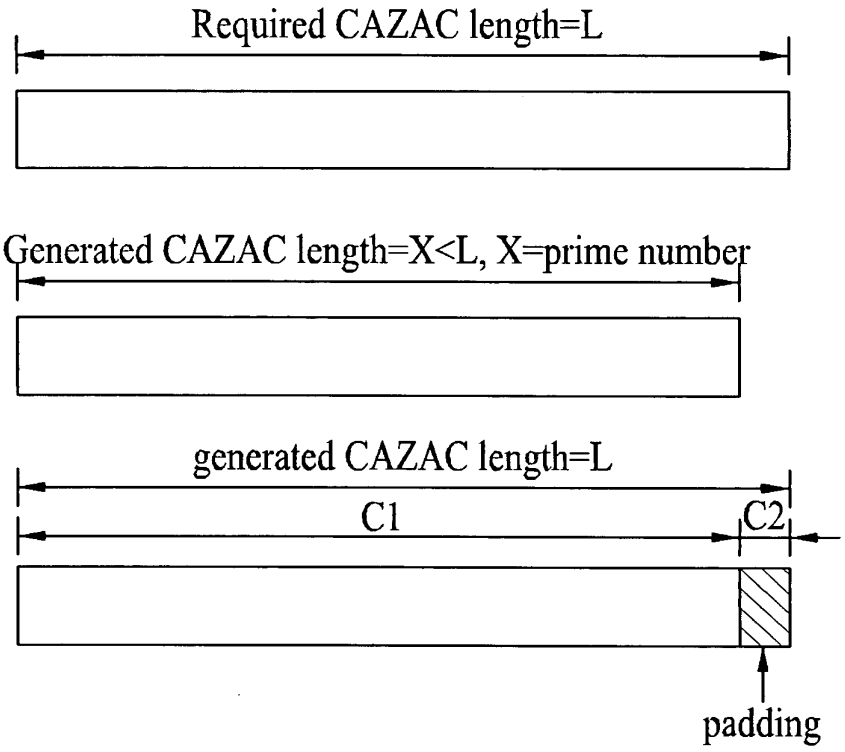
【도면】

【도 1a】

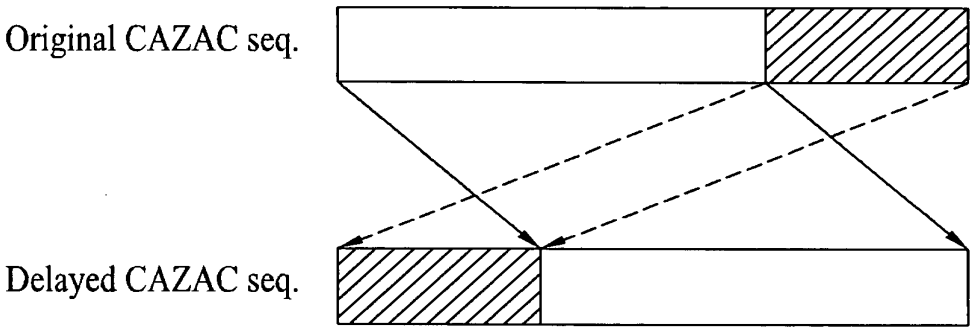


ZTE/SAMSUNG/HTC 1002-0209

【도 1b】

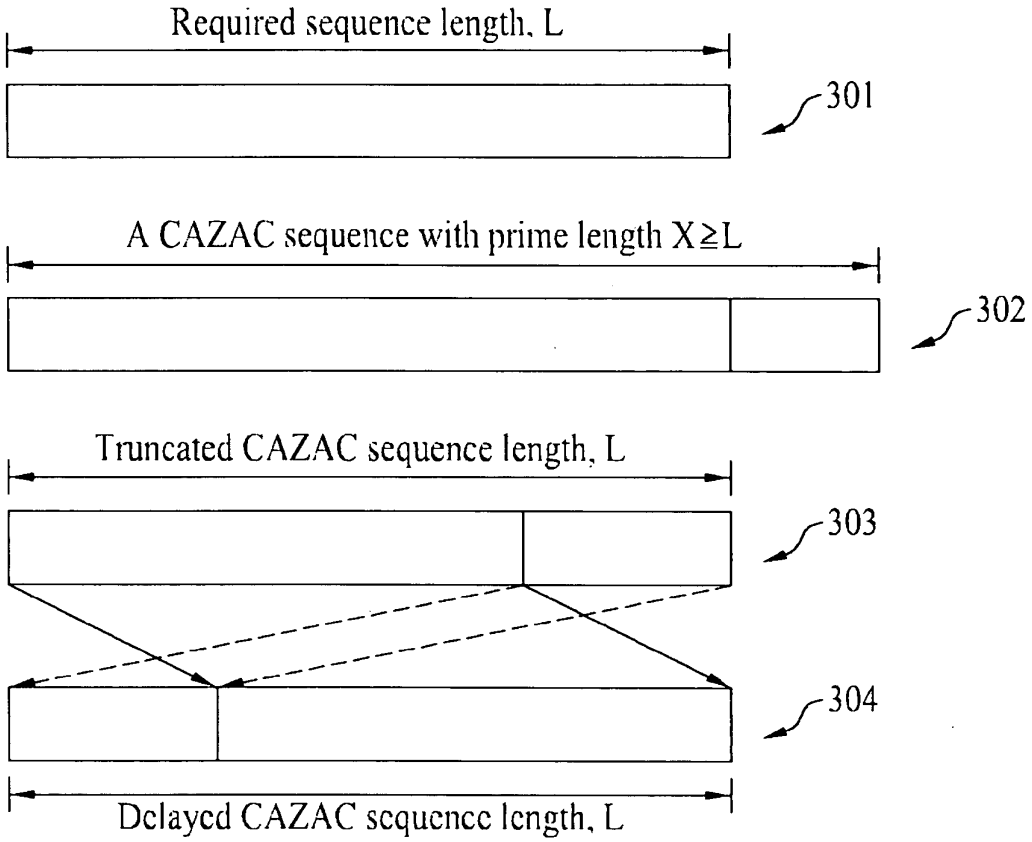


【도 2】



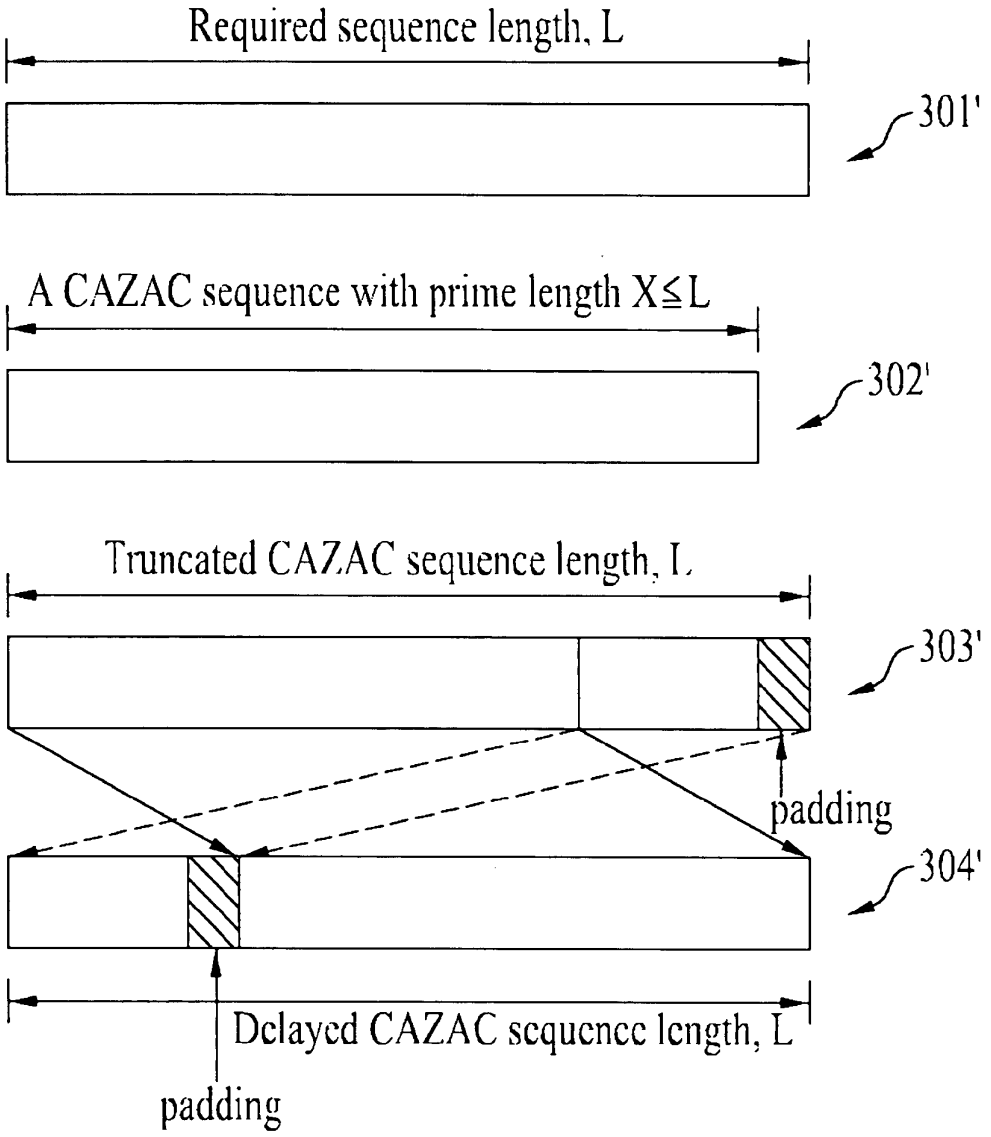
ZTE/SAMSUNG/HTC 1002-0210

【도 3a】

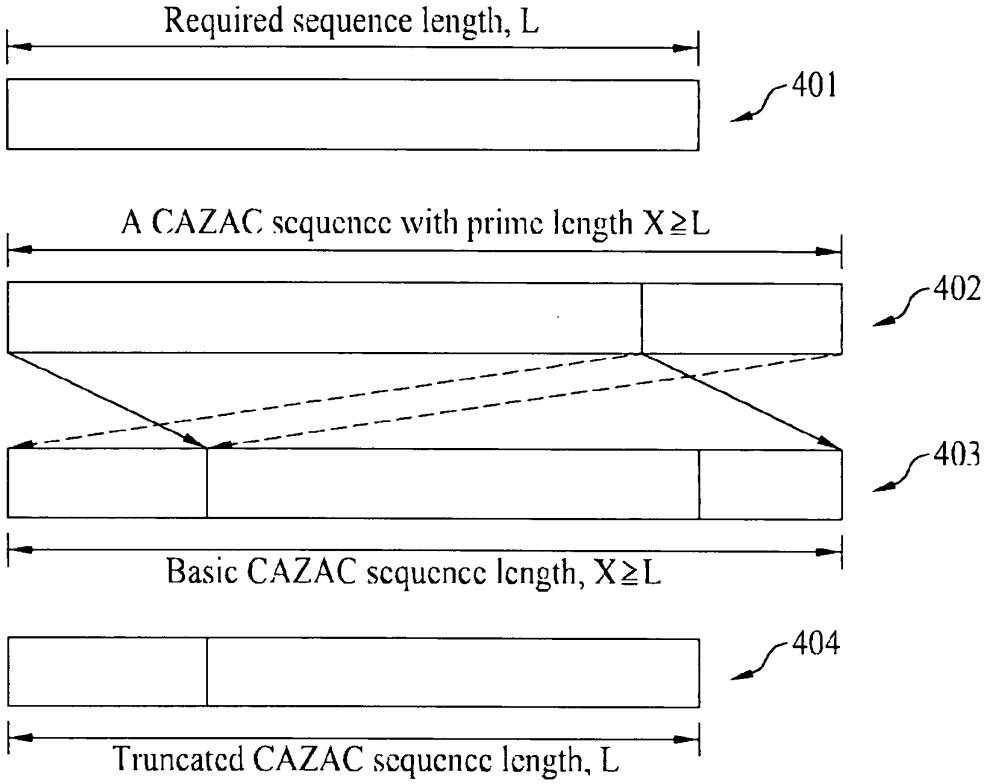


ZTE/SAMSUNG/HTC 1002-0211

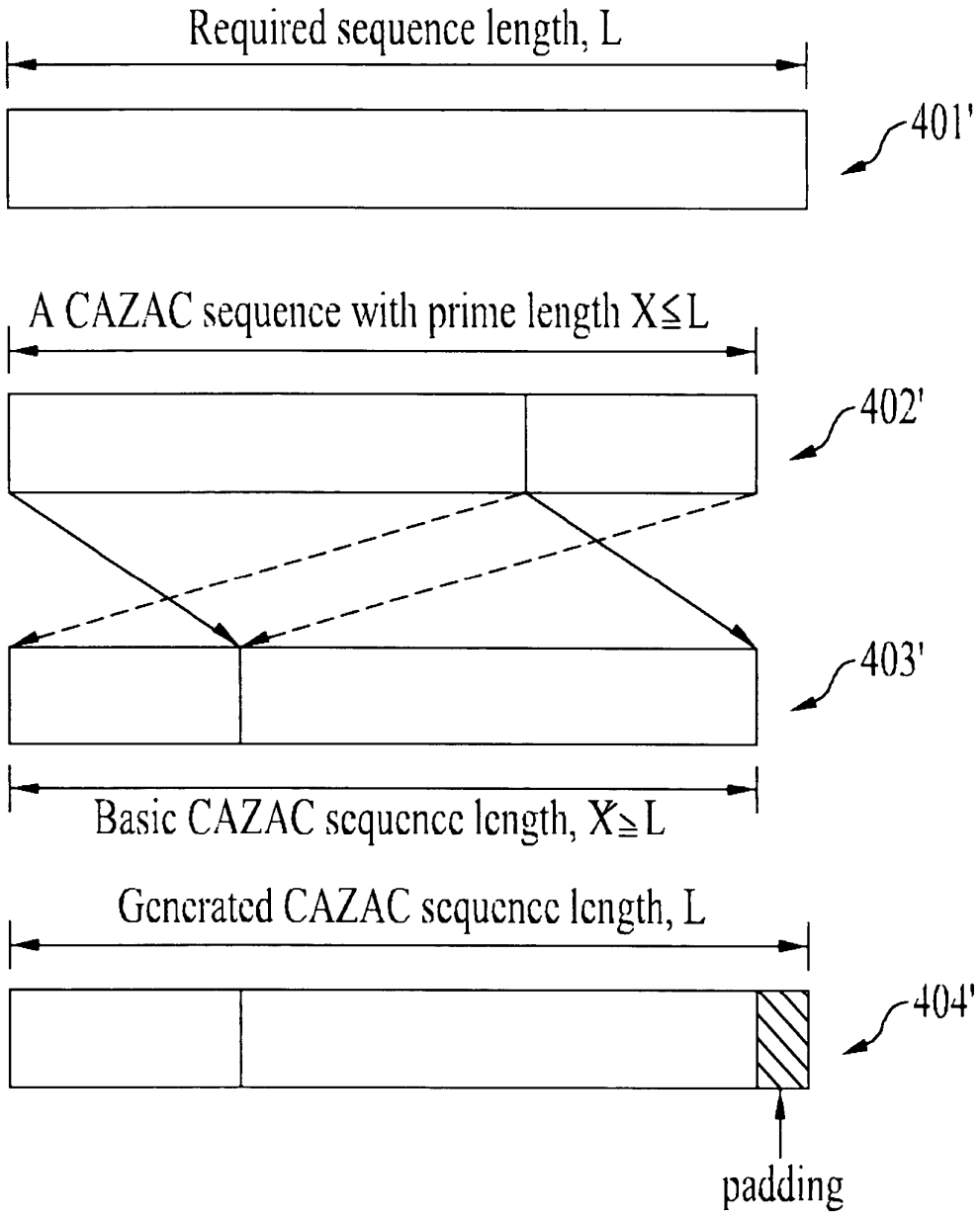
【도 3b】


Required sequence length, L
301'
A CAZAC sequence with prime length X≤L
302'
Truncated CAZAC sequence length, L
303'
padding
304'
Delayed CAZAC sequence length, L
padding

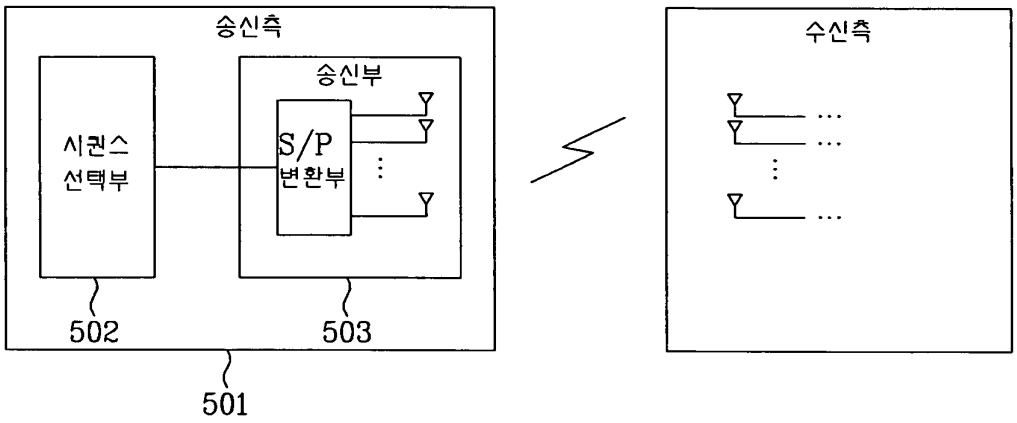
【도 4a】


Required sequence length, L
401
A CAZAC sequence with prime length X≥L
402
403
Basic CAZAC sequence length, X≥L
404
Truncated CAZAC sequence length, L

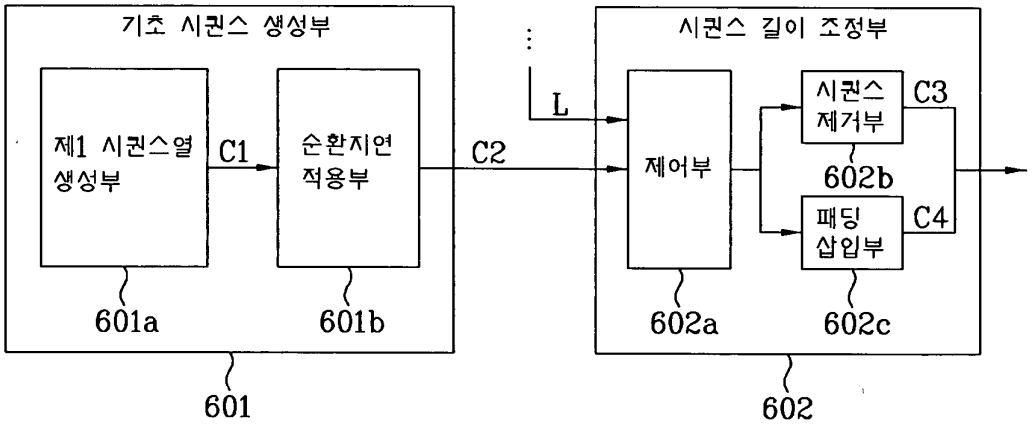
【도 4b】


Required sequence length, L
401'
A CAZAC sequence with prime length X≦L
402'
403'
Basic CAZAC sequence length, X≧L
Generated CAZAC sequence length, L
404'
padding

【도 5】

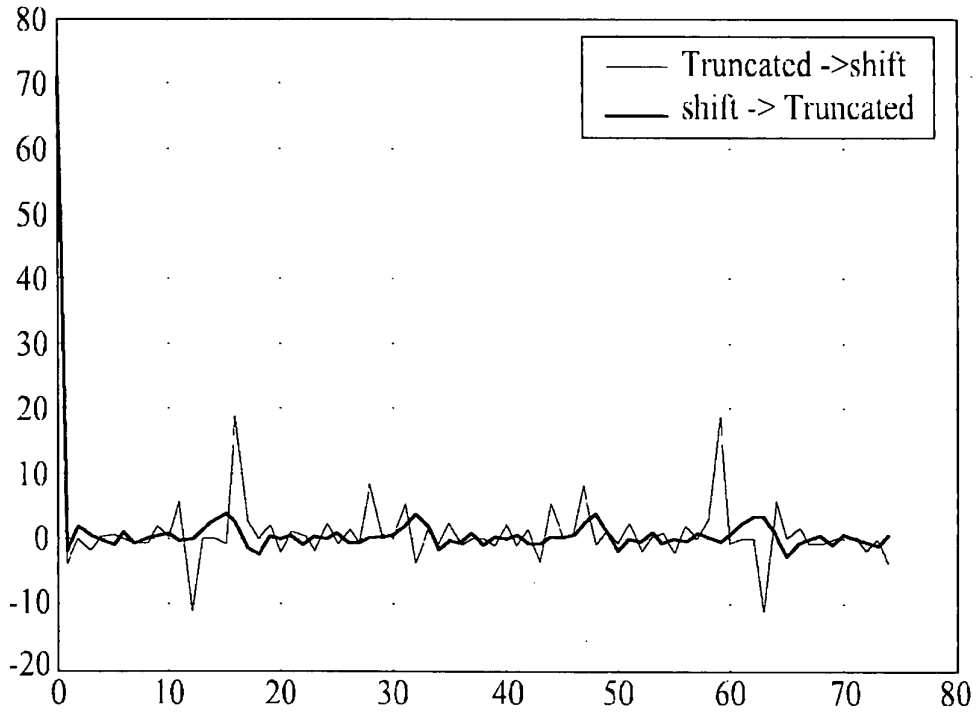


【도 6】



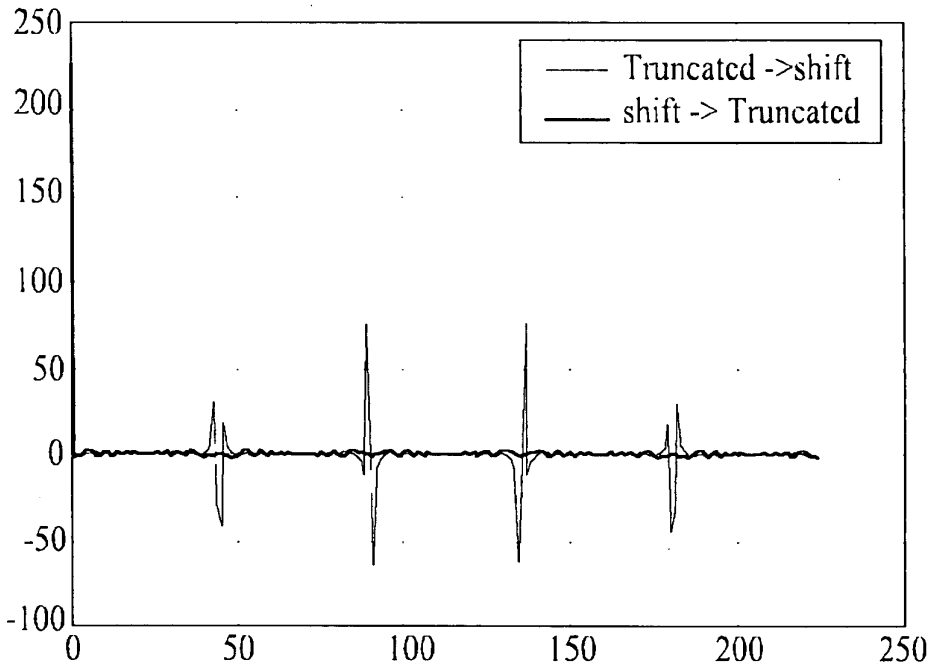
ZTE/SAMSUNG/HTC 1002-0215

【도 7】



ZTE/SAMSUNG/HTC 1002-0216

【도 8】



ZTE/SAMSUNG/HTC 1002-0217

Issue Number : 5-5-2006-061719844

대한민국특허청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

출 원 번 호 : Application Number		10-2006-0062467
출 원 년 월 일 : Date of Application		2006년 07월 04일 JUL 04, 2006
출 원 인 : Applicant(s)		엘지전자 주식회사 LG Electronics Inc.

2006년 11월 29일

특 허 청
COMMISSIONER

◆ This certificate was issued by Korean Intellectual Property Office. Please confirm any forgery or alteration of the contents by an issue number or a barcode of the document below through the KIPOnet- Online Issue of the Certificates' menu of Korean Intellectual Property Office homepage (www.kipo.go.kr). But please notice that the confirmation by the issue number is available only for 90 days.

Issue Date : 2006.11.29

ZTE/SAMSUNG/HTC 1002-0218

【서지사항】

【서류명】	특허출원서
【권리구분】	특허
【수신처】	특허청장
【참조번호】	0006
【제출일자】	2006.07.04
【국제특허분류】	H04B
【발명의 국문명칭】	통신 시스템에서의 코드 시퀀스와 이를 전송, 생성, 분석하는 방법 및 장치
【발명의 영문명칭】	Code Sequence In The Communication System, Method And Apparatus For Transmiting, Generating, And Analysing The Same
【출원인】	
【명칭】	엘지전자 주식회사
【출원인코드】	1-2002-012840-3
【대리인】	
【성명】	김용인
【대리인코드】	9-1998-000022-1
【포괄위임등록번호】	2006-037573-8
【대리인】	
【성명】	심창섭
【대리인코드】	9-1998-000279-9
【포괄위임등록번호】	2006-037574-5
【발명자】	
【성명】	권영현
【성명의 영문표기】	KWON,Yeong Hyeon
【주민등록번호】	740611-1533118

ZTE/SAMSUNG/HTC 1002-0219

【우편번호】 440-824
【주소】 경기 수원시 장안구 율전동 103-6 스마일빌 402호
【국적】 KR
【발명자】
【성명】 한승희
【성명의 영문표기】 HAN,Seung Hee
【주민등록번호】 761128-1261917
【우편번호】 122-071
【주소】 서울 은평구 역촌1동 42-35
【국적】 KR
【발명자】
【성명】 박현화
【성명의 영문표기】 PARK,Hyun Hwa
【주민등록번호】 800803-2357323
【우편번호】 431-050
【주소】 경기 안양시 동안구 비산동 1115번지 신안 메트로칸 1133호
【국적】 KR
【발명자】
【성명】 김동철
【성명의 영문표기】 KIM,Dong Cheol
【주민등록번호】 781009-1632216
【우편번호】 437-080
【주소】 경기 의왕시 내손동 763 대명 스위트빌 401호
【국적】 KR
【발명자】
【성명】 이현우
【성명의 영문표기】 LEE,Hyun Woo
【주민등록번호】 770601-1063313

ZTE/SAMSUNG/HTC 1002-0220

【우편번호】 431-080

【주소】 경기 안양시 동안구 호계동 1103-3 네오빌 204호

【국적】 KR

【발명자】

【성명】 노민석

【성명의 영문표기】 NOH,Min Seok

【주민등록번호】 770911-1558611

【우편번호】 152-053

【주소】 서울 구로구 구로3동 오피스텔 미래지오 2층 211호

【국적】 KR

【취지】 특허법 제42조의 규정에 의하여 위와 같이 출원합니다.

대리인 김용인 (인)

대리인 심창섭 (인)

【수수료】

【기본출원료】	0 면	38,000 원
【가산출원료】	40 면	0 원
【우선권주장료】	0 건	0 원
【심사청구료】	0 항	0 원
【합계】	38,000 원	

ZTE/SAMSUNG/HTC 1002-0221

【요약서】

【요약】

본 발명은 제어정보를 전송하기 위한 코드 시퀀스, 구체적으로 CAZAC 시퀀스의 구조와 이를 생성, 분석하는 기술에 대한 것이다. 이를 위해 본 발명은 통신 시스템에서 요구되는 코드 시퀀스의 길이가 소수가 아닌 경우, 요구되는 코드 시퀀스의 길이 이하의 최대 소수 길이를 선택하고, 이와 같이 선택된 최대 소수 길이를 가지는 시퀀스를 생성한 후, 통신 시스템에서 요구되는 코드 시퀀스의 길이와 상술한 최대 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부를 삽입하는 방법, 장치 및 이에 의해 생성된 코드 시퀀스를 제안한다. 이를 통해 생성된 코드 시퀀스들은 이들 사이에 중복됨이 없이, 생성가능한 코드 시퀀스의 개수를 늘일 수 있으며, 양호한 자기상관 및 교차상관 특성을 유지하여, 종래에 비해 더 정확한 동기 정보를 획득할 수 있다.

【대표도】

도 2

【색인어】

CAZAC 시퀀스, 패딩부

ZTE/SAMSUNG/HTC 1002-0222

【명세서】

【발명의 명칭】

통신 시스템에서의 코드 시퀀스와 이를 전송, 생성, 분석하는 방법 및 장치 {Code Sequence In The Communication System, Method And Apparatus For Transmiting, Generating, And Analysing The Same}

【도면의 간단한 설명】

<1> 도 1 은 종래 CAZAC 시퀀스 및 이의 생성 방법의 일례를 설명하는 도.

<2> 도 2 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스 및 이를 생성하는 방법 및 장치를 설명하기 위한 도.

<3> 도 3 은 본 발명의 다른 일 실시형태에 따른 CAZAC 시퀀스 및 이를 생성하는 방법에서 패딩부를 처리하는 일례를 설명하기 위한 도.

<4> 도 4 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스를 전송하기 위한 장치를 나타내는 블록도.

<5> 도 5 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스를 생성하는 장치를 나타내는 블록도.

<6> 도 6 는 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 전력을 부스팅하는 일례를 설명하기 위한 도.

<7> 도 7a 및 도 7b 는 각각 종래 CAZAC 시퀀스 생성 방법에 의해 생성된 CAZAC 시퀀스와 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 확률밀도함수

ZTE/SAMSUNG/HTC 1002-0223

(PDF)특성을 도시하는 도.

<8> 도 8 은 종래 CAZAC 시퀀스 생성 방법에 의해 생성된 CAZAC 시퀀스와 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 누적 확률밀도함수(CDF)특성을 도시하는 도.

【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

<9> 본 발명은 통신 시스템에 대한 것으로서, 특히 통신 시스템에서의 코드 시퀀스 및 이 코드 시퀀스를 전송, 생성, 분석하는 방법 및 장치에 대한 것이다.

<10> 통신시스템에서 시퀀스의 종류를 구분하기 위한 ID 및 동기정보 등을 포함하는 제어정보를 전송하기 위해 이용되는 시퀀스로는 여러 가지가 있으나, 현재 3GPP LTE 의 경우 CAZAC(Constant Amplitude Zero Auto-Correlation) 시퀀스가 그 기본을 이루고 있다. 이러한 CAZAC 시퀀스를 사용할 수 있는 곳은 이 시퀀스를 이용하여 각종 ID 나 정보를 추출하는 채널들이다. 이러한 채널들로는 하향링크의 동기화를 위한 동기채널들(예를 들어, primary-SCH, secondary-SCH, BCH), 상향링크 동기화를 위한 동기채널들(예를 들어, RACH), 파일럿 채널(예를 들어, 데이터 파일럿, 채널 품질 파일럿) 등이 있다. 또한, 상술한 CAZAC 시퀀스는 혼합화(scrambling)에도 사용될 수 있다.

<11> CAZAC 시퀀스의 종류로는 GCL CAZAC 과 Zadoff-Chu CAZAC 두 종류가 많이 사

ZTE/SAMSUNG/HTC 1002-0224

용되고 있다. 이들은 서로 공액복소수 관계에 있으며, GCL CAZAC 는 Zadoff-Chu 의 공액복소수를 취함으로써 획득할 수 있다. Zadoff-Chu CAZAC 은 다음과 같이 주어진다.

【수학식 1】

<12>
$$c(k;N,M)=\exp\left(\frac{j\pi Mk(k+1)}{N}\right) \qquad (for\ odd\ N)$$

【수학식 2】

<13>
$$c(k;N,M)=\exp\left(\frac{j\pi Mk^2}{N}\right) \qquad (for\ even\ N)$$

<14> 여기서, k 는 시퀀스 인덱스를, N 은 생성될 CAZAC 시퀀스의 길이를, M 은 시퀀스 ID 를 나타낸다.

<15> 상기 수학식 1 및 수학식 2 와 같이 주어지는 Zadoff-Chu CAZAC 시퀀스 및 이의 공액복소수 관계에 있는 GCL CAZAC 시퀀스를 c(k;N,M) 로 나타낼 때, 모두 다음과 같은 세 가지 특징을 가진다.

【수학식 3】

<16>
$$|\,c(k;N;M)\,| = 1 \qquad (for\ all\ k, N, M)$$

ZTE/SAMSUNG/HTC 1002-0225

【수학식 4】

<17>
$$R_{M,N}(d) = \begin{cases} 1, & (for\ \ d = 0) \\ 0, & (for\ \ d \neq 0) \end{cases}$$

【수학식 5】

<18>
$$R_{M_1, M_2, N}(d) = p \qquad (for\, all\, M_1, M_2\ \mathrm{and}\ N)$$

<19> 상기 수학식 3 은 CAZAC 시퀀스는 언제나 그 크기가 1을 의미하고, 수학식 4 는 CAZAC 시퀀스의 자기상관(Auto-Correlation) 함수가 델타 함수로 표시됨을 보여준다. 여기에서 자기상관은 순환 상관(circular correlation) 에 기반한다. 또한, 수학식 5 는 교차상관함수(Cross-Correlation) 가 언제나 상수임을 보여준다. 이하에서는 설명의 편의를 위해, 상기 수학식 3 과 같은 시퀀스 특성을 "CA 특성" 이라 하고, 상기 수학식 4 및 수학식 5 와 같은 특성을 "ZAC 특성"으로 지칭하기로 한다.

<20> 종래에 CAZAC 시퀀스를 적용하는 시스템에서 적용하고자 하는 길이를 L 이라 할 때, CAZAC 시퀀스를 생성하는 방법은 (1) L 값에 관계없이 상기 수학식 1 또는 수학식 2 의 N 을 N = L 로 설정하여 CAZAC 시퀀스를 사용하는 방법과, (2) N 을 L 보다 큰 소수로 설정하여 생성하는 방법이 고려된다.

<21> 특정 L 로 생성된 CAZAC 시퀀스의 특징을 잠시 언급하면, L 이 소수(prime number)가 아닌 경우 생성된 CAZAC 시퀀스는 M=1,2,...,L-1 까지 넣을 수는 있으나, 이 중에서 중복되는 코드가 발생한다. 즉, 실제 서로 다른 코드의 개수는

ZTE/SAMSUNG/HTC 1002-0226

L-1개보다 작다. 반면 L 이 소수인 경우에는 L-1 개의 서로 다른 코드가 생성된다. 따라서 시스템에 적용하고자 하는 코드의 길이가 소수가 아니고, 사용해야 되는 코드의 개수가 많은 경우, 상기 방법 (1) 과 같은 방법보다는 L 보다 큰 제일 작은 소수를 선택하여 이로부터 CAZAC 시퀀스를 생성하고 이의 일부 잘라내고 쓰는 방법을 고려했다.

<22> 도 1 은 상술한 바와 같은 종래 CAZAC 시퀀스 및 이를 생성하는 방법의 일례를 설명하기 위한 도면이다.

<23> 도 1 에 도시된 바와 같은 방법은 코드 종류를 확장시킬 수 있으나, 상술한 방법에 의해 생성된 코드 시퀀스는 시퀀스의 일부를 잘라내기 때문에 자기상관 및 교차상관 특성에 있어 상기 수학식 4 와 같이 지연이 0 인 경우에만 1 의 값을 가지고, 그 밖의 경우에는 0 의 값을 가지는 특성 및 수학식 5 와 같이 교차상관값이 항상 상수를 가지는 특성이 악화된다. 또한, 실제로 상관 특성이 좋지 못한 시퀀스를 제거할 경우 그 시퀀스의 개수가 L-1 보다 많다고 장담할 수 없다.

<24> 상술한 바와 같이 종래 기술에서는 원하는 길이를 얻고 그 길이에 해당하는 최대한 많은 종류의 CAZAC 시퀀스를 얻기 위하여, 요구되는 길이 L 이 소수가 아닌 경우에 L 보다 큰 최소 소수 X 를 선택하여 그로부터 CAZAC 시퀀스를 만들었지만, 이럴 경우 상관 특성이 악화되어, CAZAC 시퀀스의 특징인 수학식 4 및 수학식 5 와 같은 ZAC 특성을 가지지 못하는 단점이 있다.

ZTE/SAMSUNG/HTC 1002-0227

【발명이 이루고자 하는 기술적 과제】

<25> 상기와 같은 문제점을 해결하기 위해서 본 발명의 목적은 시스템에서 요구되는 시퀀스의 길이를 가지며, 중복 없이 최대한의 정보를 전달할 수 있는 코드 시퀀스 및 이를 생성하는 방법 및 장치를 제공하는 데 있다.

<26> 본 발명의 다른 목적은 상술한 바와 같이 최대한의 정보를 전달할 수 있음과 동시에 양호한 자기상관 및 교차상관 특성을 가지는 시퀀스 및 이를 생성하는 방법 및 생성하는 장치를 제공하는 데 있다.

<27> 본 발명의 또 다른 목적은 상술한 바와 같이 생성된 시퀀스를 전송하고, 분석하는 방법 및 장치를 제공하는 데 있다.

【발명의 구성】

<28> 상기 목적을 달성하기 위한 본 발명의 일 실시형태에 따른 코드 시퀀스는 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스로서, 소수 길이를 가지는 제 1 시퀀스 부; 및 통신 시스템에서 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스부를 포함한다.

<29> 상기 목적을 달성하기 위한 본 발명의 다른 일 실시형태에 따른 코드 시퀀스는 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스로서, 소수 길이를 가지는 제 1 시퀀스 부; 패딩부가 각각 삽입된 제 2 시퀀스부 및 제 3 시퀀스부를 포함하고, 상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의

ZTE/SAMSUNG/HTC 1002-0228

합산값은 통신 시스템에서 요구되는 길이와 상술한 소수 길이 사이의 차이와 동일하다.

<30> 여기서, 상술한 코드 시퀀스는 이 코드 시퀀스의 생성시 소수가 아닌 길이에 기초하여 생성된 시퀀스들 사이에 중복된 시퀀스가 존재하는 시퀀스로서, CAZAC 시퀀스가 일례일 수 있으나, 상술한 특성을 유지하는 한 이에 한정되는 것은 아니다.

<31> 또한, 상술한 소수 길이는 통신 시스템에서 요구되는 길이 이하의 최대 소수 길이인 것이 바람직하나, 통신 시스템의 필요에 따라 이와 다른 소수 길이인 것 역시 가능하다.

<32> 한편, 상기 목적을 달성하기 위한 본 발명의 또 다른 일 실시형태에 따른 신호 전송 방법은 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 단계; 및 이 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법으로서, 상기 코드 시퀀스는, 소수 길이를 가지는 제 1 시퀀스 부; 및 상술한 바와 같이 요구되는 길이와 상술한 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스 부를 포함하는 것을 특징으로 한다.

<33> 상기 목적을 달성하기 위한 본 발명의 또 다른 일 실시형태에 따른 신호 전송 방법은 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 단계; 및 이 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법으로서, 상기 코드 시퀀스는, 소수 길이를 가지는 제 1 시퀀스 부; 패딩부가 각각 삽입된 제 2 시퀀스부 및 제 3 시퀀스부를 포함하고,

ZTE/SAMSUNG/HTC 1002-0229

상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의 합산값은 통신 시스템에서 요구되는 길이와 상술한 소수 길이 사이의 차이와 동일한 것을 특징으로 한다.

<34> 또한, 본 발명의 또 다른 일 실시형태에 따른 신호 전송 장치는 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 시퀀스 선택부; 및 이 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치로서, 상기 코드 시퀀스는, 소수 길이를 가지는 제 1 시퀀스 부; 및 상기 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스부를 포함하는 것을 특징으로 한다.

<35> 또한, 본 발명의 또 다른 일 실시형태에 따른 신호 전송 장치는 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 시퀀스 선택부; 및 이 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치로서, 상기 코드 시퀀스는, 소수 길이를 가지는 제 1 시퀀스 부; 패딩부가 각각 삽입된 제 2 시퀀스부 및 제 3 시퀀스부를 포함하고, 상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의 합산값은 통신 시스템에서 요구되는 길이와 상술한 소수 길이 사이의 차이와 동일한 것을 특징으로 한다.

<36> 한편, 본 발명의 또 다른 일 실시형태에 따른 시퀀스 생성 방법은 통신 시스템의 송신단에서 통신 시스템에서 요구되는 시퀀스의 길이가 소수가 아닌 경우, 요구되는 시퀀스의 길이 이하의 최대 소수 길이를 선택하는 단계; 선택된 최대 소수 길이를 가지는 시퀀스를 생성하는 단계; 및 요구되는 시퀀스의 길이와 최대 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부를 삽입하는 단계를 포함한다.

ZTE/SAMSUNG/HTC 1002-0230

<37> 여기서, 상기 시퀀스는 시퀀스의 길이가 소수가 아닌 경우, 소수가 아닌 길이를 가지도록 생성된 시퀀스들 사이에 중복된 시퀀스가 존재하는 시퀀스일 수 있다.

<38> 또한, 상술한 바와 같은 본 발명의 일 실시형태에 따른 시퀀스 생성 방법은 상기 패딩부에 소정의 상수를 삽입하는 단계, 및/또는 상기 패딩부에 생성된 시퀀스의 순환 후치부를 삽입하는 단계를 더 포함할 수 있으며, 또한, 요구되는 시퀀스 길이를 가지는 시퀀스를 생성하는 단계; 및 상기 패딩부에 상기 요구되는 시퀀스의 길이를 가지도록 생성된 시퀀스로부터 상술한 차이에 해당하는 길이의 시퀀스를 추출하여 삽입하는 단계를 더 포함할 수 있다.

<39> 또한, 상술한 바와 같은 본 발명의 일 실시형태에 따른 시퀀스 생성 방법은 상기 패딩부에 상술한 바와 같이 선택된 최대 소수 길이를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상술한 차이에 해당하는 길이의 시퀀스를 추출하여 삽입하는 단계를 더 포함할 수 있으며, 이와 달리 상기 패딩부를 하위대역 보호구간으로 이용할 수 있다. 이 경우, 상기 시퀀스 생성 방법은 보호구간에 소정의 상수 또는 상술한 바와 같이 생성된 시퀀스의 순환 후치부 중 어느 하나를 삽입할 수도 있다.

<40> 아울러, 상술한 바와 같은 본 발명의 일 실시형태에 따른 시퀀스 생성방법은 요구되는 시퀀스 길이를 상기 최대 소수 길이로 나눈값 만큼 상술한 바와 같이 생성된 시퀀스를 전력 부스팅하는 단계를 더 포함할 수 있다.

<41> 상기 목적을 달성하기 위한 본 발명의 다른 일 실시형태에 따른 시퀀스 분석

ZTE/SAMSUNG/HTC 1002-0231

방법은 통신 시스템의 수신단에서 송신단에서 생성한 시퀀스 및 상기 시퀀스 생성에 이용한 시퀀스 길이를 나타내는 정보를 수신하는 단계; 및 상기 수신된 시퀀스를 상술한 바와 같이 수신된 정보로부터 획득한 시퀀스 길이에 해당하는 부분을 추출하여 분석함으로써 제어정보를 획득하는 단계를 포함한다.

<42> 이 경우, 상기 제어정보를 획득하는 단계에서 수신된 시퀀스를 상술한 바와 같이 수신된 정보로부터 획득한 상기 시퀀스 길이에 해당하는 부분을 추출하여 자기상관 또는 교차상관함으로써 동기정보를 획득하도록 할 수 있다.

<43> 한편, 상기 목적을 달성하기 위한 본 발명의 또 다른 일 실시형태에 따른 시퀀스 분석 방법은 통신 시스템의 수신단에서 송신단에서 생성한 시퀀스 및 상기 시퀀스 생성에 이용한 시퀀스 길이를 나타내는 정보를 수신하는 단계; 수신된 시퀀스를 상술한 바와 같이 수신된 정보로부터 획득한 상기 시퀀스 길이에 해당하는 부분을 추출하여 자기상관 또는 교차상관함으로써 동기정보를 획득하는 단계; 및 획득된 동기정보를 이용하여 시퀀스의 총 길이에 해당하는 상기 수신된 시퀀스의 차등 시퀀스를 생성함으로써, 수신된 시퀀스의 ID 정보를 획득하는 단계를 포함한다.

<44> 상기 다른 목적을 달성하기 위해 본 발명의 또 다른 일 실시형태에 따른 시퀀스 생성 장치는 통신 시스템의 송신단에서 통신 시스템에서 요구되는 시퀀스의 길이가 소수인지 여부를 판정하고, 소수가 아닌 경우, 상술한 바와 같이 통신 시스템에서 요구되는 시퀀스의 길이 이하의 최대 소수 길이를 선택하는 제어부; 및 제어부에서 선택된 상기 최대 소수 길이를 가지는 시퀀스를 생성하고, 상술한 바와 같이 통신 시스템에서 요구되는 시퀀스의 길이와 상기 최대 소수 길이 사이의 차이

ZTE/SAMSUNG/HTC 1002-0232

에 해당하는 길이를 가지는 패딩부를 상기 생성된 시퀀스와 결합하는 시퀀스 생성부를 포함한다.

<45> 여기서, 상기 시퀀스는 시퀀스의 길이가 소수가 아닌 경우, 소수가 아닌 길이를 가지도록 생성된 시퀀스들 사이에 중복된 시퀀스가 존재하는 시퀀스일 수 있다.

<46> 또한, 상기 시퀀스 생성부는 상기 패딩부에 소정의 상수를 삽입하거나, 상술한 바와 같이 생성된 시퀀스의 순환 후치부를 삽입하거나, 또는 통신 시스템에서 요구되는 시퀀스 길이를 가지는 시퀀스를 더 생성하여, 상기 패딩부에 상기 요구되는 시퀀스의 길이를 가지도록 생성된 시퀀스로부터 상기 차이에 해당하는 길이의 시퀀스를 추출하여 삽입할 수 있다.

<47> 또한, 상기 시퀀스 생성부는 상기 패딩부에 선택된 최대 소수 길이를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이에 해당하는 길이의 시퀀스를 추출하여 삽입할 수 있으며, 또는 상기 패딩부에 소정의 상수 또는 상기 생성된 시퀀스의 순환 후치부 중 어느 하나를 삽입하여 패딩부를 하위대역 보호구간으로 이용할 수 있다.

<48> 아울러, 상기 본 발명의 일 실시형태에 따른 시퀀스 생성 장치는 통신 세스템에서 요구되는 시퀀스 길이를 상기 최대 소수 길이로 나눈값만큼 상술한 바와 같이 생성된 시퀀스를 전력 부스팅하는 전력 부스팅부를 더 포함할 수 있다.

<49> 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적

ZTE/SAMSUNG/HTC 1002-0233

인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다. 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로 도시된다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

<50> 도 2 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스 및 이를 생성하는 방법 및 장치를 설명하기 위한 도면이다.

<51> 통신 시스템의 송신단에서 제어정보를 전달하는 시퀀스를 생성하는데 있어서, 요구되는 것보다 더 많은 자원을 이용하여 생성하는 것은 문제가 되나, 더 적은 자원을 사용하는 것은 문제가 되지 않는다. 즉, 통신 시스템에서 요구되는 시퀀스의 길이를 L 이라 할 때, L 보다 적은 길이를 가지는 시퀀스를 생성하는 것은 통신 시스템의 자원 할당 면에서 전혀 문제가 되지 않는다. 따라서, 도 2 에 도시된 바와 같은 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치는 L 보다 작은 길이(이를 "X" 라 함)를 이용하여 시퀀스를 생성하는 것을 제안한다. 여기서, 통신 시스템에서 요구되는 시퀀스의 길이 L 이란, 이용되는 통신 시스템에 정해진 표준 등에 의해 전송 프레임 구조에서 소정의 제어정보 전송을 위해 할당된 시퀀스의 길이 등을 일반적으로 의미할 수 있으나, 특정 목적을 위해 통신 시스템이 제어정보 전송을 위해 소정 길이의 시퀀스를 이용할 것을 요청할 수 있는 등 다양한 의

ZTE/SAMSUNG/HTC 1002-0234

미를 가질 수 있다.

<52> 한편, CAZAC 시퀀스의 경우, 시퀀스 생성에 이용되는 길이 N 이 소수가 아닌 경우, 다시 말해 통신 시스템에서 요구되는 길이 L 이 소수가 아니며, CAZAC 생성에 이용되는 길이 N 을 L 로 설정하는 경우, 상기 N 을 이용하여 생성된 시퀀스들 사이에 중복된 시퀀스가 존재할 수 있다. 예를 들어, CAZAC 시퀀스를 생성하는데 통신 시스템에서 요구되는 시퀀스의 길이 L 이 12 이고, 이에 따라 상기 수학식 1 및 수학식 2 에서 N 을 소수가 아닌 12 로 선택하는 경우, 시퀀스의 ID 에 해당하는 값인 M 값에 2 가 할당되는 경우와 M 값에 10 이 할당되는 경우는 서로 중복된 시퀀스를 가지게 된다. 또한, CAZAC 시퀀스로 예시되는 본 발명의 일 실시형태에 따라 생성되는 시퀀스는 시퀀스의 길이 N 과 시퀀스의 ID 에 상응하는 변수 M 이 서로 소가 아닌 경우, 생성된 시퀀스들이 ZAC(Zero Auto-Correlation) 특성을 가지지 않을 수 있다.

<53> 본 명세서는 생성되는 시퀀스를 CAZAC 시퀀스로 예를 들어 설명하나, 상술한 바와 같이 시퀀스 생성에 이용되는 길이가 소수가 아닌 경우, 이 길이를 이용하여 생성된 시퀀스들 사이에 중복된 시퀀스가 존재할 수 있는 시퀀스인 경우 임의의 시퀀스가 생성될 수 있으며, 반드시 CAZAC 시퀀스에 한정되는 것은 아니다.

<54> 상술한 바와 같은 특성을 가지는 시퀀스를 이용하기 위하여, 통신 시스템에서 요구되는 시퀀스의 길이 L 이 소수인 경우에는 N = L 로 설정하여, 바로 시퀀스를 생성하지만, 본 발명의 일 실시형태에서 길이 L 이 소수가 아닌 경우에는 길이 L 이하의 최대 소수 X 를 선택하도록 한다. 그 후, 선택된 X 를 상기 수학식 1 또

ZTE/SAMSUNG/HTC 1002-0235

는 2 의 N 값으로 설정하여 시퀀스를 생성한다. 이와 같이 생성된 길이가 X 인 시퀀스(202)의 종류는 X-1 개가 될 수 있으며, 이들 사이에 중복된 시퀀스가 발생하지 않는다. 또한, 상술한 바와 같이 생성된 길이가 X 인 시퀀스(202)는 종래와 같이 생성된 시퀀스의 일부를 잘라내는 과정이 없어 ZAC 특성이 유지되는바, 길이가 X 인 시퀀스의 자기상관값은 지연이 0 인 경우를 제외하고는 0 값을 나타내며, 교차상관값은 항상 일정한 상수를 나타내게 된다.

<55> 한편, 통신 시스템에서 요구되는 시퀀스의 길이는 이 경우에도 L 이므로, 상기 L 과 상술한 바와 같이 선택된 시퀀스의 길이에 해당하는 X 사이의 차이에 해당하는 길이를 가지는 시퀀스를 채워넣을 필요가 있다. 도 2 는 이 부분에 패딩부를 삽입하여 길이 L - X 의 시퀀스를 부가하는 것으로 도시하고 있다.

<56> 상술한 바와 같은 시퀀스 생성 방법에 의해 생성된 코드 시퀀스(203)는 X 에 기초하여 생성된 시퀀스부(C_1)와 길이가 L-X 인 시퀀스부(C_2)로 구분될 수 있으며, 이하 설명의 편의를 위해 시퀀스부(C_1)를 제 1 시퀀스부, 시퀀스부(C_2)를 제 2 시퀀스부라 지칭한다. 또한, 상기 설명에서 X 가 L 이하 최대 소수인 것으로 예를 들어 설명하였으나, X 는 L 이하의 소수인 한 이를 기초로 생성된 코드 시퀀스들 사이에 중복 문제가 발생하지 않으며, X 에 기초한 분석에서 ZAC 특성을 유지하는바, 통신 시스템의 요구에 따라 다른 값을 가질 수 있다. 다만, 생성가능한 코드 시퀀스의 조합을 가장 많이 생성할 수 있기 위해 X 를 L 이하 최대 소수로 선택하는 것이 보다 바람직하다.

ZTE/SAMSUNG/HTC 1002-0236

<57> 다음으로, 도 2 에 도시된 바와 같은 패딩부를 처리하는 방법에는 여러 가지가 있을 수 있다. 첫째, 상술한 패딩부에 소정의 상수, 예를 들어 0 을 삽입하는 방법이 있을 수 있다. 이는 상술한 패딩부가 중요하지 않은 경우, 즉 셀 탐색을 하거나 임의 접속(random access)을 할 경우에 총 길이 L 에 해당하는 부분을 모두 사용하지 않아도 문제가 없는 경우에 적용할 수 있다. 둘째, X 를 N 으로 설정하여 생성된 상술한 제 1 시퀀스부(C_1)에서 초기 L-X 에 해당하는 부분을 복사하여 도 2 에 도시된 바와 같이 제 1 시퀀스부(C_1)의 말단부에 위치한 상기 패딩부에 삽입함으로써, 패딩부에 순환 후치부(Cyclic Postfix)를 삽입하는 방법이 있을 수 있다. 이 경우는 L 에 해당하는 길이를 모두 사용하는 방식으로서, 생성된 시퀀스의 ID 를 결정하는 경우에 있어서도 길이 L 을 모두 이용하여 시퀀스의 ID 를 구분할 수 있는 장점이 있으며, 생성된 시퀀스에 왜곡을 주지 않는 방법으로 볼 수 있다. 또한, 시퀀스 ID 등의 정보를 전달하는데 전체 길이 L 의 시퀀스가 모두 이용되기 때문에 이후에 설명할 바와 같은 전력 부스팅 동작을 행할 필요가 없다. 또한, 상술한 방법을 이용하여 생성된 시퀀스를 통해 시퀀스 ID 등의 제어정보를 획득하는 방법에 대해서는 이후에서 더 상세히 설명하도록 한다. 한편, 상술한 실시예에서는 패딩부에 제 1 시퀀스부(C_1)의 순환후치부를 삽입하는 경우를 예로서 설명하였으나, 제 1 시퀀스부(C_1)와 패딩부의 상대적 위치에 따라 패딩부에 제 1 시퀀스부(C_1)의 순환전치부(Cyclic Prefix)가 삽입될 수도 있음은 당업자에게 자명하다.

<58> 한편, 상기 패딩부를 처리하는 세번째 방법으로, 통신 시스템에서 요구되는

ZTE/SAMSUNG/HTC 1002-0237

시퀀스 길이 L 을 가지는 시퀀스, 즉 N = L 을 이용하여 시퀀스를 생성한 후, 상술한 바와 같이 N = L 로 설정하여 생성된 시퀀스로부터 상기 차이, 즉 L - X 에 해당하는 길이의 시퀀스를 추출하여 상기 패딩부에 삽입하는 방법이 있을 수 있다. 이 경우 패딩부에 추가정보를 삽입하는 형태를 가지게 되며, 추가되는 값을 통해 다른 추가 메시지를 전달할 수 있다.

<59> 네번째로, 상기 패딩부에 상술한 바와 같이 선택된 최대 소수 길이 X 를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이, 즉 L - X 에 해당하는 길이의 시퀀스를 추출하여 삽입하는 방법이 있을 수 있다. 이 경우 패딩부에 삽입되는 시퀀스는 상술한 제 1 시퀀스부(C_1)와는 다른 M값을 가지는 CAZAC 시퀀스가 될 수도 있으며, M값과 L값 중 적어도 하나가 다른 CAZAC의 일부가 삽입될 수 있다. 또한, 패딩부에 삽입되는 시퀀스는 CAZAC 시퀀스가 아닌 다른 형태의 시퀀스가 삽입될 수도 있다. 이 경우 상술한 바와 같이 제 1 시퀀스부(C_1)와 상이한 유형의 시퀀스로서 패딩부에 삽입되는 시퀀스는 부가 정보를 나타내며, 시퀀스의 조합을 통한 시퀀스 종류의 확장 및 메시지 전달에도 이용할 수 있으며, 상기 패딩부에 삽입될 수 있는 정보의 구체적인 예는 이하에서 보다 상세히 서술하기로 한다.

<60> 마지막으로, 상기 패딩부를 하위대역 보호구간으로 이용하는 방법이 있을 수 있으며, 이를 이하 도 3 과 관련하여 구체적으로 살펴보기로 한다.

<61> 도 3 은 본 발명의 일 실시형태에 따른 CAZAC 시퀀스 및 이를 생성하는 방법에서 패딩부를 처리하는 일례, 즉 상술한 바와 같이 패딩부를 하부대역 보호구간으

ZTE/SAMSUNG/HTC 1002-0238

로 이용하는 예를 설명하기 위한 도면이다.

<62> 특정 시퀀스를 이용하여 제어정보를 전송하는 경우 중 임의접속 채널과 같이 서로 동기를 맞추지 않고 데이터를 전송하는 경우, 통신 시스템 내의 다수의 사용자가 데이터를 전송하는 경우, 수신된 데이터의 주파수가 왜곡되는 경우가 존재한다. 따라서, 본 발명의 일 실시형태에 따른 시퀀스 생성방법은 도 3 에 도시된 바와 같이 상기 패딩부를 시퀀스의 양측면에 위치시켜, 이를 하부대역 보호구간으로 이용함으로써, 상술한 바와 같이 수신 주파수 왜곡이 있는 경우에도 보다 용이하게 수신 데이터로부터 제어정보를 획득할 수 있도록 한다. 이 경우, 상술한 바와 같이 보호구간으로 이용되는 패딩부에는 소정의 상수, 예를 들어 0 을 삽입하거나, 또는 상술한 바와 같이 양측에 분리된 보호구역에 생성된 시퀀스의 순환 후치부 (및/또는 순환 후치부; 이하 동일함)를 삽입할 수 있다. 상술한 바와 같이 패딩부를 시퀀스의 양측에 배치하여 하위대역 보호구간으로 이용하는 경우, 해당 시퀀스 내부가 주파수 왜곡으로부터 보호될 수 있으며, 특히 이 보호구간에 0 을 삽입하는 경우, 해당 시퀀스에 인접한 시퀀스에 간섭을 주는 것을 저감시킬 수 있다. 한편, 상술한 바와 같이 시퀀스의 양측에 분리된 보호구역에 생성된 시퀀스의 순환 후치부를 삽입하는 경우, 해당 시퀀스 내부를 주파수 왜곡으로부터 보호할 수 있을 뿐만 아니라, 주파수 왜곡이 없는 경우, 순환 후치부가 삽입된 부분 역시 시퀀스 ID 를 포함하는 제어정보를 전송하는데 이용할 수 있는 장점이 있다.

<63> 상술한 바와 같은 방식으로 패딩부를 처리하여 생성한 코드 시퀀스(301)는 3

ZTE/SAMSUNG/HTC 1002-0239

부분으로 구분될 수 있다. 먼저 X 의 길이에 기초하여 생성된 시퀀스부(C_1), 이 시퀀스부의 양측에 분리되어 삽입된 2 개의 시퀀스부(C_2, C_3)로 구분된다. 이하에서는 설명의 편의를 위해 시퀀스부(C_1)를 제 1 시퀀스부, 2 개의 시퀀스부(C_2, C_3)를 각각 제 2 시퀀스부 및 제 3 시퀀스부로 지칭한다.

<64> 상술한 바와 같이 패딩부를 처리하는 방법으로서 보다 명확한 이해를 위해 5 가지 실시예를 살펴보았으나, 당업자는 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위에서 이를 변형하여 이용할 수도 있음을 알며, 본 발명은 상술한 5 가지 실시예에 한정되는 것은 아니다.

<65> 한편, 상술한 5 가지 실시예 중 패딩부에 정보를 삽입하지 않는 첫 번째 방법을 제외하고, 나머지 방법들의 경우 모두 패딩부에 부가정보를 삽입함으로써, 시퀀스의 조합의 확장 및 메시지 전달에 이용될 수 있다. 상기 패딩부에 삽입될 수 있는 정보로서, 예를 들어 임의접속 채널(RACH)의 개시접속(initial access)정보, 타이밍 갱신(timing updata)정보, 자원 요청(resource request) 정보, 사용자 ID 정보, 채널품질표시자(CQI), 사용자 그룹 ID 등을 포함할 수 있으며, 동기 채널(SCH) 의 셀 ID 정보, MIMO 정보, 동기 채널의 프레임 내의 위치 등을 가지는 동기 채널 정보 등을 포함할 수 있고, 아울러 메시지 전달을 위한 전송 데이터를 삽입할 수도 있으나 이에 한정되지 않으며, 당업자는 패딩부의 길이인 L - X 의 길이를 가지는 시퀀스를 이용하여 전달할 수 있는 한 임의의 정보를 전달하는 시퀀스가 삽입될 수 있음을 안다.

ZTE/SAMSUNG/HTC 1002-0240

<66> 도 4 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스를 전송하기 위한 장치를 나타내는 블록도이다.

<67> 이러한 시퀀스를 전송하기 위한 신호 전송 장치는 통신 시스템에서 제어 신호 등의 송신이 이루어지는 것이 상향 링크인지, 하향 링크인지에 따라 기지국, 사용자 기기를 포함하여 다양한 장치가 될 수 있음은 자명하다. 따라서, 도 4 에서는 제어 신호를 전송할 수 있는 장치를 일반적인 송신측(401)으로 도시하였다.

<68> 송신측(401)에 해당하는 장치는 시퀀스 선택부(402) 및 송신부(403)를 포함한다. 여기서 시퀀스 선택부(402)는 제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이, 즉 L 을 가지는 코드 시퀀스를 선택하는 기능을 수행한다. 이 시퀀스 선택부(402)는 일반적으로 통신 시스템에서 요구되는 길이에 해당하는 L 값에 대한 정보를 저장하고, 이에 기초하여 길이가 L 인 시퀀스 중 전달하고자 하는 제어 정보를 표현하기 위한 적절한 코드 시퀀스를 선택하게 된다.

<69> 다만, 상술한 시퀀스 선택부(402)가 선택할 수 있는 코드 시퀀스는 상술한 바와 같이 소수 길이를 가지는 제 1 시퀀스부와 L-X 의 길이를 가지는 제 2 시퀀스부를 포함하는 코드 시퀀스이거나, 소수 길이를 가지는 제 1 시퀀스부와 L-X 의 길이를 가지는 제 2 시퀀스부 및 제 3 시퀀스부가 상술한 제 1 시퀀스부의 양 측면에 분할되어 결합된 형태의 코드 시퀀스인 것이 바람직하다. 또한, 제 1 시퀀스부의 길이 X 는 L 이하 최대 소수인 것이 다양한 시퀀스를 선택할 수 있는 측면에서 바람직하나, 이에 한정될 필요는 없다.

<70> 이와 같은 구조를 가지는 코드 시퀀스는 송신부(403)를 통해 수신측으로 송

ZTE/SAMSUNG/HTC 1002-0241

신된다. 도 4 는 송신부(403)가 직렬신호를 병렬로 변환하여 다중안테나를 통해 송신되는 경우를 예로서 도시하고 있으나, 송신부(403)는 상술한 바와 같은 특징을 가지는 코드 시퀀스를 수신측으로 송신할 수 있는 한, 임의의 구성을 가질 수 있다. 그 후, 송신부(403)를 통해 송신된 코드 신퀀스 신호는 수신단에 수신되며, 수신단은 이하에서 더 상세히 설명하는 바와 같이 종래에 비해 자기상관 및 교차상관에 의한 동기추정 등에 있어 더 우수하게 제어 신호를 분석할 수 있다.

<71> 도 5 는 본 발명의 일 실시형태에 따른 CAZAC 시퀀스를 생성하는 장치를 나타내는 블록도이다.

<72> 통신 시스템의 송신단은 제어 정보를 전달하는 코드 시퀀스를 생성하는 장치를 포함할 수 있다. 이러한 코드 시퀀스를 생성하는 장치는 제어부(501)와 시퀀스 생성부(502)를 포함한다. 여기서, 제어부(501)는 통신 시스템에서 요구되는 시퀀스의 길이에 해당하는 L 이하의 최대 소수 길이 X 를 선택하는 기능을 수행한다. 이를 위해 통신 시스템에서 요구되는 길이에 해당하는 L 값이 소수인지 여부를 판정하는 수단(501a) 및 시퀀스를 생성하는데 기초하되는 길이 X 를 선택하는 수단(501b)을 포함할 수 있다. 상술한 바와 같은 수단(501a)은 L 이 소수인지 여부를 판정하고, 그 판단값을 L 값과 함께 수단(501b)에 전달한다. 그 후, 수단(501b)은 수단(501a)의 판단값에 기초하여, L이 소수인 경우 N=L로, L이 소수가 아닌 경우 L 보다 작은 최대 소수 X를 선택하여 N=X로 설정한다(설명의 편의를 위해, 시퀀스 생성에 기초되는 소수, 즉 L이 소수인 경우 L 및 L이 소수가 아닌 경우 X를 소수 X로 통칭한다).

ZTE/SAMSUNG/HTC 1002-0242

<73> 상술한 바와 같이 선택된 X 값은 시퀀스 생성부(502) 의 제 1 시퀀스부 생성부(502a) 및 제 2 시퀀스 생성부(502b)에 전달된다. 제 1 시퀀스 생성부(502a)는 X 값에 기초하여 X 의 길이를 가지는 제 1 시퀀스부(C_1)를 생성한다. 또한, 제 2 시퀀스 생성부(502b)는 L-X값에 해당하는 길이를 가지는 패딩부를 삽입한 제 2 시퀀스부(C_2)를 생성한다. 그 후, 이들 시퀀스부들에서 생성된 제 1 시퀀스부(C_1) 및 제 2 시퀀스부(C_2)는 결합부(502c)에 전달되어 합산된 코드 시퀀스(C) 가 생성된다.

<74> 도 5 는 생성되는 코드 시퀀스가 제 1 시퀀스부(C_1)와 제 2 시퀀스부(C_2)로 구성되는 경우를 예를 들어 설명하였으나, 당업자는 상술한 제 1 시퀀스 생성부(502a) 및 제 2 시퀀스 생성부(502b)에 추가하여 제 3 시퀀스 생성부(미도시)를 추가하여 3 부분으로 구성된 시퀀스를 생성할 수 있음을 충분히 알 수 있다. 또한, 3 부분으로 구분되는 시퀀스를 생성하기 위해 상술한 바와 같이 제 3 시퀀스 생성부를 추가하는 것이 아니라, 제 2 시퀀스 생성부(502b)에 의해 생성된 제 2 시퀀스부를 분할하여 제 1 시퀀스부의 양 측면에 삽입하기 위해 시퀀스 분할 수단(미도시)를 추가하여 상술한 바와 같은 코드 시퀀스를 생성할 수 있음 역시 충분히 알 수 있을 것이다.

<75> 한편, 도 6 는 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 전력을 부스팅하는 일례를 설명하기 위한 도면이다.

<76> X의 길이를 이용하여 시퀀스를 생성하고, L - X 에 해당하는 길이만큼 패딩부를 삽입한 후, 상술한 바와 같은 길이 X 를 이용하여 생성된 시퀀스 부분을 길이

ZTE/SAMSUNG/HTC 1002-0243

L 을 X 로 나눈값 만큼 전력 부스팅(boosting) 할 수 있다. 이하에서 보다 상세히 설명하는 바와 같이, 일반적으로 본 발명의 일 실시형태에 따라 생성된 길이 L 의 시퀀스 중 길이 L 이하 최대 소수에 해당하는 X 를 이용하여 생성된 시퀀스 부분만이 자기상관 및/또는 교차상관을 이용하여 동기정보 등을 전달하는데 이용하는 것이 바람직하므로, X의 길이를 이용하여 생성된 시퀀스 부분이 다른 부분에 비해 잡음에 강건할 것이 요구된다. 이와 같이 길이 X 의 시퀀스에 L/X 만큼 전력 부스팅 시킨 효과를 줌으로써, 수신단에서 상기 시퀀스를 검색할 때, 기존의 시퀀스에 비해 잡음에 강건하여 더욱 우수한 검출 성능을 보일 수 있다. 또한, 상술한 바와 같은 전력 부스팅을 위해 본 발명의 일 실시형태에 따른 시퀀스 생성 장치는 전력 부스팅부를 더 포함할 수 있다.

<77> 다만, 상술한 본 발명의 일 실시형태 중 패딩부에 생성된 시퀀스의 순환 후치부를 삽입하여 생성한 시퀀스의 경우, 전체 길이 L 의 시퀀스 모두가 시퀀스 ID 정보 획득 등에 있어 이용되기 때문에, 전력 부스팅을 행할 필요가 없다.

<78> 이하에서는, 상술한 바와 같이 본 발명의 일 실시형태에 따라 생성된 시퀀스를 이용하여 제어정보를 획득하기 위해, 상기 시퀀스를 수신하여 분석하는 방법에 대해 살펴보기로 한다.

<79> 수신단은 상술한 바와 같이 본 발명의 일 실시형태에 따라 생성된 시퀀스 및 이 시퀀스 생성에 이용한 길이 X 를 나타내는 정보를 수신한다. 그 후, 수신된 시퀀스를 상술한 바와 같이 수신된 정보로부터 획득한 길이 X 에 해당하는 부분을 추출하여 분석함으로써 제어정보를 획득할 수 있다. 일반적으로 수신신호로부터 제어

ZTE/SAMSUNG/HTC 1002-0244

정보를 획득하기 위해서는 수신 데이터의 동기 정보를 획득하는 것이 선행되어야 한다. 이와 같이 수신된 시퀀스를 이용하여 동기 정보를 획득하는 것은 다음과 같이 자기상관(수학식 6) 및/또는 교차상관(수학식 7) 을 이용하는 것이 일반적이다.

【수학식 6】

<80>
$$R_{M;N}(d) = \sum_{k=0}^{X-1} c(k;M,X) \cdot c^{*}(mod(k+d),X);M,X)$$

【수학식 7】

<81>
$$R_{M_1:M_2:N}(d) = \sum_{k=0}^{X-1} c(k;M_1,X) \cdot c^{*}(mod(k+d),X);M_2,X)$$

<82> 상기 수학식 6 은 시퀀스 ID 가 M 인, 송신된 시퀀스의 자기상관을 구하는 방법을 나타내며, 상기 수학식 6 을 통해 구한 자기상관값이 0 이 아닌 d 값을 구하여 동기를 획득하는 방법이다. 한편, 수학식 7 은 시퀀스 ID 가 M_1 인 시퀀스를 수신한 경우, 시퀀스 ID 가 M_2 인 시퀀스와 교차상관을 구하는 방법을 나타내며, 이를 통해 동기를 획득하는 방법을 나타낸다. 일반적으로, 통신 시스템이 동기 네트워크(Synchronous Network)인 경우 자기상관을 이용하여 동기 정보를 획득하며, 비동기 네트워크(Asynchronous Network)인 경우, 교차상관을 이용하여 동기정보를 획득하는 것이 바람직하나, 본 발명은 어느 한 방법에 한정하는 것이 아니라 필요에 따라 양 방법을 선택하여 또는 모두 사용하여 동기 정보를 획득할 수 있다.

<83> 상술한 바와 같은 방식을 통해 수신 시퀀스의 동기 정보를 획득한 후, 수신

ZTE/SAMSUNG/HTC 1002-0245

단은 수신 시퀀스를 분석하여 시퀀스 ID 를 다음과 같이 획득할 수 있다.

【수학식 8】

<84> $$\sigma c(k;M,X) = c(k+1;M,X) \cdot c^{*}(k;M,X) \qquad (for\, k = 0,1,...L-1)$$

【수학식 9】

<85> $$\sigma c(k;M,X) = c(k+1;M,X) \cdot c^{*}(k;M,X) \qquad (for\, k = 0,1,...X-1)$$

<86> 상기 수학식 8 및 수학식 9 에서 $\sigma c(k;M,X)$ 은 수신 시퀀스의 차등 시퀀스(Differential Sequence)를 지칭한다. 상기 수학식 8 은 수신 시퀀스의 총 길이에 해당하는 차등 시퀀스를 이용하여 수신 시퀀스의 ID 정보를 획득하는 것을 나타내며, 이는 본 발명의 일 실시형태 중 패딩부에 생성된 시퀀스의 순환후치부를 삽입하는 방법에 의해 생성된 시퀀스를 분석하는 경우 이용될 수 있다. 한편, 수학식 9 는 수신 시퀀스를 생성할 때 이용한 최대 소수 길이 X 의 길이를 가지는 시퀀스를 이용하여 ID 정보를 획득하는 것을 나타내며, 이는 본 발명의 일 실시형태 중 패딩부에 순환후치부를 삽입하는 방법 이외의 방법에 의해 패딩부가 처리된 시퀀스를 분석하는데 이용될 수 있다.

<87> 상술한 바와 같이 수학식 8 또는 수학식 9 에 의해 차등 시퀀스를 계산하는 경우, CAZAC 시퀀스의 경우, 시퀀스 인덱스를 나타내는 k 의 1 차 항이 생성되고, 그 결과값을 퓨리에 변환하는 경우, 단일 피크값이 나타난다. 따라서, 이 피크값을 검색함으로서 시퀀스의 ID 정보를 획득할 수 있다.

ZTE/SAMSUNG/HTC 1002-0246

<88> 도 7a 및 도 7b 는 각각 종래 CAZAC 시퀀스 생성 방법에 의해 생성된 CAZAC 시퀀스와 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 확률밀도함수(PDF) 특성을 도시하는 도면이다. 여기서, 도 7a 및 도 7b 는 모두 지연이 0 인 경우를 제외한 자기상관값의 확률밀도함수를 도시하고 있다.

<89> 도 7a 에 도시된 바와 같이 종래 L 보다 큰 가장 작은 소수를 선택하여, 이 소수의 길이를 가지는 CAZAC 시퀀스를 생성하고, 생성된 CAZAC 시퀀스 중 길이 L 에 해당하는 부분만을 잘라 사용하는 시퀀스의 경우, 생성된 시퀀스 중 일부가 제거되기 때문에 ZAC 특성이 악화되어, 지연값이 0 인 경우를 제외한 경우에도 확률밀도함수값이 0 이 아닌 경우가 발생하게 된다. 따라서, 상술한 종래의 CAZAC 시퀀스를 이용한 자기상관을 통해 동기 정보를 추정하는 경우 그 성능이 약화될 수 있다.

<90> 한편, 도 7b 에 도시된 바와 같이 본 발명의 일 실시형태에 따라 통신 시스템이 요구하는 길이 L 이 소수가 아닌 경우, L 이하의 최대 소수 X 를 선택하여, 이를 N 값으로 설정함으로써 생성된 CAZAC 시퀀스의 경우, 길이 X 인 시퀀스 부분을 이용하여 자기상관값을 구할 경우, 지연이 0 인 경우에만 1 의 값을 나타내는바, 지연이 0 인 경우를 제외한 자기상관의 확률밀도함수는 도 7b 에 도시된 바와 같이 0 의 값만 가지게 된다. 따라서, 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치에 의해 생성된 CAZAC 시퀀스의 자기상관값을 이용하여 동기 정보를 추정하는 경우, 종래의 CAZAC 시퀀스의 자기상관값을 이용하여 동기 정보를 추정하는 경우에 비해 그 정확도가 높아지는 효과를 가진다.

ZTE/SAMSUNG/HTC 1002-0247

<91> 도 8 은 종래 CAZAC 시퀀스 생성 방법에 의해 생성된 CAZAC 시퀀스와 본 발명의 일 실시형태에 따라 생성된 CAZAC 시퀀스의 누적 확률밀도함수(CDF) 특성을 도시하는 도면이다.

<92> 종래 CAZAC 시퀀스의 경우, 상술한 바와 같이 생성된 CAZAC 시퀀스 중 일부를 잘라내어 사용하기 때문에, 교차상관값이 일정한 상수값(p)을 나타내지 않는 부분이 발생할 수 있다. 이에 따라 종래의 CAZAC 시퀀스의 교차상관값에 대한 누적확률밀도함수는 도 8 의 실선으로 도시된 바와 같이 일정한 상수값(도 8 에서는 약 0.12)의 주변값 역시 포함하게 된다. 이에 반해, 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치에 의해 생성된 CAZAC 시퀀스의 경우 교차상관값은 일정한 상수(도 8 에서는 약 1.2)를 가지게 되어, 이에 대한 누적확률밀도함수는 도 8 의 점선으로 도시된 바와 같이 나타나게 된다. 따라서, 본 발명의 일 실시형태에 따른 시퀀스 생성방법 및 장치를 이용하여 생성된 CAZAC 시퀀스의 교차상관값을 통해 동기를 추정하는 경우, 종래의 CAZAC 시퀀스의 교차상관값을 통해 동기를 추정하는 것에 비해 우월한 성능을 얻을 수 있다.

<93> 상술한 바와 같이 개시된 본 발명의 바람직한 실시형태에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시 형태를 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을 것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라,

ZTE/SAMSUNG/HTC 1002-0248

여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

【발명의 효과】

<94> 상기와 같은 본 발명의 일 실시형태에 따르면, 중복 없이 생성가능한 시퀀스의 개수를 늘일 수 있는 효과를 가져올 수 있다.

<95> 또한, 생성된 시퀀스는 양호한 자기상관 및 교차상관 특성을 유지하여, 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치를 이용하여 생성된 시퀀스를 이용하여 제어정보를 전달할 경우, 종래에 비해 더 정확한 동기 정보를 획득할 수 있다.

<96> 또한, 상술한 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치에 의해 생성된 시퀀스의 패딩부를 처리하는 방법에 따라, 생성가능한 시퀀스의 수를 확장하거나, 하위대역 보호구간 등으로 이용할 수 있는 효과를 가진다.

<97> 아울러, 상술한 본 발명의 일 실시형태에 따른 시퀀스 생성 방법 및 장치에 의해 생성된 시퀀스 중 최대 소수 길이에 해당하는 시퀀스 부분을 전력 부스팅하여 전송함으로써, 잡음에 강건한 특성을 가질 수 있다.

ZTE/SAMSUNG/HTC 1002-0249

【특허청구범위】

【청구항 1】

제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스로서,

소수 길이를 가지는 제 1 시퀀스 부; 및

상기 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스부를 포함하는, 코드 시퀀스.

【청구항 2】

제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스로서,

소수 길이를 가지는 제 1 시퀀스 부;

패딩부가 각각 삽입된 제 2 시퀀스부 및 제 3 시퀀스부를 포함하고,

상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의 합산값은 상기 요구되는 길이와 상기 소수 길이 사이의 차이와 동일한, 코드 시퀀스.

【청구항 3】

제 1 항 또는 제 2 항에 있어서,

상기 코드 시퀀스는 상기 코드 시퀀스의 생성시 소수가 아닌 길이에 기초하여 생성된 시퀀스들 사이에 중복된 시퀀스가 존재하는 시퀀스인, 코드 시퀀스.

ZTE/SAMSUNG/HTC 1002-0250

【청구항 4】

제 1 항 또는 제 2 항에 있어서,

상기 소수 길이는 상기 요구되는 길이 이하의 최대 소수 길이인, 코드 시퀀스.

【청구항 5】

제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 단계; 및

상기 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법에 있어서,

상기 코드 시퀀스는,

소수 길이를 가지는 제 1 시퀀스 부; 및

상기 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스 부를 포함하는 것을 특징으로 하는 신호 전송 방법.

【청구항 6】

제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 단계; 및

상기 선택된 코드 시퀀스를 수신측으로 송신하는 단계를 포함하는 신호 전송 방법에 있어서,

ZTE/SAMSUNG/HTC 1002-0251

상기 코드 시퀀스는,

소수 길이를 가지는 제 1 시퀀스 부;

패딩부가 각각 삽입된 제 2 시퀀스부 및 제 3 시퀀스부를 포함하고,

상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의 합산값은 상기 요구되는 길이와 상기 소수 길이 사이의 차이와 동일한 것을 특징으로 하는 신호 전송 방법.

【청구항 7】

제어 정보를 전송하기 위해 통신 시스템에서 요구되는 길이를 가지는 코드 시퀀스를 선택하는 시퀀스 선택부; 및

상기 시퀀스 선택부가 선택한 코드 시퀀스를 수신측으로 송신하는 송신부를 포함하는 신호 전송 장치에 있어서,

상기 코드 시퀀스는,

소수 길이를 가지는 제 1 시퀀스 부; 및

상기 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스부를 포함하는 것을 특징으로 하는 신호 전송 장치.

【청구항 8】

통신 시스템의 송신단에서 제어정보를 전달하는 코드 시퀀스를 생성하는 방법에 있어서,

상기 통신 시스템에서 요구되는 시퀀스의 길이 이하의 최대 소수 길이를 선

ZTE/SAMSUNG/HTC 1002-0252

택하는 단계;

선택된 상기 최대 소수 길이에 기초하여, 상기 최대 소수 길이를 가지는 제 1 시퀀스부를 생성하는 단계; 및

상기 요구되는 시퀀스의 길이와 상기 최대 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입한 제 2 시퀀스부를 생성하는 단계를 포함하는, 코드 시퀀스 생성 방법.

【청구항 9】

제 8 항에 있어서,

상기 패딩부에 소정의 상수만으로 구성된 시퀀스를 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 10】

제 8 항에 있어서,

상기 패딩부에 상기 생성된 시퀀스의 순환 후치부를 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 11】

제 8 항에 있어서,

상기 통신 시스템에서 요구되는 시퀀스 길이에 기초하여, 상기 요구되는 길이를 가지는 시퀀스를 생성하는 단계; 및

상기 패딩부에 상기 요구되는 길이를 가지도록 생성된 시퀀스로부터 상기 차

ZTE/SAMSUNG/HTC 1002-0253

이에 해당하는 길이의 시퀀스를 추출하여 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 12】

제 8 항에 있어서,

상기 패딩부에 상기 선택된 최대 소수 길이를 가지도록 생성된 시퀀스와는 다른 유형의 시퀀스 중 상기 차이에 해당하는 길이의 시퀀스를 추출하여 삽입하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

【청구항 13】

제 8 항에 있어서,

상기 패딩부를 상기 제 1 시퀀스부의 양측에 분할하여 삽입함으로써 하위대역 보호구간으로 이용하는, 코드 시퀀스 생성 방법.

【청구항 14】

제 13 항에 있어서,

상기 보호구간에 소정의 상수 또는 상기 생성된 시퀀스의 순환 후치 중 어느 하나를 삽입하는, 코드 시퀀스 생성 방법.

【청구항 15】

제 8 항 내지 제 14 항 중 어느 한 항에 있어서,

상기 요구되는 시퀀스 길이를 상기 최대 소수 길이로 나눈값만큼 상기 생성된 시퀀스를 전력 부스팅하는 단계를 더 포함하는, 코드 시퀀스 생성 방법.

ZTE/SAMSUNG/HTC 1002-0254

【청구항 16】

통신 시스템의 수신단에서,

소수 길이를 가지는 제 1 시퀀스 부; 및

상기 요구되는 길이와 상기 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부가 삽입된 제 2 시퀀스부를 포함하는 코드 시퀀스를 분석하는 방법에 있어서,

상기 코드 시퀀스 및 상기 상기 제 2 시퀀스부의 길이를 나타내는 정보를 수신하는 단계; 및

상기 수신된 코드 시퀀스 중 상기 제 2 시퀀스부의 길이에 해당하는 부분을 추출하여 분석함으로써 제어정보를 획득하는 단계를 포함하는, 코드 시퀀스 분석 방법.

【청구항 17】

제 16 항에 있어서,

상기 제어정보를 획득하는 단계에서 상기 수신된 코드 시퀀스 중 상기 제 2 시퀀스부의 길이에 해당하는 부분을 추출하여 자기상관 또는 교차상관함으로써 동기정보를 획득하는, 코드 시퀀스 분석 방법.

【청구항 18】

제 17 항에 있어서,

획득된 상기 동기정보를 이용하여 상기 제 2 시퀀스부의 길이에 해당하는 상

ZTE/SAMSUNG/HTC 1002-0255

기 수신된 코드 시퀀스의 차등 시퀀스를 생성함으로써, 상기 수신된 코드 시퀀스의 ID 정보를 획득하는 단계를 더 포함하는, 코드 시퀀스 분석 방법.

【청구항 19】

통신 시스템의 수신단에서,

소수 길이를 가지는 제 1 시퀀스 부; 및

패딩부가 각각 삽입된 제 2 시퀀스부, 및 제 3 시퀀스부를 포함하고,

상기 제 2 시퀀스부와 상기 제 3 시퀀스부의 길이의 합산값은 상기 요구되는 길이와 상기 소수 길이 사이의 차이와 동일한 코드 시퀀스를 분석하는 방법에 있어서,

상기 코드 시퀀스 및 상기 제 2 시퀀스부 및 상기 제 2 시퀀스부의 길이를 합산한 길이를 나타내는 정보를 수신하는 단계;

상기 수신된 코드 시퀀스 중 상기 합산한 길이에 해당하는 부분을 추출하여 자기상관 또는 교차상관함으로써 상기 동기정보를 획득하는 단계; 및

획득된 상기 동기정보를 이용하여 상기 코드 시퀀스의 총 길이에 해당하는 상기 수신된 코드 시퀀스의 차등 시퀀스를 생성함으로써, 상기 수신된 코드 시퀀스의 ID 정보를 획득하는 단계를 포함하는, 코드 시퀀스 분석 방법.

【청구항 20】

통신 시스템의 송신단에서 제어정보를 전달하는 코드 시퀀스를 생성하는 장치에 있어서,

ZTE/SAMSUNG/HTC 1002-0256

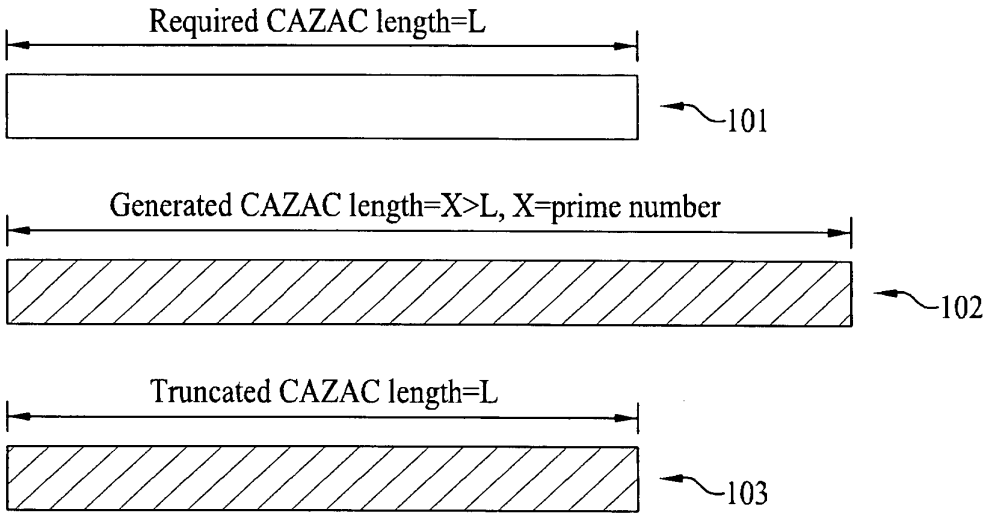
상기 통신 시스템에서 요구되는 시퀀스의 길이 이하의 최대 소수 길이를 선택하는 제어부; 및

상기 제어부에서 선택된 상기 최대 소수 길이를 가지는 제 1 시퀀스부를 생성하고, 상기 요구되는 시퀀스의 길이와 상기 최대 소수 길이 사이의 차이에 해당하는 길이를 가지는 패딩부를 삽입한 제 2 시퀀스부를 생성하여 상기 제 1 시퀀스부와 결합하는 시퀀스 생성부를 포함하는, 코드 시퀀스 생성 장치.

ZTE/SAMSUNG/HTC 1002-0257

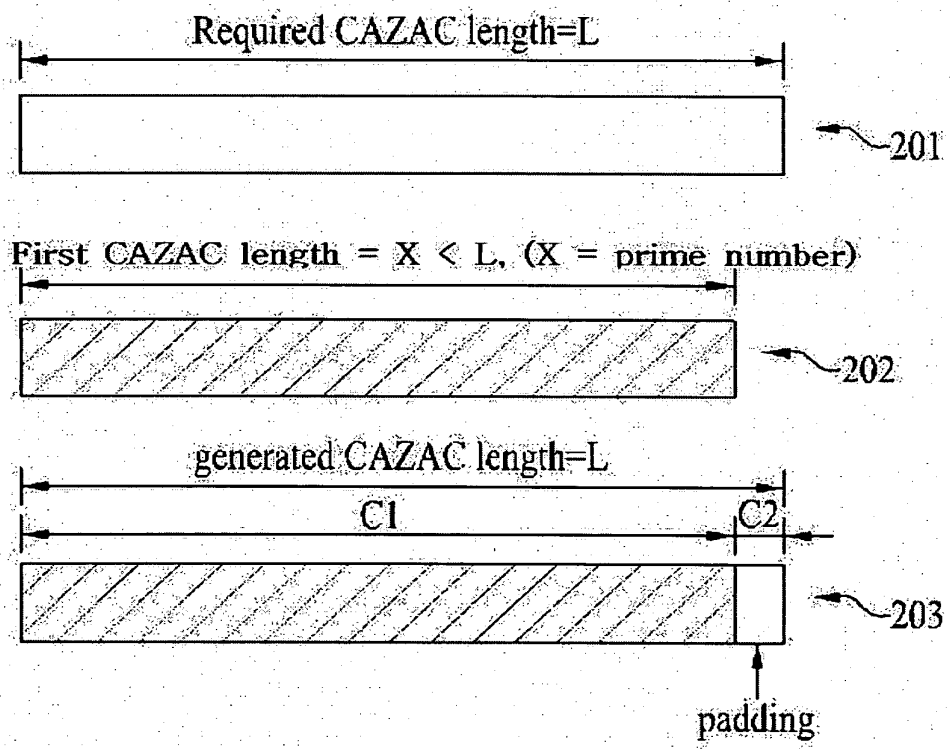
【도면】

【도 1】

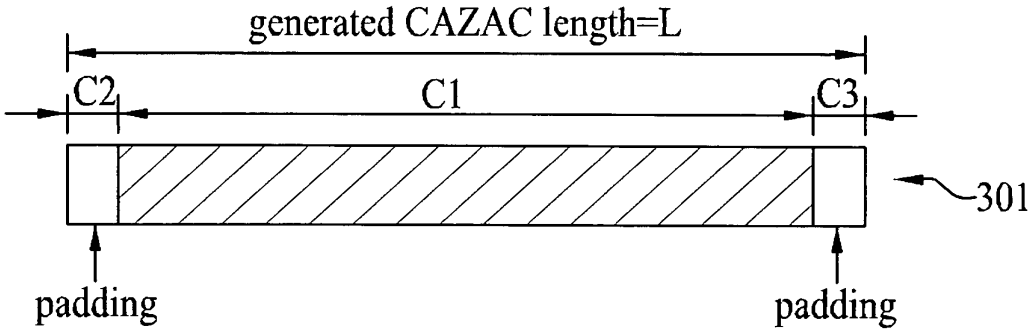


ZTE/SAMSUNG/HTC 1002-0258

【도 2】

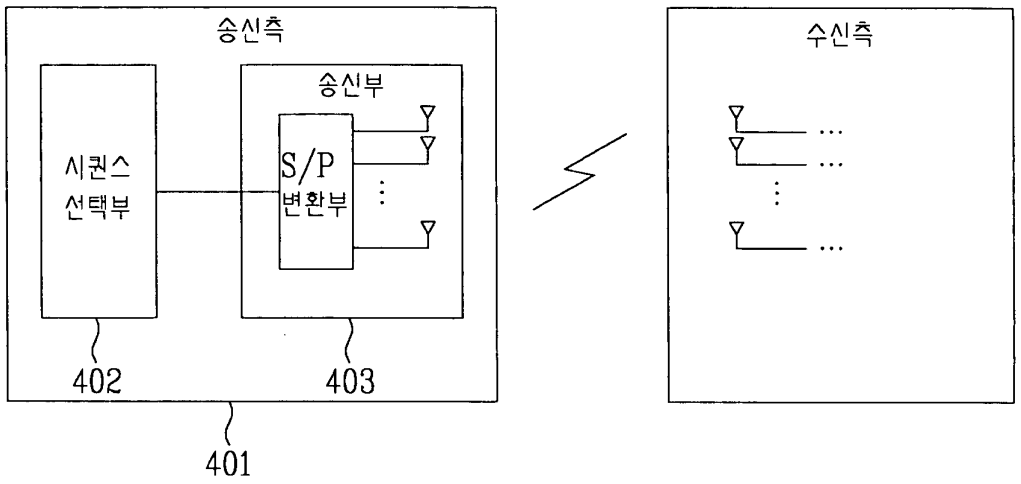


【도 3】

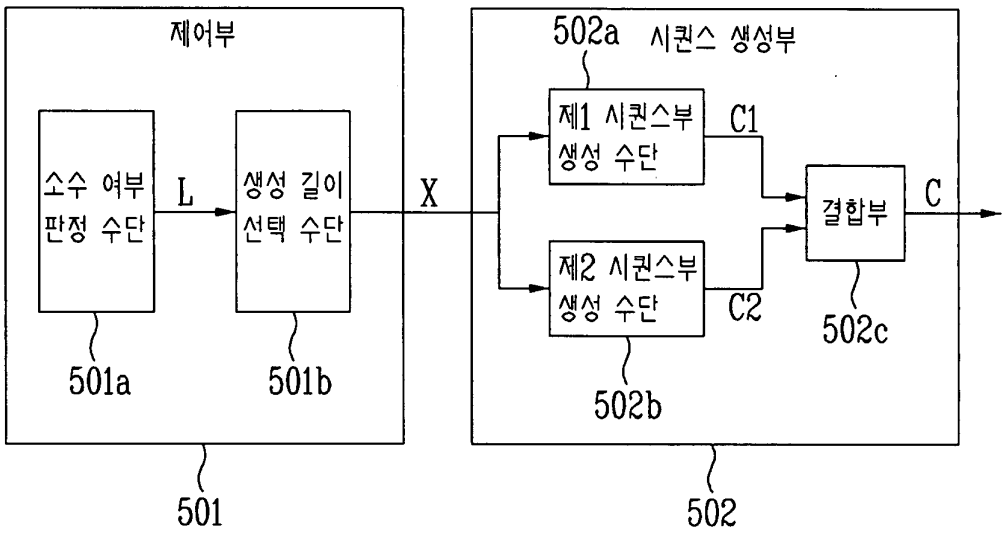


ZTE/SAMSUNG/HTC 1002-0259

【도 4】

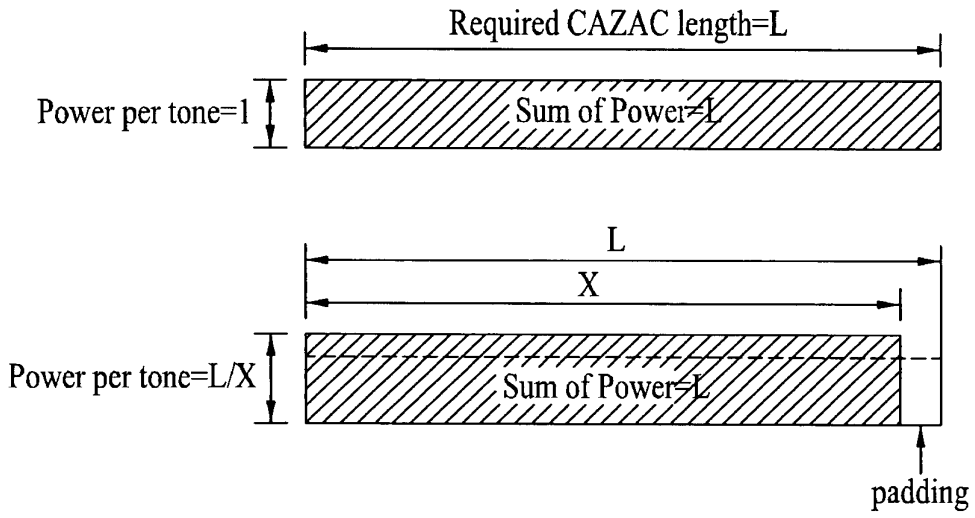


【도 5】

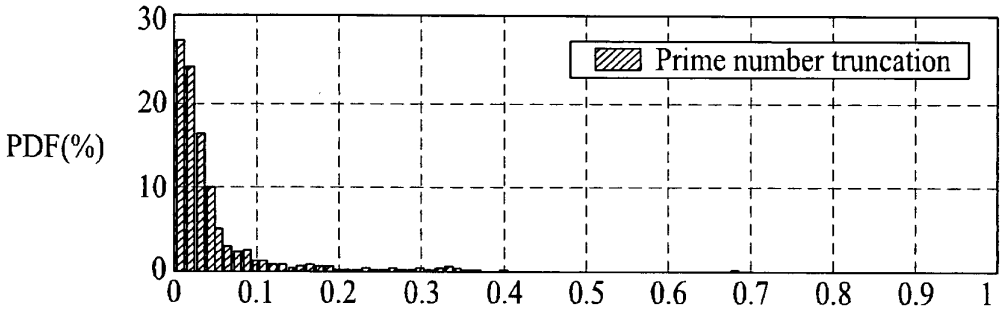


ZTE/SAMSUNG/HTC 1002-0260

【도 6】

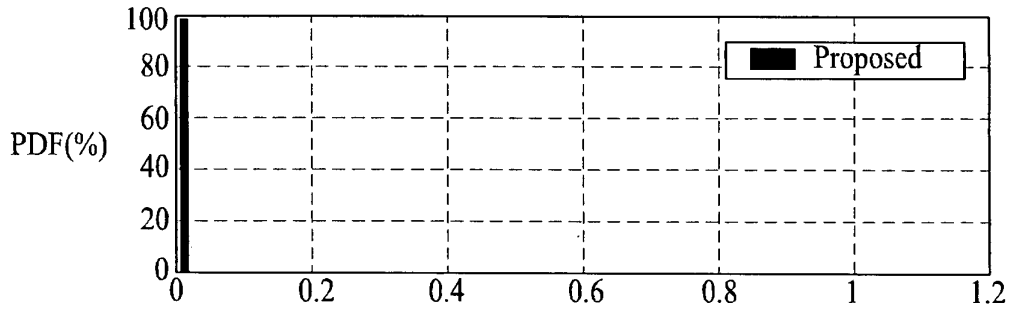


【도 7a】

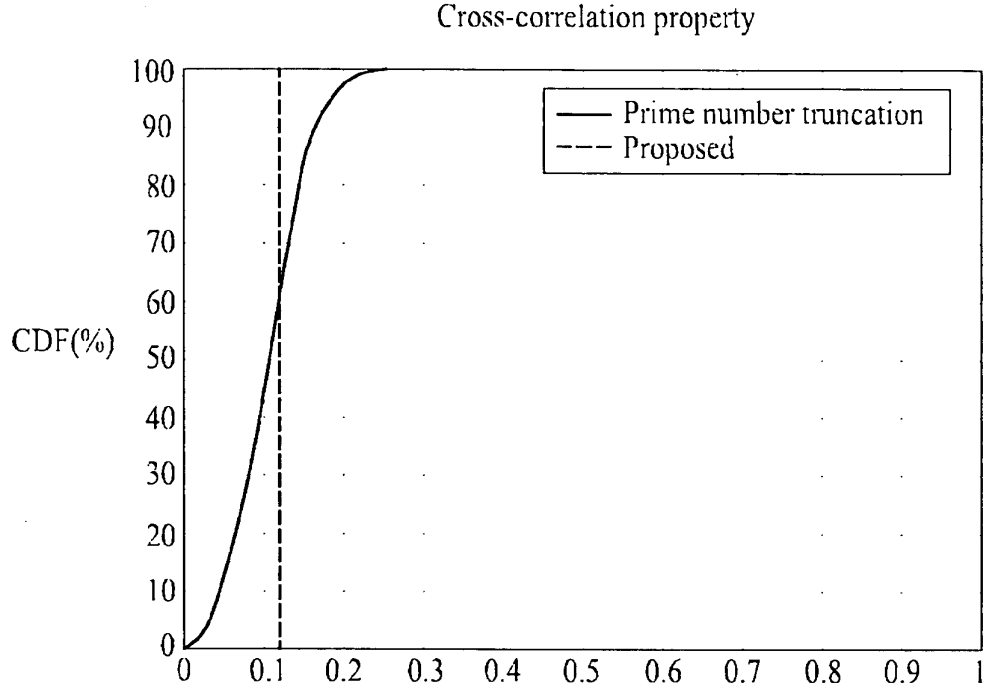


ZTE/SAMSUNG/HTC 1002-0261

【도 7b】



【도 8】



ZTE/SAMSUNG/HTC 1002-0262

Issue Number : 5-5-2006-057887306

대한민국특허청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office.

출원번호 : Application Number		10-2005-0114306
출원년월일 : Date of Application		2005년 11월 28일 NOV 28, 2005
출원인 : Applicant(s)		엘지전자 주식회사 LG Electronics Inc.

2006년 11월 09일

특허청 COMMISSIONER

◆ This certificate was issued by Korean Intellectual Property Office. Please confirm any forgery or alteration of the contents by an issue number or a barcode of the document below through the KIPOnet- Online Issue of the Certificates' menu of Korean Intellectual Property Office homepage (www.kipo.go.kr). But please notice that the confirmation by the issue number is available only for 90 days.

Issue Date : 2006.11.09

ZTE/SAMSUNG/HTC 1002-0263

【서지사항】

【서류명】 특허출원서

【권리구분】 특허

【수신처】 특허청장

【참조번호】 0019

【제출일자】 2005.11.28

【국제특허분류】 H04B

【발명의 국문명칭】 통신 시스템에서 코드 시퀀스 생성 방법, 신호 전송 방법, 송신 장치, 코드 시퀀스 및 코드 시퀀스 세트

【발명의 영문명칭】 Method of generating code sequence, transmitting signals, apparatus thereof, code sequence, and code sequence set

【출원인】

【명칭】 엘지전자 주식회사

【출원인코드】 1-2002-012840-3

【대리인】

【성명】 김용인

【대리인코드】 9-1998-000022-1

【포괄위임등록번호】 2002-027000-4

【대리인】

【성명】 심창섭

【대리인코드】 9-1998-000279-9

【포괄위임등록번호】 2002-027001-1

【발명자】

【성명】 한승희

【성명의 영문표기】 HAN,Seung Hee

【주민등록번호】 761128-1261917

ZTE/SAMSUNG/HTC 1002-0264

【우편번호】 122-899

【주소】 서울 은평구 역촌1동 42-35

【국적】 KR

【발명자】

【성명】 노민석

【성명의 영문표기】 NOH,Min Seok

【주민등록번호】 770911-1558611

【우편번호】 152-053

【주소】 서울 구로구 구로3동 오피스텔 미래지오 2층 211호

【국적】 KR

【발명자】

【성명】 윤영우

【성명의 영문표기】 YUN,Young Woo

【주민등록번호】 700122-1041915

【우편번호】 151-069

【주소】 서울특별시 관악구 봉천본동 두산아파트 114동 1502호

【국적】 KR

【발명자】

【성명】 권영현

【성명의 영문표기】 KWON,Yeong Hyeon

【주민등록번호】 740611-1533118

【우편번호】 440-824

【주소】 경기 수원시 장안구 율전동 103-6 스마일빌 402호

【국적】 KR

【취지】 특허법 제42조의 규정에 의하여 위와 같이 출원합니다.

대리인 김용인 (인)

대리인 심창섭 (인)

ZTE/SAMSUNG/HTC 1002-0265

【수수료】

【기본출원료】	0 면	38,000 원
【가산출원료】	25 면	0 원
【우선권주장료】	0 건	0 원
【심사청구료】	0 항	0 원
【합계】	38,000 원	

ZTE/SAMSUNG/HTC 1002-0266

【요약서】

【요약】

본 발명은 통신 시스템에서 초기 동기 획득, 셀 탐색 또는 채널 추정 등의 목적으로 사용되는 코드 시퀀스에 관한 것이다. 본 발명에 따른 코드 시퀀스 생성 방법은, 통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스 생성 방법에 있어서, 코드 종류에 따른 코드 생성 알고리즘에 의해 길이가 M인 코드 시퀀스 세트를 생성하는 단계; 및 상기 코드 시퀀스에 속하는 적어도 하나 이상의 코드 시퀀스의 코드 길이를 상기 길이 M보다 작은 자연수 N이 되도록 조정하는 단계를 포함하여 구성됨을 특징으로 한다.

【대표도】

도 1

【색인어】

통신, 코드 시퀀스, 하다마드 코드, CAZAC 코드, PN 코드

ZTE/SAMSUNG/HTC 1002-0267

【명세서】

【발명의 명칭】

통신 시스템에서 코드 시퀀스 생성 방법, 신호 전송 방법, 송신 장치, 코드 시퀀스 및 코드 시퀀스 세트{Method of generating code sequence, transmitting signals, apparatus thereof, code sequence, and code sequence set}

【도면의 간단한 설명】

<1> 도1은 본 발명에 따른 코드 시퀀스 생성 방법의 바람직한 일 실시예의 절차 흐름도임.

<2> 도2 내지 도5는 본 발명의 바람직한 일 실시예의 성능을 평가하기 위한 성능 곡선들을 도시한 것임.

<3> 도6 및 도7은 본 발명에 따른 신호 전송 방법 및 전송 장치의 바람직한 일 실시예를 설명하기 위한 도면임.

【발명의 상세한 설명】

【발명의 목적】

【발명이 속하는 기술분야 및 그 분야의 종래기술】

<4> 본 발명은 통신 시스템에 관한 것이다. 보다 구체적으로, 본 발명은 통신 시스템에서 초기 동기 획득, 셀 탐색 또는 채널 추정 등의 목적으로 사용되는 코드 시퀀스에 관한 것이다.

<5> 통신 시스템에서 사용되는 파일롯 신호(pilot signal) 또는 프리앰블

ZTE/SAMSUNG/HTC 1002-0268

(preamble)은 초기 동기, 셀 탐색, 채널 추정 등의 목적으로 사용되는 기준 신호(reference signal)로서, 프리앰블을 구성하는 코드 시퀀스(code sequence)는 상관 관계 특성이 좋은 직교(orthogonal) 또는 준직교(quasi-orthogonal) 코드로 구성된다.

<6> 예를 들어, PI(Portable Internet, 2.3GHz 휴대인터넷 표준 물리계층 - : Specifications for 2.3GHz band Portable Internet Service - Physical Layer)의 경우, 128 × 128 하다마드(Hadamard) 행렬을 이용하여 모두 1인 경우를 제외한 127 가지의 시퀀스를 사용하여 주파수 영역에서 삽입한다.

<7> 이진 하다마드 코드나 다위상(poly-phase) CAZAC(Constant Amplitude Zero Auto-Correlation) 코드는 직교 코드로서 직교성을 유지하는 코드 개수가 한정적이다. 예를 들어, N×N 하다마드 행렬로 만들 수 있는 길이 N의 직교 코드 개수는 N개이고, CAZAC 코드로 만들 수 있는 길이 N의 직교 코드의 개수는 N과 서로 소인 N 이하의 자연수의 개수만큼이 된다. [David C. Chu, "Polyphase Codes with Good Periodic Correlation Propertie", *Information Theory IEEE Transaction on*, vol. 18, issue 4, pp. 531-532, July, 1972]

<8> 예를 들어, OFDM(Orthogonal Frequency Division Multiplexing) 시스템에서 한 OFDM 심볼의 길이는 FFT(Fast Fourier Transform)와 IFFT(Inverse Fast Fourier Transform)의 빠른 구현을 위해 통상적으로 2의 멱승의 길이를 갖는다. 이 경우 하다마드 코드로 시퀀스를 생성할 경우, 총 길이만큼의 시퀀스 종류가 생성될 수 있고, CAZAC 코드로 시퀀스를 생성할 경우, N/2 개만큼의 시퀀스 종류가 생성될 수

ZTE/SAMSUNG/HTC 1002-0269

있으므로 그 시퀀스 종류 개수에 대해 제한을 받는 문제점이 있다.

【발명이 이루고자 하는 기술적 과제】

<9> 본 발명은 상기한 바와 같은 종래기술의 문제점을 해결하기 위하여 안출된 것으로서, 본 발명의 목적은 일정 길이를 갖는 코드 시퀀스의 개수를 필요에 따라 증가시킬 수 있으면서도 상관 특성을 유지할 수 있는 코드 시퀀스 생성 방법을 제공하는 것이다.

<10> 본 발명의 다른 목적은 일정 길이를 가지면서 개수가 증가된 코드 시퀀스 세트 및 그에 속하는 코드 시퀀스를 제공하는 것이다.

<11> 본 발명의 또 다른 목적은 수신측에서 초기 동기, 셀 탐색, 채널 추정 등의 기능을 수행할 수 있도록 신호를 전송하는 방법 및 그 장치를 제공하는 것이다.

【발명의 구성】

<12> 본 발명의 일 양상으로서, 본 발명에 따른 신호 전송 방법은, 통신 시스템의 송신측에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상을 목적으로 특정 코드 시퀀스를 상기 통신 시스템에서 요구되는 형태로 데이터 처리하여 수신측으로 전송하는 신호 전송 방법에 있어서, 상기 특정 코드 시퀀스는, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 특정 코드 시퀀스의 성분들(elements) 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 한다.

<13> 본 발명의 다른 양상으로서, 본 발명에 따른 송신 장치는, 통신 시스템에서

ZTE/SAMSUNG/HTC 1002-0270

초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상을 목적으로 하여 수신측으로 신호를 전송하기 위하여, 특정 코드 시퀀스를 상기 통신 시스템에서 요구되는 형태로 데이터 처리하는 수단과, 데이터 처리된 상기 특정 코드 시퀀스를 전송하는 수단을 포함하는 송신 장치에 있어서, 상기 특정 코드 시퀀스는, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 특정 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 한다.

<14> 본 발명의 또 다른 양상으로서, 본 발명에 따른 코드 시퀀스는, 통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스에 있어서, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 한다.

<15> 본 발명의 또 다른 양상으로서, 본 발명에 따른 코드 시퀀스 세트는, 통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스에 있어서, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 한다.

<16> 본 발명의 또 다른 양상으로서, 본 발명에 따른 코드 시퀀스 생성 방법은, 통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스 생성 방법에 있어서, 코드 종류에 따른 코드 생성

ZTE/SAMSUNG/HTC 1002-0271

알고리즘에 의해 길이가 M인 코드 시퀀스 세트를 생성하는 단계; 및 상기 코드 시퀀스 세트에 속하는 적어도 하나 이상의 코드 시퀀스의 코드 길이를 상기 길이 M보다 작은 자연수 N이 되도록 조정하는 단계를 포함하여 구성됨을 특징으로 한다.

<17> 이하에서 첨부된 도면을 참조하여 설명되는 본 발명의 바람직한 실시예들에 의해 본 발명의 구성, 작용 및 다른 특징들이 용이하게 이해될 수 있을 것이다. 도1은 본 발명에 따른 코드 시퀀스 생성 방법의 바람직한 일 실시예의 절차 흐름도이다.

<18> 도1은 코드 길이가 N 이고 코드 시퀀스의 개수가 N_{seq_N}인 코드 시퀀스 세트(code sequence set) $a_{N_{seq_N}\times N}$ 에 대한 코드 시퀀스의 개수를 N_{seq_M}으로 확장하여 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 를 생성하는 방법을 설명하기 위한 절차 흐름도이다.

<19> 여기서, $a_{N_{seq_N}\times N}$ 는 $a_{N_{seq_N}\times N}=\left[a^0_{N_{seq_N}\times N}\ a^1_{N_{seq_N}\times N}\cdots a^{N_{seq}-1}_{N_{seq_N}\times N}\right]^T$ 인 $N_{seq_N}\times N$ 의 행렬(matrix) 이고, $a^k_{N_{seq_N}\times N}$ 는 $a^k_{N_{seq_N}\times N}=\left[a^k_{N_{seq_N}\times N}(0)\ a^k_{N_{seq_N}\times N}(1)\cdots a^k_{N_{seq_N}\times N}(N-1)\right]$ 인 행(row) 벡터이다. 또한, $a^k_{N_{seq_N}\times N}(n)$ 은 $k\left(=0,1,2,\cdots,N_{seq_N}-1\right)$ 번째 시퀀스 인덱스의 $n\left(=0,1,2,\cdots,N-1\right)$ 번째 성분(element)을 나타낸다.

<20> 도1을 참조하면, 코드 종류에 따른 코드 생성 알고리즘에 따라 N보다 큰 자

ZTE/SAMSUNG/HTC 1002-0272

연수 M 의 길이를 갖고 코드 시퀀스의 개수가 N_{seq_M} 인 코드 시퀀스 세트 $a_{N_{seq_M} \times M}$ 을 생성한다[S101]. 본 발명이 적용될 수 있는 코드의 종류로는 하다마드 코드, PN 코드, CAZAC 코드 등으로서, 통신 시스템에서 초기 동기 획득, 셀 탐색, 채널 추정 등의 목적으로 사용될 수 있는 코드이다. 각 코드 종류별로 M의 길이를 갖는 코드 시퀀스 세트는 공지된 다양한 방법에 의해 생성될 수 있다. CAZAC 코드의 경우 상기 M은 N보다 큰 자연수 중 가장 작은 소수인 것이 바람직하다.

<21> 그 다음 N_{seq_M} 개의 코드 시퀀스 개수를 갖는 코드 시퀀스 세트 $a_{N_{seq_M} \times M}$ 에 속하는 각 코드 시퀀스에 대하여 각 코드 시퀀스를 구성하는 성분들(elements) 중에서 (M-N) 개의 성분들을 제거하여 코드 길이 N 이고 코드 시퀀스의 개수가 N_{seq_M} 인 코드 시퀀스 세트 $a_{N_{seq_M} \times N}$ 을 생성한다[S102].

<22> 보다 구체적인 예로서, 코드 길이가 $N = 1024$ 인 CAZAC 코드 시퀀스의 코드 개수를 확장하는 일예를 설명하면 다음과 같다. CAZAC 코드를 생성하는 알고리즘으로서 대표적인 것은 다음의 수학식 1에 의해 표현 가능하다.

ZTE/SAMSUNG/HTC 1002-0273

【수학식 1】

$$a^{index(A)}(n)=\begin{cases}\exp\left(i\dfrac{A\pi n(n+1)}{M}\right), & when\ M\ is\ odd\\ \exp\left(i\dfrac{A\pi n^2}{M}\right), & when\ M\ is\ even\end{cases}$$

$$where\ n=0,1,2,\cdots,M-1$$

<23>

<24> 여기서, A는 M과 서로 소인 자연수들이고, $index(A)(=0,1,2,\cdots,N_{seq_M}-1)$는 상기 A를 오름차순으로 정렬했을 때의 인덱스를 의미한다.

<25> $N=1024$인 CAZAC 코드 시퀀스의 코드 개수를 확장하기 위하여, N보다 큰 자연수 중 N에 가장 가까운 소수 $M=1031$인 CAZAC 코드 시퀀스 세트 $a_{N_{seq_M}\times M}$를 수학식 1을 이용하여 생성한다.

<26> $M(=1031)$이 소수이므로 $N_{seq_M}=1030$이 된다. 따라서, A는 상관 특성이 좋은 시퀀스를 생성하는 시드seed) 값이 된다. M이 소수일 경우에는 $A=1,2,\cdots,M-1$이 되어 시퀀스 인덱스가 $0,1,\cdots,M-2$인 총 $M-1$개의 코드 시퀀스가 생성될 수 있다. 예를 들면, $M=1024$의 경우 1024/2=512 개의 코드 시퀀스가 생성되지만, $M=1031$의 경우 총 1030 개의 코드 시퀀스가 생성될 수 있다. 또한, M이 홀수일 경우 생성된 코드의 상호상관(cross-correlation) 특성은 M

ZTE/SAMSUNG/HTC 1002-0274

이 짝수인 경우에 비해 상대적으로 더 좋다.

<27> 상기의 방법에 의해 생성된 N_{seq_M} 개의 코드 시퀀스 개수를 갖는 코드 시퀀스 세트 $a_{N_{seq_M}\times M}$ 에 속하는 각 코드 시퀀스에 대하여 각 코드 시퀀스를 구성하는 성분들(elements) 중에서 (M-N) 개의 성분들을 제거하여 코드 길이 N이고 코드 시퀀스의 개수가 N_{seq_M} 인 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 을 생성한다. 즉, 길이 $M=1031$ 인 CAZAC 코드 시퀀스 세트 $a_{N_{seq_M}\times M}$ 를 코드 길이 $N=1024$인 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 로 조정하기 위하여, 상기 코드 시퀀스 세트 $a_{N_{seq_M}\times M}$ 중 열 인덱스 $n=N,\cdots,M-1$ 의 $M-N$ 개의 성분을 제거하면, 그 결과로서 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 가 생성된다.

<28> M 의 값을 결정함에 있어서, N 보다 크게 할수록 코드 시퀀스의 개수를 증가시킬 수는 있으나 코드 길이 N 인 코드 시퀀스로 변환했을 때 좋은 상관관계(correlation) 특성을 유지할 수 있도록 하는 M 값을 선택하는 것이 바람직하다. CAZAC 코드의 경우 M 값을 N 보다 큰 자연수 중 N 에 가장 가까운 소수로 했을 때 가장 좋은 상관관계 특성을 유지할 수 있음이 시뮬레이션을 통하여 입증되었다.

<29> $N=1024$ 로 생성한 코드 시퀀스 세트 $a_{N_{seq_N}\times N}$ 와 상기한 바와 같은 본 발명에 따른 일실시예의 결과 $a_{N_{seq_M}\times N}$ 를 비교해 보면, 전자의 경우 생성 가능한 총

ZTE/SAMSUNG/HTC 1002-0275

코드 시퀀스는 $0,1,\cdots,N/2-1\,(N=1024)$ 의 인덱스를 갖는 $N/2\,(512)$ 개의 코드 시퀀스를 갖게 되고 후자의 경우 생성 가능한 총 코드 시퀀스는 $0,1,2,\cdots,M-2\,(M=1031)$ 의 인덱스를 갖는 $M-1\,(1030)$ 개의 코드 시퀀스를 갖게 된다.

<30> 도2는, 본 발명의 바람직한 일 실시예에 의해 생성된 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 에 속하는 코드 시퀀스 $a^0_{N_{seq_M}\times N}$ 에 대한 나머지 $N_{seq_M}\,(1029)$ 개 코드 시퀀스들 $a^k_{N_{seq_M}\times N}\,(k=1,2,\cdots,N_{seq_M}-1)$ 의 상호 상관(cross-correlation) 특성을 도시한 도면이다. 도3은 길이 종래기술에 따라 $N\,(=1024)$ 의 CAZAC 코드 시퀀스 $a_{N_{seq_N}\times N}$ 를 생성한 결과로서, 시퀀스 $a^0_{N_{seq_N}\times N}$ 에 대한 나머지 $N_{seq_N}\,(=511)$ 개 시퀀스들 $a^k_{N_{seq_N}\times N}\,(k=1,2,\cdots,N_{seq_N}-1)$ 의 상호상관 특성을 도시한 도면이다. 도2와 도3을 비교해 보면, 도2의 본 발명의 바람직한 일 실시예에 따라 생성된 코드 시퀀스의 상호 상관 특성이 더 좋음을 확인할 수 있다.

<31> 도4는 본 발명에 따른 일실시예인 $N=1024$ 일 때, 본 발명에 따른 시퀀스 $a_{N_{seq_M}\times N}$ 과 종래기술에 따른 CAZAC 시퀀스 $a_{N_{seq_N}\times N}$ 의, 각각의 경우에 대해 생성 가능한 코드들의 상호상관 특성 CDF(Cumulative Distribution Function)를 도시한 도면이다.

<32> 도5는 $N=1031$ 의 소수로 생성한 종래기술에 따른 CAZAC 코드 시퀀스와,

ZTE/SAMSUNG/HTC 1002-0276

본 발명에 따른 길이를 1024로 줄인(7개 성분 제거) 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$의, 각각의 경우에 대해 생성 가능한 코드들의 상호상관 특성 CDF를 도시한 그림이다. 도2 내지 도5의 성능 곡선을 통하여 7개 성분을 제거한 코드 시퀀스 세트가 원래의 코드 시퀀스 세트의 좋은 상호상관 특성이 거의 유지됨을 확인할 수 있다.

<33> 전술한 바와 같이, 본 발명의 기술적 특징은 PN 코드나 하다마드 코드의 생성시에도 적용 가능하다. PN 코드의 경우는 모듈러 쉬프트 레지스터 발진기(modular shift register generator)에 의해 생성되는데, 구성되는 레지스터의 개수를 N이라 할 경우, 2^N-1의 길이를 갖는 코드 시퀀스가 만들어지고 생성된 코드 시퀀스에 "1"을 더하는 방법으로 2^N의 길이를 갖는 코드 시퀀스를 최종적으로 생성한다. 따라서, 본 발명의 기술적 특징을 PN 코드에 적용하면 레지스터의 개수를 N보다 큰 자연수 M 개만큼으로 늘려 2^M의 길이를 갖는 코드 시퀀스를 생성하고 생성된 코드 시퀀스의 길이를 2^N으로 조정하여 필요에 따라 사용하면 된다. 이때, 상기 M을 결정할 때에는 상관관계 특성을 고려해서 선택해야 한다.

<34> 하다마드 코드의 경우에는 코드 시퀀스의 길이만큼의 코드 시퀀스 개수가 하나의 코드 시퀀스 세트를 구성한다. 그러나, 예를 들어, N의 길이를 갖는 코드 시퀀스의 개수가 N보다 큰 M 개만큼 필요한 경우, 우선 M의 길이를 갖는 M 개의 코드 시퀀스를 생성하여 각 코드 시퀀스의 일부 성분을 제거하여 그 길이를 N 개로 조정하는 방법을 이용할 수 있다.

ZTE/SAMSUNG/HTC 1002-0277

<35> 코드 길이가 $N=1024$ 인 코드 시퀀스 세트 $a_{N_{seq_M}\times N}$ 는 N의 코드 길이를 필요로 하는 통신 시스템에서 상기 통신 시스템에서 요구되는 형태로 데이터 처리되어 프리앰블 또는 파일롯 신호 등의 용도로 삽입될 수 있다. 도6 및 도7은 본 발명에 따른 신호 전송 방법 및 전송 장치의 바람직한 일 실시예를 설명하기 위한 도면으로서, 본 발명의 기술적 특징이 OFDM(Orthogonal Frequency Division Multiplexing) 또는 OFDMA(Orthogonal Frequency Division Multiple Access) 기반 무선 통신 시스템에 적용된 예이다. 도6은 송신기의 블록 구성도이고, 도7은 도6에 대응되는 수신기의 블록 구성도이다.

<36> 도6을 참조하면, 트래픽 데이터(traffic data)와 제어 데이터(control data)가 먹서(61)에 의해 먹싱(multiplexing)되어 입력된다. 상기 트래픽 데이터는 송신측에서 수신측으로 제공하는 서비스와 직접 관련된 데이터이고, 상기 제어 데이터는 상기 송신측 및 수신측이 원할하게 통신을 수행할 수 있도록 제어하기 위해 삽입하는 데이터를 의미한다. 상기한 바와 같은 본 발명의 기술적 특징에 따라서 생성된 코드 시퀀스는 제어 데이터의 일종으로서 수신측에서의 초기 동기(initial synchronization) 획득, 셀 탐색 또는 채널 추정의 용도로 삽입될 수 있다. 상기 코드 시퀀스가 삽입되는 위치는 통신 시스템에 따라 달라질 수 있다. 예를 들어, IEEE 802.16 광대역 무선 접속 시스템(wideband wireless access system)에서 상기 코드 시퀀스는 프리앰블이나 파일롯 신호의 형태로 삽입될 수 있으며, 다중 안테나 시스템(MIMO system)이 적용될 경우에는 미드앰블(midamble)의 형태로 삽입되는 것

ZTE/SAMSUNG/HTC 1002-0278

도 가능하다.

<37> 트래픽 데이터 및 제어 데이터를 포함하는 입력 데이터는 채널 코딩 모듈(62)에 의한 채널 코딩 과정을 거친다. 채널 코딩(channel coding)은 송신측에서 전송되는 신호에 전송 과정에서 에러가 발생했을 경우 수신측에서 에러를 정정할 수 있도록 패리티 비트들(parity bits)을 추가하는 과정으로서, 일반적으로 콘볼루션(convolution) 코딩, 터보(turbo) 코딩, LDPC(Low Density Parity Check) 코딩 등의 방법이 이용될 수 있다.

<38> 상기 채널 코딩 모듈(62)에 의해 채널 코딩된 데이터는 디지털 변조 모듈(63)에 의해 QPSK 또는 16QAM 등의 알고리즘에 따라 심볼 매핑 과정을 거쳐 디지털 변조된다. 심볼 매핑 과정을 거친 데이터 심볼들은 서브채널 변조 모듈(74)에 의해 서브채널 변조되어 OFDM 또는 OFDMA 시스템의 각 서브캐리어에 매핑된 후, IFFT 변환 모듈(65)에 의해 IFFT 변환되어 시간 영역의 신호로 변환된다. IFFT 변환된 데이터 심볼은 필터(66)에 의한 필터링 과정을 거쳐 DAC 모듈(67)에서 아날로그 신호로 변환된 후 RF 모듈(68)에 의해 RF 신호로 변환되어 안테나(69)를 통해 수신측으로 전송된다. 생성되는 코드 종류에 따라서는(예를 들어, CAZAC 코드의 경우) 특정 코드 시퀀스를 채널 코딩 과정이나 심볼 매핑 과정을 생략하고 상기 서브채널 변조 모듈(64)에 의해 서브채널에 매핑되어 그 다음 데이터 처리 과정을 거쳐 전송하는 것도 가능하다. 도7의 수신기에서는 도6의 송신기에서의 데이터 처리 과정의 역과정을 거쳐 데이터를 복원하여 최종적으로 트래픽 데이터와 제어 데이터를 획득하게 된다.

ZTE/SAMSUNG/HTC 1002-0279

<39> N-크기(N-size)를 갖는 FFT 변환에 의한 OFDM 심볼을 고려하면, OFDM 시스템에서는 빠른 처리의 DFT(Discrete Fourier Transform) 구현을 위해 FFT 크기를 하나의 OFDM 심볼로 하여 2의 멱승으로서 구성한다. N=1024의 FFT 크기를 갖는 OFDM 심볼에서 상기의 일실시예에서 사용한 CAZAC 시퀀스는 총 512 개가 존재한다. 본 발명의 바람직한 일 실시예에 따라 코드 시퀀스 세트를 생성하면, 사용 가능한 코드 시퀀스의 개수는 총 1030 개가 되며, 상호상관 특성도 N의 크기에 맞춰 생성한 것 이상의 특성을 유지할 수 있다.

<40> 도6 및 도7에 도시된 송수신기 구조는 본 발명의 기술적 특징에 대한 이해를 돕기 위한 일예에 불과한 것으로서, 수신측에서의 초기 동기 획득, 셀 탐색 또는 채널 추정의 용도로 코드 시퀀스를 전송하기 위하여 데이터 처리하는 방법은 공지된 다양한 방법에 의해 이루어질 수 있음은 당업자에게 자명한 사항이다. 본 발명에 따른 코드 시퀀스 또는 코드 시퀀스 세트는 이동통신 표준화 단체인 3GPP 또는 3GPP2에 의한 CDMA 또는 OFDMA 기반 무선 이동통신 시스템이나 와이브로(Wibro)나 와이맥스(Wimax)에 의한 무선 인터넷 시스템 등에서도 송신측에서 해당 시스템에서 요구되는 방식으로 데이터 처리되어 수신측으로 전송하는 방식으로 이용될 수 있다.

<41> 본 발명은 본 발명의 정신 및 필수적 특징을 벗어나지 않는 범위에서 다른 특정한 형태로 구체화될 수 있음은 당업자에게 자명하다. 따라서, 상기의 상세한 설명은 모든 면에서 제한적으로 해석되어서는 아니되고 예시적인 것으로 고려되어야 한다. 본 발명의 범위는 특허청구범위의 합리적 해석에 의해 결정되어야 하고,

ZTE/SAMSUNG/HTC 1002-0280

본 발명의 등가적 범위 내에서의 모든 변경은 본 발명의 범위에 포함된다.

【발명의 효과】

<42> 본 발명에 따르면 통신 시스템에서 이용 가능한 일정 길이를 갖는 코드 시퀀스의 개수를 증가시키면서도 상관관계 특성을 그대로 유지할 수 있어 이용 효율을 증대시킬 수 있는 효과가 있다.

ZTE/SAMSUNG/HTC 1002-0281

【특허청구범위】

【청구항 1】

통신 시스템의 송신측에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상을 목적으로 특정 코드 시퀀스를 상기 통신 시스템에서 요구되는 형태로 데이터 처리하여 수신측으로 전송하는 신호 전송 방법에 있어서,

상기 특정 코드 시퀀스는, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 특정 코드 시퀀스의 성분들(elements) 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 하는 신호 전송 방법.

【청구항 2】

제1항에 있어서,

상기 특정 코드 시퀀스는 프리앰블 또는 파일롯 신호의 형태로 데이터 처리되어 전송되는 것을 특징으로 하는 신호 전송 방법.

【청구항 3】

제1항에 있어서,

상기 코드는 CAZAC(Constant Amplitude Zero Auto-Correlation) 코드인 것을 특징으로 하는 신호 전송 방법.

【청구항 4】

제1항에 있어서,

ZTE/SAMSUNG/HTC 1002-0282

상기 코드는 PN 코드 또는 하다마다(Hardamard) 코드인 것을 특징으로 하는 신호 전송 방법.

【청구항 5】

제3항에 있어서,

상기 코드 생성 알고리즘은,

$$a^{index(A)}(n)=\begin{cases}\exp\left(i\dfrac{A\pi n(n+1)}{M}\right), & when\ M\ is\ odd\\ \exp\left(i\dfrac{A\pi n^2}{M}\right), & when\ M\ is\ even\end{cases}$$

$$where\ n=0,1,2,\cdots,M-1$$

(여기서, A 는 M 과 서로 소인 자연수들이고, $index(A)(=0,1,2,\cdots,N_{sea\ M}-1)$ 는 상기 A 를 오름차순으로 정렬했을 때의 인덱스를 의미함.)인 것을 특징으로 하는 신호 전송 방법.

【청구항 6】

제3항에 있어서,

상기 M은 상기 N보다 큰 자연수 중 가장 작은 소수인 것을 특징으로 하는 신호 전송 방법.

【청구항 7】

통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하

ZTE/SAMSUNG/HTC 1002-0283

나 이상을 목적으로 하여 수신측으로 신호를 전송하기 위하여, 특정 코드 시퀀스를 상기 통신 시스템에서 요구되는 형태로 데이터 처리하는 수단과, 데이터 처리된 상기 특정 코드 시퀀스를 전송하는 수단을 포함하는 송신 장치에 있어서,

상기 특정 코드 시퀀스는, 길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 특정 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 하는 송신 장치.

【청구항 8】

제7항에 있어서,

상기 특정 코드 시퀀스는 프리앰블 또는 파일롯 신호의 형태로 데이터 처리되는 것을 특징으로 하는 송신 장치.

【청구항 9】

제7항에 있어서,

상기 코드는 CAZAC 코드인 것을 특징으로 하는 송신 장치.

【청구항 10】

제7항에 있어서,

상기 코드는 PN 코드 또는 하다마다(Hardamard) 코드인 것을 특징으로 하는 송신 장치.

ZTE/SAMSUNG/HTC 1002-0284

【청구항 11】

제9항에 있어서,

상기 코드 생성 알고리즘은,

$$a^{index(A)}(n)=\begin{cases}\exp\left(i\frac{A\pi n(n+1)}{M}\right), & when\ M\ is\ odd\\ \exp\left(i\frac{A\pi n^2}{M}\right), & when\ M\ is\ even\end{cases}$$

$$where\ n=0,1,2,\cdots,M-1$$

(여기서, A 는 M 과 서로 소인 자연수들이고, $index(A)(=0,1,2,\cdots,N_{seq\ M}-1)$ 는 상기 A 를 오름차순으로 정렬했을 때의 인덱스를 의미함.)인 것을 특징으로 하는 송신 장치.

【청구항 12】

제9항에 있어서,

상기 M은 상기 N보다 큰 자연수 중 가장 작은 소수인 것을 특징으로 하는 송신 장치.

【청구항 13】

통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스에 있어서,

길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세

ZTE/SAMSUNG/HTC 1002-0285

트에 속하는 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 하는 코드 시퀀스.

【청구항 14】

제13항에 있어서,

상기 코드는 CAZAC 코드인 것을 특징으로 하는 코드 시퀀스.

【청구항 15】

제14항에 있어서,

상기 M은 상기 N보다 큰 자연수 중 가장 작은 소수인 것을 특징으로 하는 코드 시퀀스.

【청구항 16】

통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스 세트에 있어서,

길이가 M이 되도록 하는 코드 생성 알고리즘에 의해 생성된 코드 시퀀스 세트에 속하는 각 코드 시퀀스의 성분들 중 일부가 제거되어 상기 M보다 작은 자연수 N의 코드 길이를 갖는 것을 특징으로 하는 코드 시퀀스들로 이루어진 코드 시퀀스 세트.

【청구항 17】

제16항에 있어서,

상기 코드는 CAZAC 코드인 것을 특징으로 하는 코드 시퀀스 세트.

ZTE/SAMSUNG/HTC 1002-0286

【청구항 18】

제17항에 있어서,

상기 M은 상기 N보다 큰 자연수 중 가장 작은 소수인 것을 특징으로 하는 코드 시퀀스 세트.

【청구항 19】

통신 시스템에서 초기 동기 획득, 셀 탐색 및 채널 추정 중 적어도 어느 하나 이상의 용도로 사용되는 코드 시퀀스(code sequence) 생성 방법에 있어서,

코드 종류에 따른 코드 생성 알고리즘에 의해 길이가 M인 코드 시퀀스 세트를 생성하는 단계; 및

상기 코드 시퀀스 세트에 속하는 적어도 하나 이상의 코드 시퀀스의 코드 길이를 상기 길이 M보다 작은 자연수 N이 되도록 조정하는 단계를 포함하는 코드 시퀀스 생성 방법.

【청구항 20】

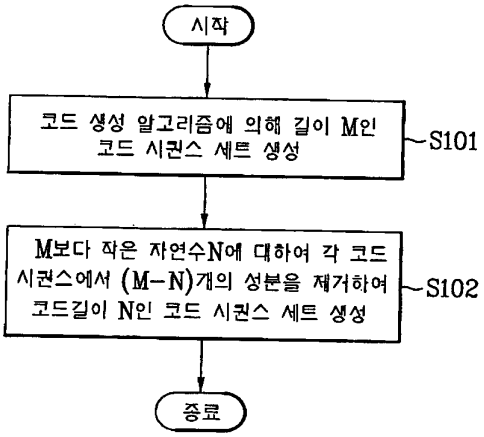
제19항에 있어서,

상기 코드 시퀀스의 길이를 조정하는 단계는, 각 코드 시퀀스에서 (M-N) 개의 성분을 제거함으로써 이루어지는 것을 특징으로 하는 코드 시퀀스 생성 방법.

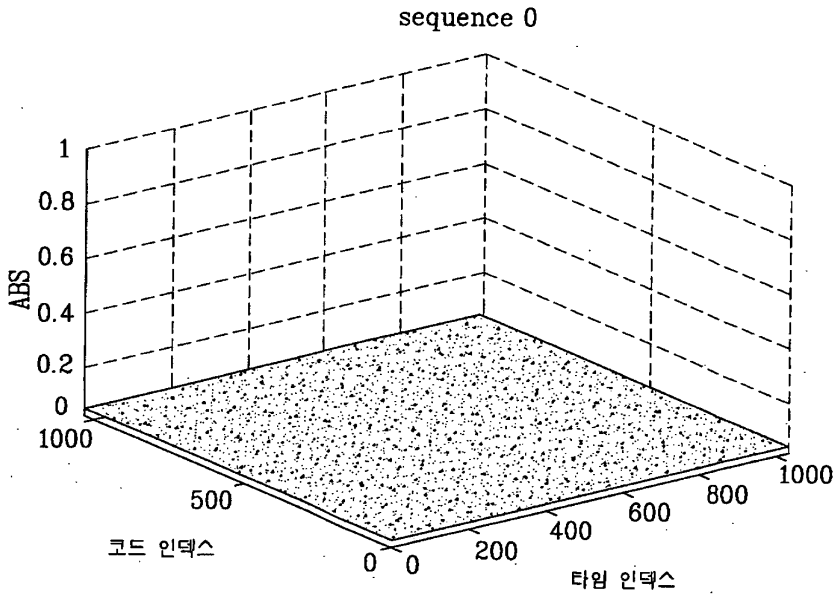
ZTE/SAMSUNG/HTC 1002-0287

【도면】

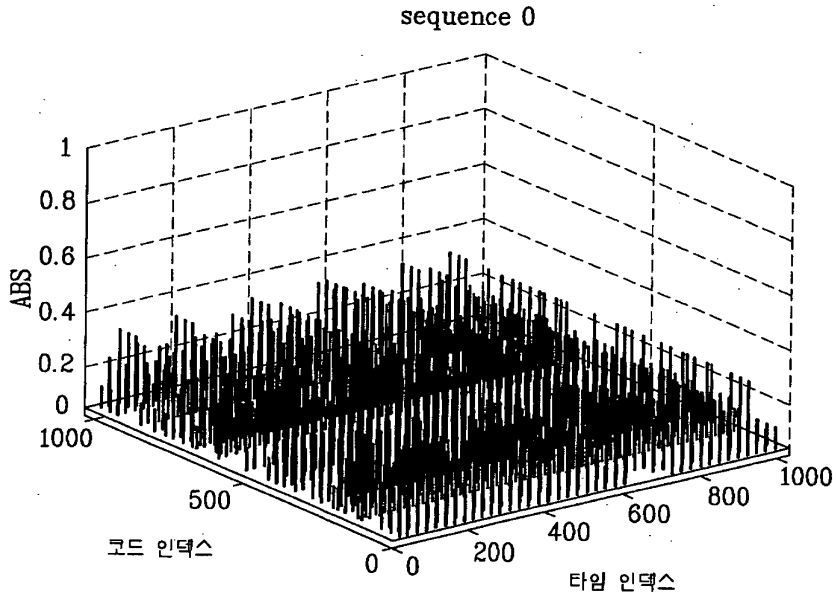
【도 1】


시작
코드 생성 알고리즘에 의해 길이 M인 코드 시퀀스 세트 생성
S101
M보다 작은 자연수N에 대하여 각 코드 시퀀스에서 (M-N)개의 성분을 제거하여 코드길이 N인 코드 시퀀스 세트 생성
S102
종료

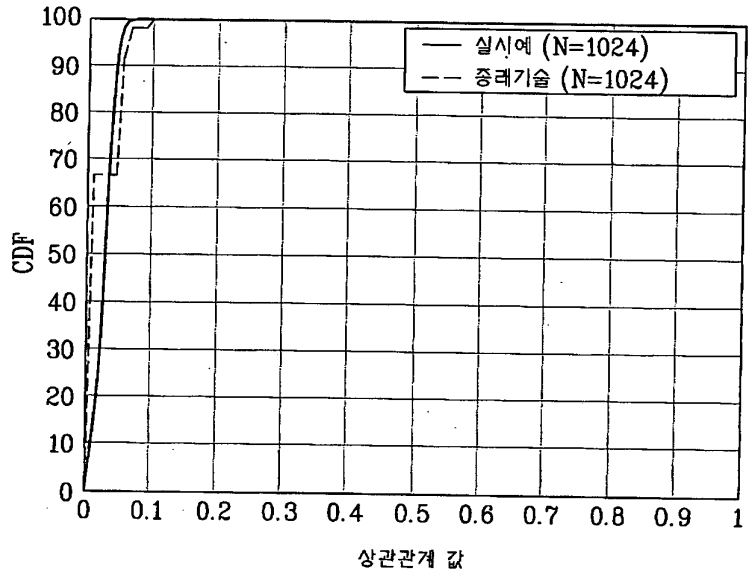
【도 2】


sequence 0
ABS
1
0.8
0.6
0.4
0.2
0
1000
500
0
코드 인덱스
0
200
400
600
800
1000
타임 인덱스

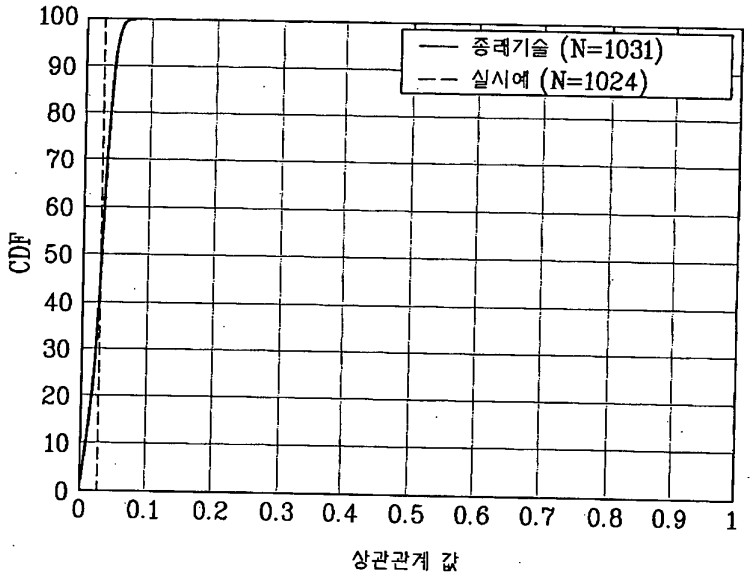
【도 3】


sequence 0
ABS
1
0.8
0.6
0.4
0.2
0
1000
500
0
코드 인덱스
0
200
400
600
800
1000
타임 인덱스

【도 4】

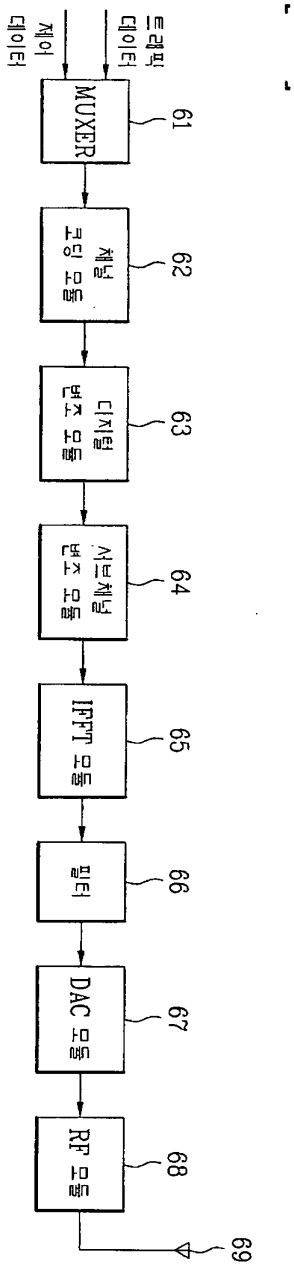

실시예 (N=1024)
종래기술 (N=1024)
CDF
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
상관관계 값

【도 5】

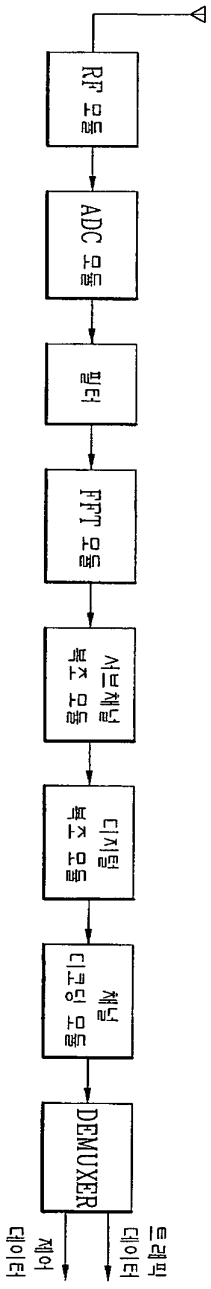


ZTE/SAMSUNG/HTC 1002-0290

【도 6】


트래픽 데이터
제어 데이터
MUXER
61
채널 코딩 모듈
62
디지털 변조 모듈
63
서브채널 변조 모듈
64
IFFT 모듈
65
필터
66
DAC 모듈
67
RF 모듈
68
69

【도 7】



ZTE/SAMSUNG/HTC 1002-0292

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
11/563,909	11/28/2006	Seung Hee Han	2101-3280

CONFIRMATION NO. 1721

35884
LEE, HONG, DEGERMAN, KANG & SCHMADEKA
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA90017

Title: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Publication No. US-2007-0177682-A1
Publication Date: 08/02/2007

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Pre-Grant Publication Division, 703-605-4283

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/563,909	11/28/2006	2611	1280	2101-3280	23	3

CONFIRMATION NO. 1721

UPDATED FILING RECEIPT

35884
LEE, HONG, DEGERMAN, KANG & SCHMADEKA
801 S. FIGUEROA STREET
12TH FLOOR
LOS ANGELES, CA90017

Date Mailed: 03/23/2007

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

Seung Hee Han, Seoul, KOREA, REPUBLIC OF;
Min Seok Noh, Seoul, KOREA, REPUBLIC OF;
Yeon Hyeon Kwon, Suwon-si, KOREA, REPUBLIC OF;
Hyun Hwa Park, Anyang-si, KOREA, REPUBLIC OF;
Hyun Woo Lee, Anyang-si, KOREA, REPUBLIC OF;
Dong Cheol Kim, Uiwang-si, KOREA, REPUBLIC OF;

Assignment For Published Patent Application

LG Electronics Inc.

Power of Attorney: The patent practitioners associated with Customer Number 035884

Domestic Priority data as claimed by applicant

Foreign Applications

REPUBLIC OF KOREA 10-2005-0114306 11/28/2005
REPUBLIC OF KOREA 10-2006-0062467 07/04/2006
REPUBLIC OF KOREA 10-2006-0064091 07/07/2006

If Required, Foreign Filing License Granted: 01/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is

US11/563,909

Projected Publication Date: 07/05/2007

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Preliminary Class

375

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all

applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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	ATTORNEY DOCKET NUMBER
11/563,909	11/28/2006	Seung Hee Han	2101-3280

CONFIRMATION NO. 1721

FORMALITIES LETTER

35884
LEE, HONG, DEGERMAN, KANG & SCHMADEKA
801 S. FIGUEROA STREET
12TH FLOOR
LOS ANGELES, CA 90017

Date Mailed: 01/16/2007

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing. *A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.*
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$130** for a non-small entity

- **$130** Surcharge.

Replies should be mailed to: Mail Stop Missing Parts

MISSING PARTS

~~FINAL OA~~

DUE DATE:	3/16/07
EXT. 1	4/16/07
EXT. 2	5/16/07
EXT. 3	6/16/07
FINAL	8/16/07
EXT. 4	7/16/07

DOCKETED

JAN 18 2007

LHDK&S

ZTE/SAMSUNG/HTC 1002-0297

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

TQUACH

Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382
PART 1 - ATTORNEY/APPLICANT COPY

PATENT (U.S.A.)
ATTORNEY'S DOCKET NO. 2101-3280

DECLARATION
and POWER OF ATTORNEY

☒ ORIGINAL
☐ CONTINUATION-IN-PART
☐ DIVISIONAL

As a below named inventor, I declare that the information given herein is true, that I believe that I am the original, first and sole inventor (if only one name is listed as 1 below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

the specification of which is attached hereto unless the following box is checked:
☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____.

My residence, post office address and citizenship are as stated below next to my name.
I acknowledge my duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations § 1.56(a).
I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.
I hereby claim foreign priority benefits under Title 35, United States Code, § 119 OR 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING Month Day Year	PRIORITY CLAIMED UNDER 35 U.S.C. 119
KR	10-2005-0114306	November 28, 2005	
KR	10-2006-0064091	July 07, 2006	
KR	10-2006-0062467	July 04, 2006	

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or Agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Attorneys associated with Customer No. 035884

Direct All correspondence to: JONATHAN Y. KANG, ESQ.
LEE, HONG, DEGERMAN, KANG & SCHMADEKA, P.C.
At the address associated with Customer No. 035884

DIRECT TELEPHONE CALLS TO: JONATHAN Y. KANG
213-623-2221

(Please Print)

	Name of Inventor	Residence:	STATE or COUNTRY
1	Seung Hee HAN	Seoul	Korea
	Mailing Address: 42-35, Yeokchon 1-dong, Eunpyeong-gu, Seoul		CITIZENSHIP: Korea
2	Name of Inventor: Min Seok NOH	Residence: Seoul	STATE or COUNTRY: Korea
	Mailing Address: 211, Second floor, Miraegio OfficeTel, Guro 3(sam)-dong, Guro-gu, Seoul		CITIZENSHIP: Korea
3	Name of Inventor: Yeon Hyeon KWON	Residence: Suwon-si, Gyeonggi-do	STATE or COUNTRY: Korea
	Mailing Address: 402, Smile village, 103-6, Yuljeon-dong, Jangan-gu, Suwon-si, Gyeonggi-do		CITIZENSHIP: Korea
4	Name of Inventor: Hyun Hwa PARK	Residence: Anyang-si, Gyeonggi-do	STATE or COUNTRY: Korea
	Mailing Address: 1133, Shinan Metro Kahn, 1115, Bisan-dong, Dongan-gu, Anyang-si, Gyeonggi-do		CITIZENSHIP: Korea
5	Name of Inventor: Hyun Woo LEE	Residence: Anyang-si, Gyeonggi-do	STATE or COUNTRY: Korea
	Mailing Address: 204, Neo Village, 1103-3, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do		CITIZENSHIP: Korea
6	Name of Inventor: Dong Cheol KIM	Residence: Uiwang-si, Gyeonggi-do	STATE or COUNTRY: Korea
	Mailing Address: 401, Daemyung Sweet Village, 763, Naeson-dong, Uiwang-si, Gyeonggi-do		CITIZENSHIP: Korea

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

CC210002.1
00847620003
11/29/2006 ly

MH 11/94

ZTE/SAMSUNG/HTC 1002-0300

SIGNATURE OF INVENTOR 1	SIGNATURE OF INVENTOR 2
DATE 2006.11.29	DATE 2006.11.29
SIGNATURE OF INVENTOR3	SIGNATURE OF INVENTOR 4
DATE 2006.11.29.	DATE 2006.11.29
SIGNATURE OF INVENTOR 5	SIGNATURE OF INVENTOR 6
DATE 2006.11.29.	DATE 2006.11.29

Attorney Docket No. _____

ZTE/SAMSUNG/HTC 1002-0301

Electronic Patent Application Fee Transmittal

Application Number:	11563909
Filing Date:	28-Nov-2006
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Filer:	Lew Edward V. Macapagal/Maggie Wen
Attorney Docket Number:	2101-3280
Filed as Large Entity	

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	1051	1	130	130
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**130**

Electronic Acknowledgement Receipt

EFS ID:	1597143
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Lew Edward V. Macapagal/Maggie Wen
Filer Authorized By:	Lew Edward V. Macapagal
Attorney Docket Number:	2101-3280
Receipt Date:	15-MAR-2007
Filing Date:	28-NOV-2006
Time Stamp:	19:30:09
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$130
RAM confirmation Number	962
Deposit Account	502290
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1		2101-3280_MP.pdf	131055	yes	6

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Miscellaneous Incoming Letter	1	1
	Applicant Response to Pre-Exam Formalities Notice	2	3
	Oath or Declaration filed	4	6

Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8233	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	139288		

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.

PATENT DOCKET NO. 2101-3280
CUSTOMER NO. 035884

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee HAN et al. Serial No: 11/563,909 Filed: November 28, 2006 For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: 2611 Examiner: Unassigned Conf. No.: 1721

TRANSMITTAL OF MISSING PARTS

Mail Stop Missing Parts
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Enclosed herewith is a signed Declaration and Power of Attorney for the above-identified application per the Patent Office "Notice to File Missing Parts of Nonprovisional Application" dated January 16, 2007.

The Commissioner is hereby authorized to charge any required fees associated with this communication and credit any overpayment to Deposit Account No. 502290.

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & SCHMADEKA

Date: March 15, 2007

By: _____
Lew Edward V. Macapagal
Registration No. 55,416
Attorney for Applicant(s)

Customer No. 035884

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
11/563,909	11/28/2006	2611	1150	2101-3280	18	23	3

CONFIRMATION NO. 1721

35884
LEE, HONG, DEGERMAN, KANG & SCHMADEKA
801 S. FIGUEROA STREET
12TH FLOOR
LOS ANGELES, CA90017

FILING RECEIPT

Date Mailed: 01/16/2007

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

Seung Hee Han, Residence Not Provided;
Min Seok Noh, Residence Not Provided;
Yeon Hyeon Kwon, Residence Not Provided;
Hyun Hwa Park, Residence Not Provided;
Hyun Hwa Park, Residence Not Provided;
Hyun Woo Lee, Residence Not Provided;
Dong Cheol Kim, Residence Not Provided;

Assignment For Published Patent Application

LG Electronics Inc.

Power of Attorney: None

Domestic Priority data as claimed by applicant

Foreign Applications

REPUBLIC OF KOREA 10-2005-114306 11/28/2005
REPUBLIC OF KOREA 10-2006-62467 07/04/2006
REPUBLIC OF KOREA 10-2006-46091 07/07/2006

If Required, Foreign Filing License Granted: 01/12/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US11/563,909**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

Preliminary Class

375

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to

revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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	ATTORNEY DOCKET NUMBER
11/563,909	11/28/2006	Seung Hee Han	2101-3280

CONFIRMATION NO. 1721

FORMALITIES LETTER

35884
LEE, HONG, DEGERMAN, KANG & SCHMADEKA
801 S. FIGUEROA STREET
12TH FLOOR
LOS ANGELES, CA 90017

Date Mailed: 01/16/2007

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing. *A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.*
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

• To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$130** for a non-small entity

- **$130** Surcharge.

Replies should be mailed to: Mail Stop Missing Parts

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

TQUACH

Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382
PART 3 - OFFICE COPY

FORM PTO-1082

PATENT DOCKET NO. 2101-3280
CUSTOMER NO. 035884

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee HAN, Min Seok NOH, Yeon Hyeon KWON, Hyun Hwa PARK, Hyun Hwa PARK, Hyun Woo LEE and Dong Cheol KIM Serial No: Filed: Herewith For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: Examiner:

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

Dear Sir:

Transmitted herewith for filing is the patent application identified above.

☒ 18 sheet(s) of drawings (☒ formal ☐ informal) is(are) enclosed.

☒ 40 page(s) of specification and 1 page(s) of abstract of the invention are enclosed.

☒ An assignment of the invention to LG Electronics Inc. ☐ is enclosed ☒ will follow.

☒ Declaration and Power of Attorney ☐ is enclosed ☒ will follow.

☒ Certified copies of Korean Patent Application Nos. 10-2005-114306 filed on November 28, 2005, 10-2006-62467 filed on July 4, 2006, and 10-2006-64091 filed on July 7, 2006, from which priority is claimed in the subject case pursuant to 35 U.S.C. § 119 ☒ will follow ☐ is/are enclosed.

CALCULATION OF FEES								
ITEM		TOTAL NO. OF CLAIMS		NO. OF CLAIMS OVER BASE	LG/SM $ ENTITY FEE		$ AMOUNT	$ FEE
A	TOTAL CLAIMS FEE	23	-20	3	LG=$50 SM=$25	$ 50	$ 150	$ 150
B	INDEPENDENT CLAIMS FEE*	3	-3	0	LG=$200 SM=$100	$ 200	$ 0	$ 0
C	SUBTOTAL - ADDITIONAL CLAIMS FEE (ADD FINAL COLUMN IN LINES A + B)							$ 150
D	MULTIPLE-DEPENDENT CLAIMS FEE					LARGE ENTITY FEE = $360 SMALL ENTITY FEE = $180		$ 0
E	BASIC FILING FEE					LARGE ENTITY FEE = $300 SMALL ENTITY FEE = $150		$ 300
F	SEARCH FEE					LARGE ENTITY FEE = $500 SMALL ENTITY FEE = $250		$ 500
G	EXAMINATION FEE					LARGE ENTITY FEE = $200 SMALL ENTITY FEE = $100		$ 200
H	APPLICATION SIZE FEE (If the specification and drawings exceed 100 sheets of paper, for each additional 50 sheets or fraction thereof.)					LARGE ENTITY FEE = $250 SMALL ENTITY FEE = $125		$ 0
I	TOTAL FILING FEE (ADD TOTALS FOR LINES C, D, E, F, G AND H)							$ 1,150
J	ASSIGNMENT RECORDING FEE						$ 40	$ 0
	*LIST INDEPENDENT CLAIMS [LIST OF INDEPENDENT CLAIMS]							

ZTE/SAMSUNG/HTC 1002-0312

☒ The Commissioner is hereby authorized to charge any deficiency for the following fees associated with this communication or credit any overpayment to Deposit Account No. 502290. A copy of this sheet is enclosed.

- ☒ The amount of $ 1,150 for the total filing fee.
- ☒ Any additional filing fees required under 37 C.F.R. § 1.16
- ☒ Any patent application processing fees under 37 C.F.R. § 1.17

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & SCHMADEKA

Date: November 28, 2006

By: _____
Lew Edward V. Macapagal
Registration No. 55,416
Attorney for Applicant(s)

Customer No. 35884

ZTE/SAMSUNG/HTC 1002-0313

FORM PTO-1082

PATENT DOCKET NO. 2101-3280
CUSTOMER NO. 035884

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Seung Hee HAN, Min Seok NOH, Yeon Hyeon KWON, Hyun Hwa PARK, Hyun Hwa PARK, Hyun Woo LEE and Dong Cheol KIM Serial No: Filed: Herewith For: METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM	Art Unit: Examiner:

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

Dear Sir:

Transmitted herewith for filing is the patent application identified above.

☒ 18 sheet(s) of drawings (☒ formal ☐ informal) is(are) enclosed.

☒ 40 page(s) of specification and 1 page(s) of abstract of the invention are enclosed.

☒ An assignment of the invention to LG Electronics Inc. ☐ is enclosed ☒ will follow.

☒ Declaration and Power of Attorney ☐ is enclosed ☒ will follow.

☒ Certified copies of Korean Patent Application Nos. 10-2005-114306 filed on November 28, 2005, 10-2006-62467 filed on July 4, 2006, and 10-2006-64091 filed on July 7, 2006, from which priority is claimed in the subject case pursuant to 35 U.S.C. § 119 ☒ will follow ☐ is/are enclosed.

CALCULATION OF FEES								
	ITEM	TOTAL NO. OF CLAIMS		NO. OF CLAIMS OVER BASE	LG/SM $ ENTITY FEE		$ AMOUNT	$ FEE
A	TOTAL CLAIMS FEE	23	-20	3	LG=$50 SM=$25	$ 50	$ 150	$ 150
B	INDEPENDENT CLAIMS FEE*	3	-3	0	LG=$200 SM=$100	$ 200	$ 0	$ 0
C	SUBTOTAL - ADDITIONAL CLAIMS FEE (ADD FINAL COLUMN IN LINES A + B)							$ 150
D	MULTIPLE-DEPENDENT CLAIMS FEE					LARGE ENTITY FEE = $360 SMALL ENTITY FEE = $180		$ 0
E	BASIC FILING FEE					LARGE ENTITY FEE = $300 SMALL ENTITY FEE = $150		$ 300
F	SEARCH FEE					LARGE ENTITY FEE = $500 SMALL ENTITY FEE = $250		$ 500
G	EXAMINATION FEE					LARGE ENTITY FEE = $200 SMALL ENTITY FEE = $100		$ 200
H	APPLICATION SIZE FEE (If the specification and drawings exceed 100 sheets of paper, for each additional 50 sheets or fraction thereof.)					LARGE ENTITY FEE = $250 SMALL ENTITY FEE = $125		$ 0
I	TOTAL FILING FEE (ADD TOTALS FOR LINES C, D, E, F, G AND H)							$ 1,150
J	ASSIGNMENT RECORDING FEE						$ 40	$ 0
	*LIST INDEPENDENT CLAIMS [LIST OF INDEPENDENT CLAIMS]							

ZTE/SAMSUNG/HTC 1002-0314

☒ The Commissioner is hereby authorized to charge any deficiency for the following fees associated with this communication or credit any overpayment to Deposit Account No. 502290. A copy of this sheet is enclosed.

☒ The amount of $ 1,150 for the total filing fee.
☒ Any additional filing fees required under 37 C.F.R. § 1.16
☒ Any patent application processing fees under 37 C.F.R. § 1.17

Respectfully submitted,

LEE, HONG, DEGERMAN, KANG & SCHMADEKA

Date: November 28, 2006

By: _____
Lew Edward V. Macapagal
Registration No. 55,416
Attorney for Applicant(s)

Customer No. 35884

ZTE/SAMSUNG/HTC 1002-0315

Customer No. 35884 Attorney Docket No. 2101-3280

PATENT APPLICATION

OF

Seung Hee HAN, Min Seok NOH, Yeon Hyeon KWON, Hyun Hwa PARK,

Hyun Hwa PARK, Hyun Woo LEE, and Dong Cheol KIM

FOR

METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM

ZTE/SAMSUNG/HTC 1002-0316

[0001] This application claims the benefit of Korean Application No. P2005-114306, filed on November 28, 2005, Korean Application No. P2006-62467, filed on July 4, 2006, and Korean Application No. P2006-64091, filed on July 7, 2006, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a method of generating and transmitting code sequence, and more particularly, to a method and apparatus for generating and transmitting code sequence in a wireless communication system.

Discussion of the Related Art

[0003] Usually, a pilot signal or a preamble of a wireless communication system is referred to as a reference signal used for initial synchronization, cell search, and channel estimation. Further, the preamble is comprised of a code sequence, and the code sequence is further comprised of orthogonal or quasi-orthogonal which represent good correlation properties.

[0004] For example, a Hadamard matrix of 128x128 is used in a portable internet (PI) to insert the code sequence to the frequency domain. In so doing, 127 types of code sequences are used.

ZTE/SAMSUNG/HTC 1002-0317

[0005] Although the Hadmard code sequence and a poly-phase Constant Amplitude Zero Auto-Correlation (CAZAC) code sequence are orthogonal codes, a number of codes used to maintain orthogonality is limited. For example, a number of N orthogonal codes in a NxN Hadamard matrix is N, and a number of N orthogonal codes that can be expressed by the CAZAC codes is N and a prime number smaller than N (David C. Chu, "Polyphase Codes with Good Periodic Correlation Properties," *Information Theory IEEE Transaction on*, vol. 18, issue 4, pp. 531-532, July 1972). With respect to CAZAC sequence types, GCL CAZAC and Zadoff-Chu CAZAC are often used.

[0006] If the code sequence is generated using the Hadamard codes, N number of sequence types corresponding to the entire length of the codes is generated. However, the if the code sequence is generated using the CAZAC codes, only half or N/2 number of sequence types are generated.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to a method and apparatus for generating and transmitting code sequence in a wireless communication system that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0008] An object of the present invention is to provide a method of generating a code sequence in a wireless communication system.

ZTE/SAMSUNG/HTC 1002-0318

[0009] Another object of the present invention is to provide an apparatus for generating a code sequence in a wireless communication system.

[0010] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0011] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of generating a code sequence in a wireless communication system includes recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length. Here, the step of modifying includes discarding at least one element of the generated code sequence or inserting at least one null element to the generated code sequence.

[0012] In another aspect of the present invention, method of generating a code sequence in a wireless communication system includes a recognizing a desired length of a first code sequence, generating a second code sequence having a length different from the desired length of the first code sequence, and modifying the length of the second code sequence to equal the desired length of the first code sequence. Here, the step of modifying

ZTE/SAMSUNG/HTC 1002-0319

includes discarding at least one element of the modified code sequence if the length of the modified code sequence is longer than the desired length of the first code sequence or inserting at least one null element to the modified code sequence if the length of the modified second code sequence is shorter than the desired length of the first code sequence.

[0013] In a further aspect of the present invention, an apparatus for generating a code sequence in a wireless communication system includes a sequence selection unit for recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length, wherein the sequence selection unit discards at least one element of the generated code sequence or inserts at least one null element to the generated code sequence in modifying the length of the generated code sequence, and a transmitting unit for transmitting the modified generated code sequence via at least one antenna.

[0014] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this

ZTE/SAMSUNG/HTC 1002-0320

application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings;

[0016] FIG. 1 illustrates a structure of an apparatus for transmitting data using Orthogonal Frequency Division Multiplexing (OFDM) or OFDM Access (OFDMA) scheme;

[0017] FIG. 2 illustrates a structure of an apparatus for receiving data using OFDM/OFDMA scheme;

[0018] FIG. 3 is a flow diagram illustrating adjusting a code sequence;

[0019] FIG. 4 illustrates cross-correlation properties of the generated code sequence;

[0020] FIG. 5 illustrates a generated CAZAC sequence $a_{N_{seq_N}xN}$ using N (=1024);

[0021] FIG. 6 illustrates a cross-correlation properties cumulative distribution function (CDF) of the code sequences that can be generated according to the code sequence $a_{N_{seq_M}xN}$ and the CAZAC sequence $a_{N_{seq_N}xN}$ when $N = 1024$;

[0022] FIG. 7 illustrates the cross-correlation properties CDF of the code sequences that can be generated based on the CAZAC sequence generated using the prime number of N=1031 and a code sequence set $a_{N_{seq_M}xN}$ having length of 1024 (seven (7) elements removed);

[0023] FIG. 8 illustrates a method of generating CAZAC sequence using a length required by a communication system;

ZTE/SAMSUNG/HTC 1002-0321

[0024] FIG. 9 illustrates a method of generating a CAZAC sequence using a padding portion;

[0025] FIG. 10 illustrates an exemplary application of circular shift;

[0026] FIG. 11 is an exemplary diagram illustrating application of circular shift to the generated code sequence after the elements of the code sequence are removed;

[0027] FIG. 12 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to removing the elements of the code sequence;

[0028] FIG. 13 is an exemplary diagram illustrating application of circular shift to the generated code sequence after a padding portion is attached;

[0029] FIG. 14 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to attaching a padding portion;

[0030] FIG. 15 is an exemplary diagram of a padding portion of the code sequence in which the padding portion is used as a lower bandwidth guard interval;

[0031] FIG. 16 is a structural diagram for transmitting the code sequence. Depending on whether the transmission of the code sequence is made in a downlink direction or an uplink direction, the structure can be in different form;

[0032] FIG. 17 is a structural diagram illustrating a basic code sequence generation unit and a code sequence length adjustment unit;

[0033] FIG. 18 illustrates cross-correlation characteristics of the code sequence;

[0034] FIG. 19 illustrates cross-correlation characteristics of the code sequence; and

ZTE/SAMSUNG/HTC 1002-0322

[0035] FIG. 20 is an exemplary diagram illustrating boosting the power of the generated code sequence.

DETAILED DESCRIPTION OF THE INVENTION

[0036] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0037] Figure 1 illustrates a structure of an apparatus for transmitting data using Orthogonal Frequency Division Multiplexing (OFDM) or OFDM Access (OFDMA) scheme. Figure 2 illustrates a structure of an apparatus for receiving data using OFDM/OFDMA scheme.

[0038] In Figure 1, traffic data and control data are multiplexed at a muxer 11. Here, the traffic data is used to provide service from a transmitting end to a receiving end, and the control data is used to facilitate transmission from the transmitting end to the receiving end. The discussion relating to the present invention regarding the code sequence which relates to a type of a code sequence of the control data. The code sequence can be used for initial synchronization, cell search, or channel estimation.

[0039] Depending on the communication system, the code sequence can be used in various forms. For example, the code sequence in an IEEE 802.16 wideband wireless access

ZTE/SAMSUNG/HTC 1002-0323

system can be used in a preamble or a pilot signal format, and in a multi-input, multi-output (MIMO) system, the code sequence can be used as a midamble format.

[0040] After being processed at the muxer 11, the multiplexed traffic and control data is then channel coded by a channel coding module 12. Channel coding is used to allow the receiving end to correct error that can occur during transmission by adding parity bits. Examples of channel coding include convolution coding, turbo coding, and low density parity check (LDPC) coding.

[0041] Thereafter, the channel coded data is modulated by a digital modulation module 13 in which data symbols are mapped using algorithms such as a quadrature phase shift keying (QPSK) or a 16-quadrature amplitude modulation (16QAM). The mapped data symbols are then processed by a subchannel modulation module 14 through which the data symbols are mapped to each subcarrier of the OFDM system or OFDMA system. Then, the data symbols mapped to subcarriers are processed by an inverse fast Fourier transform (IFFT) module 15 which transform the data symbols into a signal in a time domain. The transformed data symbols are then processed through a filter 16 and further processed through a digital-to-analog conversion (DAC) module 17 where the filtered data symbols are converted to analog signals. Lastly, the analog signals are converted into a radio frequency (RF) by a RF module 18 which is then transmitted via an antenna 19 to the receiving end.

ZTE/SAMSUNG/HTC 1002-0324

[0042] Based on the type of generated code (e.g., CAZAC code), the steps of channel coding and/or symbol mapping can be omitted. Figure 2 illustrates a receiving end whose processes are inverse to those of the transmitting end.

[0043] A code sequence is used for transmitting control information, which includes identification (ID) and synchronization information, to classify types of sequences in a communication system. In order for more effective reception of the control information using code sequence, the code sequence can be adjusted or modified. Further, the code sequence can be applied to all of the channels that use code sequence for control signaling such as a random access channel (RACH), downlink/uplink reference symbol, channel quality information (CQI), and Acknowledgement (ACK)/Negative Acknowledgement (NACK).

[0044] Figure 3 is a flow diagram illustrating adjusting a code sequence. More specifically, a length of the code sequence is defined as N, a number of codes in the code sequence is defined as N_{seq_N}, and a code sequence set defined as $a_{N_{seq_N}xN}$. In operation, the code sequence set $a_{N_{seq_N}xN}$ having N_{seq_N} number of codes can be extended to a code sequence set $a_{N_{seq_M}xN}$ having N_{seq_M} number of codes.

[0045] Equation $a_{N_{seq_N}xN}$ is a matrix of $N_{seq_N}xN$ of $a_{N_{seq_N}xN} = \left[a^0_{N_{seq_N}xN}\ a^1_{N_{seq_N}xN} \cdots a^{N_{seq}-1}_{N_{seq_N}xN}\right]^T$, and $a^k_{N_{seq_N}xN}$ is a row vector of $a^k_{N_{seq_N}xN} = \left[a^k_{N_{seq_N}xN}(0)\, a^k_{N_{seq_N}xN}(1) \cdots a^k_{N_{seq_N}xN}(N-1)\right]$. Furthermore, $a^k_{N_{seq_N}xN}(n)$ indicates $n(=0,1,2,\cdots,N-1)$ element of $k(=0,1,2,\cdots,N_{seq_N}-1)$ code sequence.

ZTE/SAMSUNG/HTC 1002-0325

[0046] Referring to Figure 3, a code sequence set $a_{N_{seq_M} xM}$, having N_{seq_M} number of code sequence(s) where each code sequence has length M, can be generated based on the code generation algorithm based on code type in which a value of length M is a natural number greater than a value of length N (S301). Here, the code types include Hadamard code, Pseudo Noise (PN) code, and a Constant Amplitude Zero Auto-Correlation (CAZAC) code, among others to be used for initial synchronization, cell search, and channel estimation in the wireless communication system. The code sequence set having length M per each code type can be generated by various schemes as discussed. As for the CAZAC code, the value of length M is a smallest prime number greater than the value of length N, preferably.

[0047] Subsequently, a code sequence set $a_{N_{seq_M} xN}$, having N_{seq_M} number of code sequences, can be generated where a resulting length of the code sequence is length N. More specifically, the code sequence set $a_{N_{seq_M} xM}$, having N_{seq_M} number of code sequences where each code sequence has length M (from step S301), can have elements of the code sequence removed. That is, elements which comprise each code sequence can be removed from the code sequence allowing the length of the code sequence to be adjusted or shortened. Here, $M - N$ number of elements can be removed from the code sequence whose length corresponds to length M. By removing elements from the code sequence with length M, a code sequence having length N can be generated. As discussed, N is smaller than M.

ZTE/SAMSUNG/HTC 1002-0326

Consequently, a code sequence set $a_{N_{seq_M} \times N}$, having N_{seq_M} number of code sequences in which each code sequence has length N, can be generated (S302).

[0048] A code sequence is used for transmitting control information, which includes identification (ID) and synchronization information, to classify types of sequences in a communication system. Currently in 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), a CAZAC sequence is being considered.

[0049] The CAZAC sequence can be used by channels to output various IDs and information. The channels include channels for downlink synchronization (e.g., primary synchronization channel, secondary synchronization channel, and broadcast channel), uplink synchronization (e.g., random access channel), and pilot channels (e.g., data pilot and channel quality pilot). Further, the CAZAC sequence can be used in scrambling as well as channels that use code sequence such as RACH.

[0050] Although there are various types of the CAZAC sequences, there are two types of often used CAZAC sequences – GCL CAZAC and Zadoff-Chu CAZAC. The Zadoff-Chu CAZAC sequence can be defined by the following equations.

[Equation 1]

$$c(k;N,M) = \exp\left(\frac{j\pi Mk(k+1)}{N}\right) \quad (for\ odd\ N)$$

[Equation 2]

$$c(k;N,M) = \exp\left(\frac{j\pi Mk^2}{N}\right) \quad (for\ even\ N)$$

ZTE/SAMSUNG/HTC 1002-0327

[0051] Here, k denotes sequence index, N denotes a length of CAZAC to be generated, and M denotes sequence ID.

[0052] If the Zadoff-Chu CAZAC sequence and the GCL CAZAC sequence are expressed by $c(k;N,M)$ as shown in Equations 1 and 2, then the sequences have the following three (3) characteristics as presented in following equations.

[Equation 3]

$$|c(k;N,M)| = 1 \quad (for\ all\ k, N, M)$$

[Equation 4]

$$R_{M:N}(d) = \begin{cases} 1, & (for\ d = 0) \\ 0, & (for\ d \neq 0) \end{cases}$$

[Equation 5]

$$R_{M_1,M_2:N}(d) = p \quad (for\ all\ M_1, M_2\ and\ N)$$

[0053] According to Equation 3, the CAZAC sequence always has a size of 1, and the CAZAC sequence of Equation 4 has an auto-correlation function denoted by a delta function. Here, the auto-correlation is based on circular correlation. Further, Equation 5 is a cross-correlation which is constant if N is a prime number.

[0054] If the length to be applied in the wireless communication system for generating the CAZAC sequence is denoted by L, a method for generating the CAZAC sequence sets N of Equations 1 and 2 to equal L ($N = L$) – identified as step (1). Step (2) can

ZTE/SAMSUNG/HTC 1002-0328

be identified by a method where a value of N is set to be a prime number greater than a value of length L for generating the CAZAC sequence.

[0055] Referring to the characteristics of the generated CAZAC sequence having a specified length of L, if L is not a prime number, the generated CAZAC sequence can include $M = 1, 2, \ldots L\text{-}1$ number of codes, some of which are repeated codes. In other words, the number of different codes is less than L-1 number of codes. On the contrary, if L is a prime number, there is L-1 number of different codes. The above descriptions may also be applied to other types of code sequences and are not limited to Zadoff-Chu CAZAC sequence.

[0056] Further, the following technique has been considered. More specifically, if the length of code to be applied to the system is not a prime number, and there are a large number of codes to be used, a smallest prime number greater than L was selected. Using the selected prime number, the CAZAC sequence was generated, and discards or removes at least one element of the generated CAZAC sequence for use. This technique is different than the technique introduced with respect to step 1.

[0057] For example, assume that a number of codes of a CAZAC code sequence (N) is 1024. The following equation can be used to express an algorithm for generating a Zadoff-Chu CAZAC code.

[Equation 6]

ZTE/SAMSUNG/HTC 1002-0329

$$a^{index(A)}(n) = \begin{cases} \exp\left(i\frac{A\pi n(n+1)}{M}\right), when\ M\ is\ odd \\ \exp\left(i\frac{A\pi n^2}{M}\right), when\ M\ is\ even \end{cases}$$

$$where\ \ n = 0,1,2,\cdots,M-1$$

[0058] In Equation 6, A and M are natural numbers, and $index(A)(= 0,1,2,\cdots,N_{seq_M}-1)$ is an index of A in ascending order. In order to extend the CAZAC sequence where N=1024, a smallest prime number greater than 1024 is used. That is, the smallest prime number greater than 1024 is 1031. As such, the code sequence set $a_{N_{seq_M}xM}$ where M=1031 is applied to Equation 6.

[0059] Since M (=1031) is a prime number, N_{seq_M}=1030. Furthermore, A can be referred to as a seed value used to generate a code sequence maintaining CAZAC properties. If M is a prime number, a total of $M-1$ number of code sequences can be generated. In other words, for example, if M = 1024, a total of 512 (=1024/2 or N/2) number of code sequences are generated. However, if M = 1031, a total of 1030 number of code sequences (M – 1) are generated. Moreover, the cross-correlation properties of the generated code sequence are better if M is a prime number than a composite number.

[0060] In order to adjust or modify the CAZAC code sequence set $a_{N_{seq_M}xM}$ where M = 1031 to a code sequence set $a_{N_{seq_M}xM}$ whose length is N = 1024, $M-N$ number of elements can be removed from index $n = N,\cdots,M-1$, generating a code sequence set $a_{N_{seq_M}xN}$.

ZTE/SAMSUNG/HTC 1002-0330

[0061] In determining the value of M, although the number of code sequences can increase with increase in value of N, it is preferable to determine the value of M based on the code sequence whose length is N that promotes maintenance of good correlation properties. In case of the CAZAC code, optimum correlation properties can be attained if the value of length M is the smallest prime number greater than the value of length N.

[0062] If the code sequence set $a_{N_{seq_N}xN}$ generated using length N=1024 is compared with the code sequence set $a_{N_{seq_M}xN}$, a total number code sequences of the former can be represented by $N/2$ or 512 (=1024/2) code sequences having an index $0,1,2,\cdots,N/2-1(N=1024)$, and a total number of code sequences of the latter can be represented by M – 1 or 1030 having an index $0,1,2,\cdots,M-2(M=1031)$.

[0063] Figure 4 illustrates cross-correlation properties of the generated code sequence. More specifically, the cross-correlation properties of $a^{k}_{N_{seq_M}xN}(k=1,2,\cdots,N_{seq_M}-1)$ associated with the remaining N_{seq_M} (1029) code sequences for $a^{0}_{N_{seq_M}xN}$ code sequence of the code sequence set $a_{N_{seq_M}xN}$. The figure illustrates this with respect to amplitude, code index, and time index.

[0064] Further, Figure 5 illustrates a generated CAZAC sequence $a_{N_{seq_N}xN}$ using N (=1024). More specifically, the figures illustrate cross-correlation properties of $a^{k}_{N_{seq_M}xN}(k=1,2,\cdots,N_{seq_M}-1)$ regarding the remaining N_{seq_N} (511) code sequences. The figure illustrates this with respect to amplitude, code index, and time index. Between Figure

ZTE/SAMSUNG/HTC 1002-0331

4 and Figure 5, the cross-correlation properties of the generated code sequence of Figure 4 are better.

[0065] Figure 6 illustrates a cross-correlation properties cumulative distribution function (CDF) of the code sequences that can be generated according to the code sequence $a_{N_{seq_M}xN}$ and the CAZAC sequence $a_{N_{seq_N}xN}$ when $N = 1024$.

[0066] Figure 7 illustrates the cross-correlation properties CDF of the code sequences that can be generated based on the CAZAC sequence generated using the prime number of N=1031 and a code sequence set $a_{N_{seq_M}xN}$ having length of 1024 (seven (7) elements removed). The performance lines of Figures 4 – 7 indicate that the code sequence set with seven (7) elements removed has equivalent cross-correlation properties compared to the original code sequence set.

[0067] As discussed, the codes in addition to the CAZAC code are available, such as the PN code and the Hadamard code. The discussion with respect to the CAZAC code sequence can also be applied to the PN code and the Hadamard code. With respect to the PN code, a modular shift register generator is used to generate the code sequences. If a number of shift registers generated is represented by N, a code sequence having a length of $2^N - 1$ is generated. Thereafter, a value "1" is added to the shift register, resulting in a length $2^{N+1} - 1$, and then, adjust the length to equal 2^N.

[0068] With respect to the Hadamard codes, a number of code sequences, which equal the length of the code sequence, make up a code sequence. However, for example, if

ZTE/SAMSUNG/HTC 1002-0332

M number of code sequences having length N is required ($M > N$), then M number of code sequences having length M are generated, followed by removing a specified number of elements to make the length of the code sequence equal length N.

[0069] Figure 8 illustrates a method of generating CAZAC sequence using a length required by a communication system. That is, the required (or desired) length of the CAZAC sequence can be represented by length L. Further, the codes types can be extended. However, since a generated code sequence can be truncated or have elements discarded to correspond to the desired length L, the auto-correlation and cross-correlation properties of the truncated code sequence can experience deterioration. Similarly, even if a code sequence portion is added/attached to the generated code sequence (e.g., zero-padding or cyclic prefix) to correspond to the desired length L, the auto-correlation and cross-correlation properties can experience deterioration. Here, auto-correlation properties relate to the auto-correlation value being 1 when the delay is 0. Otherwise, the auto-correlation value is 0 when the delay is a value other than 0. Further, the cross-correlation properties having a constant value is negatively affected.

[0070] Assuming that the code sequence having poor auto-correlation and cross-correlation properties are removed, the remaining number of code sequences may be less than $L - 1$.

[0071] In order to attain a desired length and a maximum number of CAZAC sequence types corresponding to the desired length, a smallest prime number, X, greater

ZTE/SAMSUNG/HTC 1002-0333

than the desired length, L, ($X > L$) can be selected. Although the CAZAC sequence can be generated using X, due to deterioration of the correlation properties, the correlations properties of CAZAC sequence as shown in Equations 4 and 5 cannot be attained. Further, when selecting a length of the generated code sequence, the length that is nearest to the desired length L which is between a smallest prime number larger than the desired length or a largest prime number smaller than the desired length can be selected.

[0072] Referring to Figure 8, the generated CAZAC sequence has length X. Thereafter, the generated CAZAC sequence having length X has elements of the code sequence removed (or truncated) so as to make the length of the generated CAZAC sequence correspond to the desired length L.

[0073] Figure 9 illustrates a method of generating a CAZAC sequence using a padding portion. As discussed, the generated CAZAC sequence is truncated. With respect to auto-correlation and cross correlation properties, delay of 0 indicates an auto-correlation value of 1, as shown in Equation 4, and a delay not equaling 0 indicates a value of 0. Moreover, the properties where the cross-correlation value is always a prime number is not deteriorated whereby effective correlation is maintained. Further, additional control information can be transmitted by using the information inputted to the fading unit.

[0074] Referring to Figure 9, the generated CAZAC sequence has length X. Here, the value of X is a largest prime number less than the value of L. In other words, X is a prime number less than L. Thereafter, the generated CAZAC sequence having length X has

ZTE/SAMSUNG/HTC 1002-0334

elements added or a padding portion added to the CAZAC sequence so as to make the length of the generated CAZAC sequence correspond go the desired length L. Here, C1 represents the length of the CAZAC sequence having length X, and C2 represents the padding portion. By combining C1 and C2 (C1 + C2), the generated CAZAC sequence can have a length corresponding to the desired length L.

[0075] Figure 10 illustrates an exemplary application of circular shift. The circular shift is typically applied to increase amount of control information transmitted to the communication system. That is, for example, a back portion of the sequence is re-allocated to a front portion of the sequence, and accordingly, the remaining sequence is shifted in the direction of the back portion of the sequence in amount (or length) corresponding to the re-allocated back portion, as illustrated in Figure 2. Further, if specified control information is applied the circular shift as described above, then the control information amount that can be transmitted via corresponding sequence increases.

[0076] Discussions of above relate to the methods of generating the sequence using the desired length L, and of increasing transmitted control information using the circular shift. If these methods are applied in generating the sequence, the following processes take place. First, select a smallest prime number greater than L or a largest prime number less than L, which is referred to as X. Second, remove or add a sequence unit having a length corresponding to X-L or L-X. Third, apply the circular shift to the resulting sequence.

ZTE/SAMSUNG/HTC 1002-0335

[0077] Figure 11 is an exemplary diagram illustrating application of circular shift to the generated code sequence after the elements of the code sequence are removed. Referring to Figure 11, the code sequence 1102 is generated based on length X which is the smallest prime number greater than length L. In other words, the generated code sequence 1102 has a length equaling length X which is longer than the desired length L. From the generated code sequence 1102, a portion having a length corresponding to length $X - L$ is removed, resulting in a code sequence having length L 1103. Thereafter, the result of the generated code sequence 1103 having length L is applied circular shift thereto, resulting in the code sequence 1104.

[0078] Figure 12 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to removing the elements of the code sequence. In other words, circular shift is performed to the generated CAZAC sequence having length X, and after circular shift is performed, the elements of the code sequence are removed.

[0079] Referring to Figure 12, the code sequence 1202 is generated based on length X which is the smallest prime number greater than length L. In other words, the generated code sequence 1202 has a length equaling length X which is longer than the desired length L. A circular shift is then performed to the generated code sequence 1203 having length X. Thereafter, a portion of the generated code sequence having a length corresponding to length $X-L$ is removed, resulting in a code sequence 1204 having length L.

ZTE/SAMSUNG/HTC 1002-0336

[0080] Figure 13 is an exemplary diagram illustrating application of circular shift to the generated code sequence after a padding portion is attached. Referring to Figure 13, the code sequence 1302 is generated based on length X which is the largest prime number smaller than the value of length L. To the generated CAZAC sequence 1302, a padding portion is added 1303. The length of the padding portion corresponds to a length $L-X$. As discussed, the padding portion can be comprised of zeroes or cyclic prefix/postfix. With the addition of the padding portion, the length of the CAZAC sequence equals the desired length L. Thereafter, the result of the generated code sequence having length L 1303 is applied circular shift thereto, resulting in the CAZAC sequence 1304.

[0081] Figure 14 is an exemplary diagram illustrating application of circular shift to the generated code sequence prior to attaching a padding portion. In other words, circular shift is performed to the generated CAZAC sequence having length X, and after circular shift is performed, the padding portion is attached.

[0082] Referring to Figure 14, the code sequence 1402 is generated based on length X which is the largest prime number smaller than the value of the desired length L. To the generated CAZAC sequence 1402, circular shift is performed. The circularly-shifted CAZAC sequence 1403 still has length X. To the CAZAC sequence 1403, a padding portion is added, resulting in the CAZAC sequence 1404. The length of the padding portion corresponds to a length $L-X$. As discussed, the padding portion can be comprised of zeroes

ZTE/SAMSUNG/HTC 1002-0337

or cyclic prefix/postfix. With the addition of the padding portion, the length of the CAZAC sequence 1404 equals the desired length L.

[0083] Between Figures 11 and 12, the difference is that circular shift is performed either before or after the elements of the CAZAC sequence are removed. By performing circular shift before removing the elements (or adjusting the length to equal the desired length), correlation deterioration can be reduced. To put differently, the CAZAC sequence does not have discontinuous codes.

[0084] Between Figures 13 and 14, the difference is that circular shift is performed either before or after the padding portion is added to the generated CAZAC sequence. By attaching the padding portion after performing circular shift, better correlation properties can be attained, especially since the padding portion is placed at the end of the code sequence.

[0085] Further, according to the discussion above, the desired length L (or required length) is first recognized. As illustrated with respect to Figures 11 – 14, the generated code sequence is adjusted/modified based on the desired length L. Based on that, after the desired length L recognized, a determination can be made as to whether the generated length X should be shortened or extended. In other words, the determination can be made whether to remove or discard at least one element of the generated code sequence or to add or insert at least one element to the generated code sequence. As discussed, the elements to be inserted can be a null (0) element (e.g., zero padding) or cyclic prefix/postfix, for example. In order

ZTE/SAMSUNG/HTC 1002-0338

to make the determination between discarding the element(s) or adding the element(s), the system can choose to select the length closest to the desired length L.

[0086] For example, if the desired length L is 75, the value of the smallest prime number greater than 75 is 79, and the value of the largest prime number smaller than the 75 is 73. Here, the prime number 73 can be selected since 73 is closer to 75 than 79 is to 75.

[0087] Although the illustration above selects the prime number closest to the desired length L, selection regarding removal or addition of the element(s) is not limited to the example of above and other implementations may be applied.

[0088] Regarding padding, there are five (5) schemes by which padding can be accomplished. As a first padding scheme, the padding portion can be comprised of a constant number (e.g., 0s). Although the padding portion is used to fill the portion of the code sequence so that the length of the code sequence coincides with the desired length, it is possible for the padding portion to be less then completely full. In other words, it is possible for that the length of the code sequence with padded portion is not equal to or is shorter than the code sequence with the desired length. That is, when the code sequence is used for functions deemed less important, such as for cell search or random access, it is not necessary to use the entire length of the code sequence, and as such, the padding portion does not need to be completely occupied to correspond to the desired length of the code sequence.

ZTE/SAMSUNG/HTC 1002-0339

[0089] As a second padding scheme, the padding portion can be comprised of a repeated portion. In other words, the portion corresponding to $L - X$ of the code sequence 1204 can be duplicated and inserted/attached to the end of the code sequence 1204. This can be referred to as cyclic postfix. Here, the code sequence uses the entire length L. When determining the identification (ID) of the code sequence, the entire length L is used to facilitate identifying of the code sequence ID. At the same time, the generated code sequence does not experience distortion by using the entire length L. In the discussion above, the cyclic postfix is used. Alternatively, cyclic prefix can also be used.

[0090] As a third padding scheme, the padding portion can be comprised of additional information through which different messages can be delivered. More specifically, the desired length L of the code sequence can be used to generate a supplemental code sequence whose length equals the desired length L ($N = L$). The code sequence portion corresponding to $L - X$ is extracted from the supplemental code sequence and inserted/attached to the generated code sequence as the padded portion.

[0091] As a fourth padding scheme, a portion corresponding to length $L - X$ is extracted from the code sequence and inserted as the padding portion. Here, the code sequence inserted to the padding portion may be a different code sequence than the code sequence 1204. Put differently, the code sequence inserted to the padding portion may be a CAZAC sequence having a length of M, for example, which is different from the code sequence 1204 having a length of L. Further, the code sequence inserted to the padding

ZTE/SAMSUNG/HTC 1002-0340

portion can be a different code sequence other than the CAZAC sequence. By using different code sequence, additional information can be delivered including information related to type of code sequence adjustments.

[0092] As a fifth padding scheme, the padding portion can be used as lower bandwidth guard interval. During transmission of control information using a prescribed sequence, the following possible scenarios can occur such as transmitting data without establishing synchronization with an access channel, transmitting data by a plurality of users within a communication system, and distortion of frequency of the received data.

[0093] Furthermore, the padding portions can be placed at both ends of the code sequence to use the padding portions as guard intervals of the lower bandwidth. Consequently, a more reliable acquisition of control information from the received data can take place despite distorted frequency signals. In the padding portions used as guard intervals, constant numbers (e.g., 0s) can be used or cyclic prefix or postfix of the generated code sequence can be used.

[0094] If the padding portions are placed at both ends of the code sequence and used as guard intervals of the lower bandwidth, the code sequences can be protected from frequency signal distortions. Moreover, if 0s are inserted between the guard intervals or put differently, within the code sequence, interference to neighboring codes can be reduced. Alternatively, if cyclic prefix/postfix is used as guard intervals, the code sequences can be

ZTE/SAMSUNG/HTC 1002-0341

protected from frequency distortions and can be used to transmit the control information containing the sequence ID if there is no frequency distortion.

[0095] Figure 15 is an exemplary diagram of a padding portion of the code sequence in which the padding portion is used as a lower bandwidth guard interval. Referring to Figure 15, the code sequence 1501 can be divided into three (3) parts – a portion (C1), which is generated based on length X, and the other two portions (C2 and C3) are attached to both ends of the code sequence 1501.

[0096] In the discussions above, five (5) padding schemes are introduced. However, the padding schemes are not limited to the discussed schemes, and there can be other types of padding schemes.

[0097] Besides the first padding scheme in which no information is inserted, the other four padding schemes insert additional information in the padding portions to allow expansion of the code sequence and/or transmission of message(s). Various information can be inserted into the padding portion including, for example, initial access information, timing update information, resource request information, user ID information, channel quality information (CQI), user group ID information related to a random access channel (RACH). Furthermore, the information can include cell ID information, multi-input multi-output (MIMO) information, and synchronization channel information of a synchronization channel (SCH), for example. In addition, the padding portion can be used for transmitting

ZTE/SAMSUNG/HTC 1002-0342

data for message transmission as well as arbitrary information using a code sequence having a length of $L-X$.

[0098] Figure 16 is a structural diagram for transmitting the code sequence. Depending on whether the transmission of the code sequence is made in a downlink direction or an uplink direction, the structure can be in different form. With that, Figure 16 is described with respect to a general transmitting end for transmitting the control signal.

[0099] Referring to Figure 16, the transmitting end 1601 comprises a sequence selection unit 1602 and a transmitting unit 1603. The sequence selection unit 1602 is used to generate the code sequence for transmitting the control information. More specifically, the sequence selection unit 1602 performs an operation to select a code sequence having a desired length of L. In other words, the sequence selection unit 1602 stores the value of the desired length L, and then selects an appropriate code sequence for expressing the control information to be transmitted where the code sequence has a length of L.

[00100] The code sequence that can be selected by the sequence selection unit 1602 has a length of L as illustrated in Figures 12 and 14 (e.g., code sequence 1204 and code sequence 1404). Moreover, the code sequence is applied circular shift (e.g., code sequences 1203 and 1403) to which a padded portion corresponding to lengths $L-X$ or $X-L$ is removed or inserted/added. As a result, discontinuous parts are not formed within or in the code sequence to promote superior correlation characteristics.

ZTE/SAMSUNG/HTC 1002-0343

[00101] Although it is preferable to use length X which is a smallest prime number greater than the length of L or a largest prime number smaller than the length of L, as long as the value of length X is a prime number, different or other prime numbers can be used as the value of length X.

[00102] Figure 17 is a structural diagram illustrating a basic code sequence generation unit and a code sequence length adjustment unit. In Figure 17, the basic code sequence generation unit 1701 further comprises a code sequence generation unit 1701a and a circular shift application unit 1701b. The code sequence generation unit 1701a is used to generate a first code sequence (C1). Here, C1 can be defined as a code sequence having a length of X where the value of length X is a smaller prime number larger than the value of length L or a code sequence having a length of X where the value of length X is a larger prime number smaller than the value of length L. C1 is then applied circular shift by the circular shift application unit 1701b. More specifically, the circular shift application unit 1701b receives C1 having length of X, applies circular shift, and outputs a second code sequence (C2) to the code sequence length adjustment unit 1702.

[00103] The code sequence length adjustment unit 1702 further comprises a control unit 1702a, a code sequence removing unit 1702b, and a padding unit 1702c. More specifically, the control unit 1702a receives C2 as well as the value of length L. The control unit 1702a determines whether to remove a portion/section of C2 or insert/add a portion/section to C2. Based on the determination from the control unit 1702a, C2 is

ZTE/SAMSUNG/HTC 1002-0344

delivered to the sequence removing unit 1702b in which a portion/section of C2 corresponding to a length of $X - L$ is removed. Alternatively, C2 can be delivered to the padding unit 1702c for inserting/adding a portion/section of C2 whose length corresponds to the length of $L - X$.

[00104] If C2 and the value of length L are provided to the control unit 1702a, the control unit 1702a compares the value of length X which identifies the length of C2 with the value of the length L. Here, if X is greater than L, then C2 is inputted into the sequence removing unit 1702b. From C2, the portion length of C2 corresponding to length $X - L$ is removed, resulting in C3. However, if X is less than L, then C2 is inputted into the padding unit 1702c. From C2, the padding portion length corresponding to length $L - X$ is inserted/added to C2, resulting in C4. Here, the padding portion can be inserted to either end or both ends of C2.

[00105] Figures 18 and 19 illustrate cross-correlation characteristics of the code sequence. The illustrations of Figures 18 and 19 is based on the value of length X being the smallest prime number greater than the value of the desired length L; however, the illustrations are not limited to the smallest prime number greater than length L but can have a prime number value of length X smaller than the value of length L.

[00106] Referring to Figures 18 and 19, the x-axis represents values of circular shift while the y-axis represents un-normalized cross-correlation values. Furthermore, a thinner line represents the value of cross-correlation of the code sequence with circular shift applied

ZTE/SAMSUNG/HTC 1002-0345

thereto after a code sequence portion having the length $X - L$ is removed. A darker/thicker line represents values of code sequence to which circular shift is applied prior to removing the code sequence portion corresponding to the length $X - L$. More specifically, Figure 7 illustrates a graph where L is 75 and X is 79 which is the smallest prime number greater than 75. Moreover, Figure 8 illustrates a graph where L 8 is 225 and X is 227 which is the smallest prime number greater than 225.

[00107] In Figures 18 and 19, if the value of circular shift is 0 or put differently, if there is no shift, then high correlation value is indicated only when the auto-correlation value of the code sequence corresponds and in other cases, moderate correlation is maintained. On the contrary, if the code sequence has a section corresponding to length $X - L$ is removed and thereafter applied circular shift, severe fluctuations occur with correlation values, resulting in deteriorated correlation characteristics. As such, if cross-correlation is used to analyze the code sequence, the code sequence according to the embodiments of the present invention shows superior performance and outcome to that of the conventional code sequence.

[00108] Figure 20 is an exemplary diagram illustrating boosting the power of the generated code sequence. As discussed, the code sequence is generated based on length X, and a padding portion, whose length corresponds to length $L - X$, is attached to the code sequence (e.g., CAZAC sequence). Thereafter, the portion of the code sequence corresponding to length X is used where length L is divided by length X (L/X). The result of

ZTE/SAMSUNG/HTC 1002-0346

the division is the amount of power that can be boosted. Moreover, the amount of power that can be boosted can be applied to the code sequence whose length is length X. When the receiving end receives power boosted code sequence, more effective detection performance can be achieved since interference is reduced.

[00109] However, regarding a code sequence generated with a padding portion with cyclic prefix/postfix attached thereto, there is no need to power boost since all of the code sequences corresponding to length L are used for acquiring sequence ID information.

[00110] In the receiving end, information related to the generated code sequence and length X used to generate the code sequence is received. From the code sequence, a portion corresponding to length X is processed to acquire the control information. To this end, it is important to first receive synchronization information of the received data. Equation 7 and Equation 8 can be used to acquire synchronization information. Here, Equation 7 relates to auto-correlation, and Equation 8 relates to cross-correlation.

[Equation 7]

$$R_{M:N}(d) = \sum_{k=0}^{X-1} c(k, M, X) \bullet c^{*}(\mathrm{mod}(k+d), X); M, X)$$

[Equation 8]

$$R_{M_1:M_2:N}(d) = \sum_{k=0}^{X-1} c(k, M_1, X) \bullet c^{*}(\mathrm{mod}(k+d), X); M_2, X)$$

[00111] Equation 7 is used to acquire auto-correlation value(s) from the received code sequence whose sequence ID is M. Further, the acquired auto-correlation value d, which is a value other than 0, is used to achieve synchronization.

ZTE/SAMSUNG/HTC 1002-0347

[00112] Equation 8 is used to acquire cross-correlation value(s) of a code sequence whose ID is M_2 from the received code sequence whose sequence ID is M_1. Through the acquired value, synchronization can be achieved.

[00113] Typically, if the wireless communication system is a synchronous network, auto-correlation is used to acquire synchronization information, and if the system is an asynchronous network, cross-correlation is used to acquire synchronization information. However, according to the embodiments of the present invention, synchronization information can be acquired using any one or at least one of the correlation schemes.

[00114] After the synchronization information of the received code sequence is acquired, the receiving end analyzes the received code sequence to acquire the sequence ID, as shown in Equations 9 and 10.

[Equation 9]

$$\sigma c(k;M,X) = c(k+1;M,X) \bullet c^*(k;M,X) \quad (for\ k = 0,1,\cdots,L-1)$$

[Equation 10]

$$\sigma c(k;M,X) = c(k+1;M,X) \bullet c^*(k;M,X) \quad (for\ k = 0,1,\cdots,X-1)$$

[00115] In Equations 9 and 10, $\sigma c(k;M,X)$ denotes difference sequence of the received sequences. Equation 9 is used to acquire the ID information of the received sequence using the differential sequence corresponding to the total length of the received sequence. Equation 9 can also be used to acquire the ID information of the code sequence which has been generated with the cyclic prefix/postfix padded portion. Equation 10 is used

ZTE/SAMSUNG/HTC 1002-0348

to acquire the ID information of the received sequence using the smallest prime number corresponding to length X.

[00116] As discussed, if the differential sequence of the CAZAC sequence is calculated using Equations 9 or 10, k of the sequence index is generated, and the result therefrom is transformed by the Fourier transform scheme, to show a single peak value. Thereafter, by detecting the peak value, the ID information of the sequence can be acquired.

[00117] The discussion of above regarding a code sequence or a code sequence set can be applied to 3rd Generation Partnership Project (3GPP) system or 3GPP2 system as well as a Wibro system or a Wimax system.–

[00118] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

ZTE/SAMSUNG/HTC 1002-0349

WHAT IS CLAIMED IS:

1. A method of generating a code sequence in a wireless communication system, the method comprising:

recognizing a desired length of the code sequence;

generating a code sequence having a length different from the desired length; and

modifying the length of the generated code sequence to equal the desired length,

wherein the step of modifying includes discarding at least one element of the generated code sequence or inserting at least one null element to the generated code sequence.

2. The method of claim 1, wherein the length of the generated code sequence is a prime number.

3. The method of claim 1, wherein the length of the generated code sequence is a smallest prime number larger than the desired length.

ZTE/SAMSUNG/HTC 1002-0350

4. The method of the claim 1, wherein the length of the generated code sequence is a largest prime number smaller than the desired length.

5. The method of claim 1, further comprising selecting the length of the generated code sequence nearest to the desired length between a smallest prime number larger than the desired length or a largest prime number smaller than the desired length.

6. The method of claim 1, further comprising performing circular shift to the generated code sequence.

7. The method of claim 1, further comprising performing circular shift to the generated code sequence having the modified length.

8. The method of claim 1, further comprising adjusting a power constraint of the generated code sequence having modified length to a total power constraint of the recognized the code sequence having the desired length.

9. The method of claim 1, wherein a number of at least one element to be discarded corresponds to a difference in number between the desired length and the length of the generated code sequence.

ZTE/SAMSUNG/HTC 1002-0351

10. The method of claim 1, wherein a number of at least one null element to be inserted corresponds to a difference in number between the length of the generated code sequence and the desired length.

11. The method of claim 1, wherein the step of modifying further includes inserting a cyclic prefix or a cyclic postfix to the generated code sequence.

12. A method of generating a code sequence in a wireless communication system, the method comprising:

recognizing a desired length of a first code sequence;

generating a second code sequence having a length different from the desired length of the first code sequence; and

modifying the length of the second code sequence to equal the desired length of the first code sequence,

wherein the step of modifying includes discarding at least one element of the modified code sequence if the length of the modified code sequence is longer than the desired length of the first code sequence or inserting at least one null element to the modified code sequence if the length of the modified second code sequence is shorter than the desired length of the first code sequence.

ZTE/SAMSUNG/HTC 1002-0352

13. The method of claim 12, wherein the length of the second code sequence is a prime number.

14. The method of claim 12, wherein the length of the second code sequence is a smallest prime number larger than the desired length of the first code sequence.

15. The method of the claim 12, wherein the length of the second code sequence is a largest prime number smaller than the desired length of the first code sequence.

16. The method of claim 12, further comprising selecting the length of the second code sequence nearest to the desired length between a smallest prime number larger than the desired length or a largest prime number smaller than the desired length.

17. The method of claim 12, further comprising performing circular shift to the second code sequence.

18. The method of claim 12, further comprising performing circular shift to the second code sequence having the modified length.

ZTE/SAMSUNG/HTC 1002-0353

19. The method of claim 12, further comprising adjusting a power constraint of the second code sequence having modified length to a total power constraint of the recognized the code sequence having the desired length.

20. The method of claim 12, wherein a number of at least one element to be discarded corresponds to a difference in number between the desired length and the length of the second code sequence.

21. The method of claim 12, wherein a number of at least one null element to be inserted corresponds to a difference in number between the length of the second code sequence and the desired length.

22. The method of claim 12, wherein the step of modifying further includes inserting a cyclic prefix or a cyclic postfix to the second code sequence.

23. An apparatus for generating a code sequence in a wireless communication system, the apparatus comprising:

a sequence selection unit for recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length, wherein

ZTE/SAMSUNG/HTC 1002-0354

the sequence selection unit discards at least one element of the generated code sequence or inserts at least one null element to the generated code sequence in modifying the length of the generated code sequence; and

a transmitting unit for transmitting the modified generated code sequence via at least one antenna.

ZTE/SAMSUNG/HTC 1002-0355

ABSTRACT

A method of generating a code sequence in a wireless communication system is disclosed. More specifically, the method includes recognizing a desired length of the code sequence, generating a code sequence having a length different from the desired length, and modifying the length of the generated code sequence to equal the desired length. Here, the step of modifying includes discarding at least one element of the generated code sequence or inserting at least one null element to the generated code sequence.

ZTE/SAMSUNG/HTC 1002-0356

FIG. 1

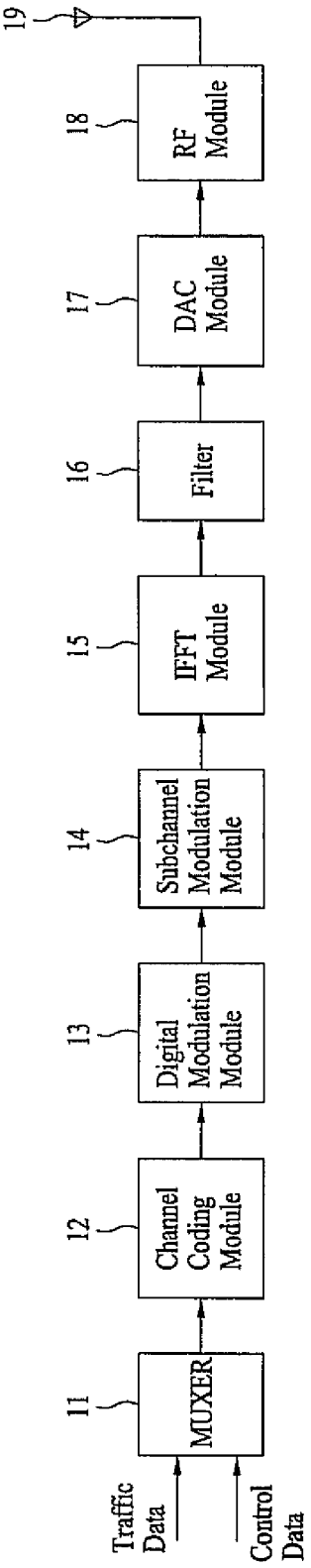

19
18
RF Module
17
DAC Module
16
Filter
15
IFT Module
14
Subchannel Modulation Module
13
Digital Modulation Module
12
Channel Coding Module
11
MUXER
Traffic Data
Control Data

FIG. 2

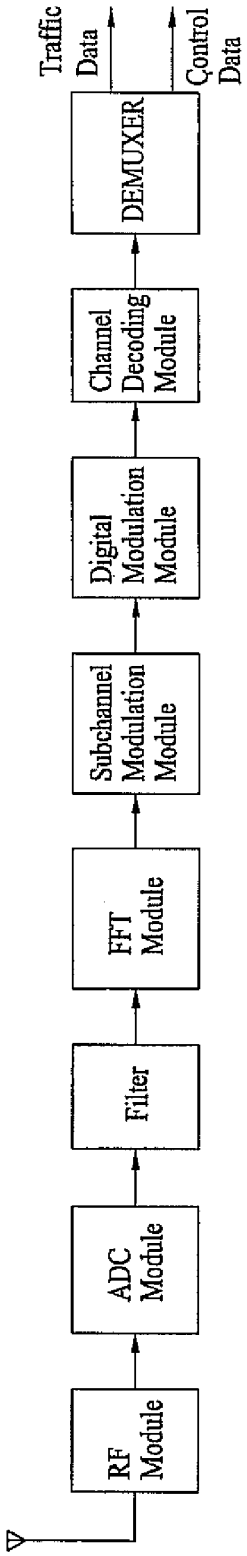

Traffic Data
Control Data
DEMUXER
Channel Decoding Module
Digital Modulation Module
Subchannel Modulation Module
FFT Module
Filter
ADC Module
RF Module

FIG. 3

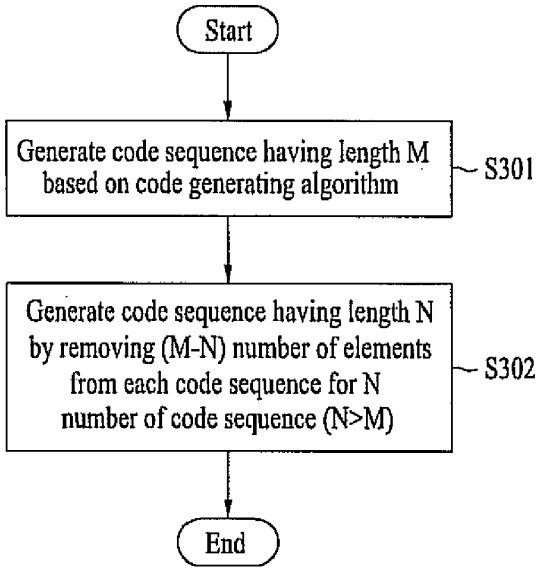

Start
Generate code sequence having length M based on code generating algorithm
S301
Generate code sequence having length N by removing (M-N) number of elements from each code sequence for N number of code sequence (N>M)
S302
End

FIG. 4

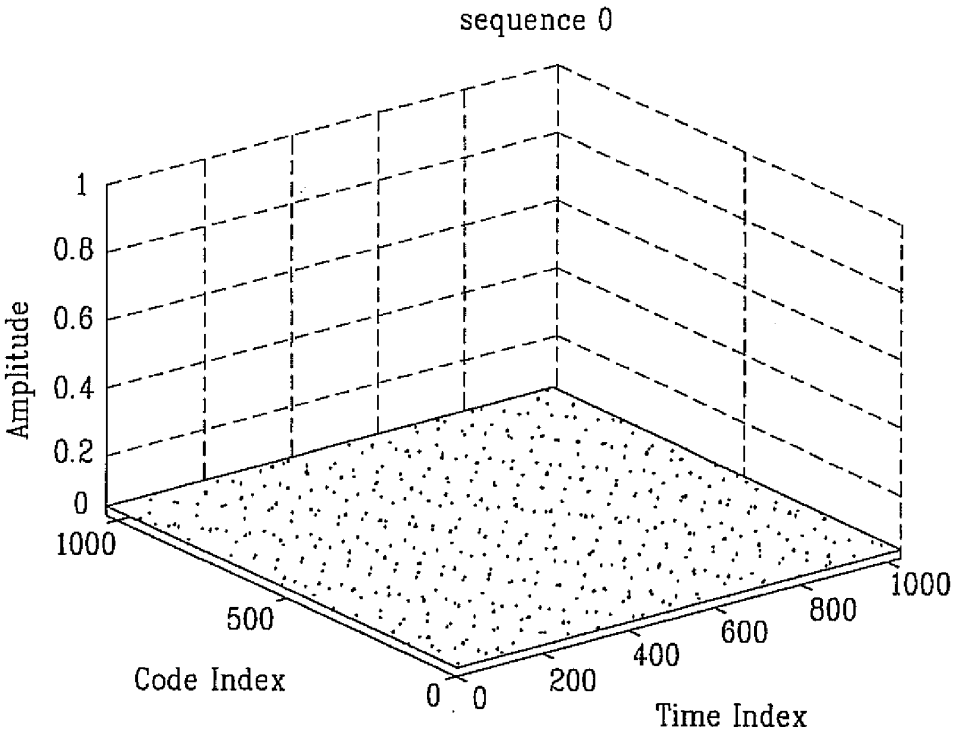

sequence 0
Amplitude
1
0.8
0.6
0.4
0.2
0
1000
500
0
Code Index
0
200
400
600
800
1000
Time Index

FIG. 5

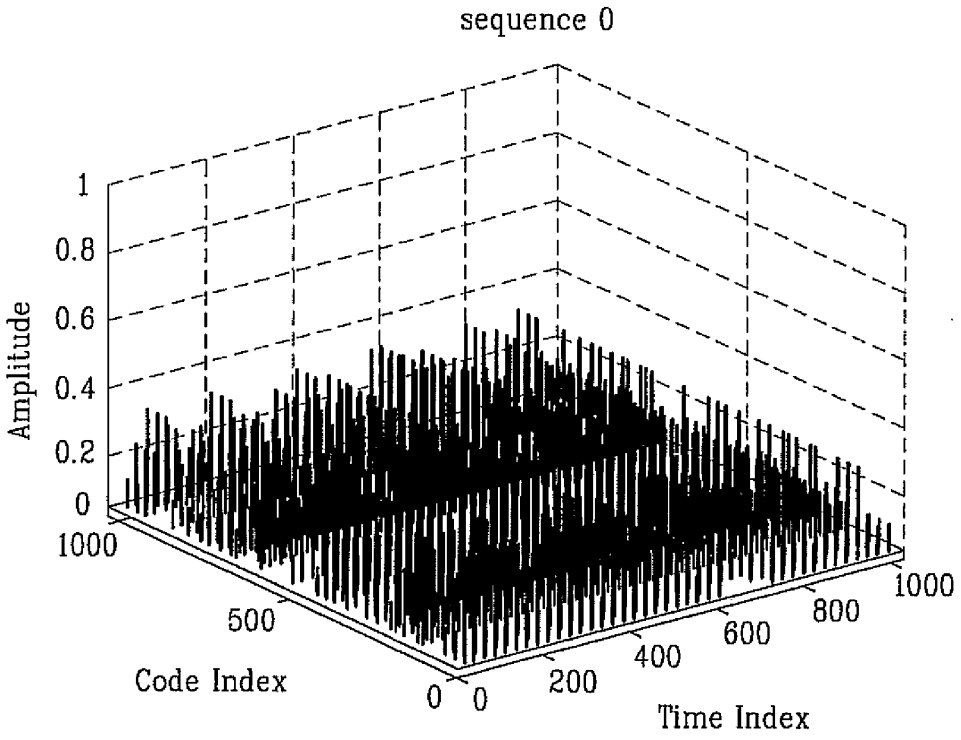

sequence 0
Amplitude
1
0.8
0.6
0.4
0.2
0
1000
500
0
Code Index
0
200
400
600
800
1000
Time Index

FIG. 6

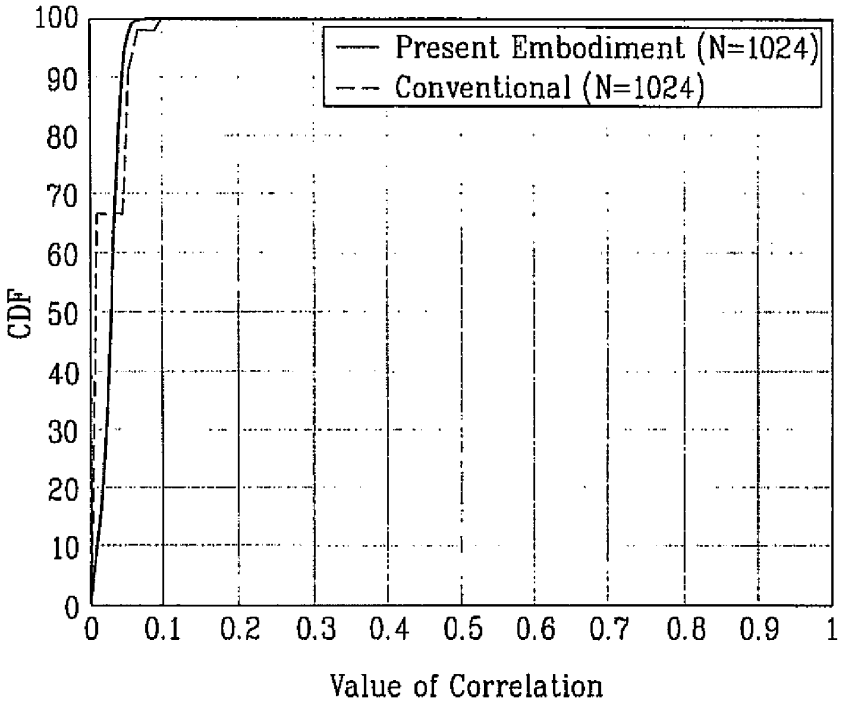

Present Embodiment (N=1024)
Conventional (N=1024)
CDF
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Value of Correlation

FIG. 7

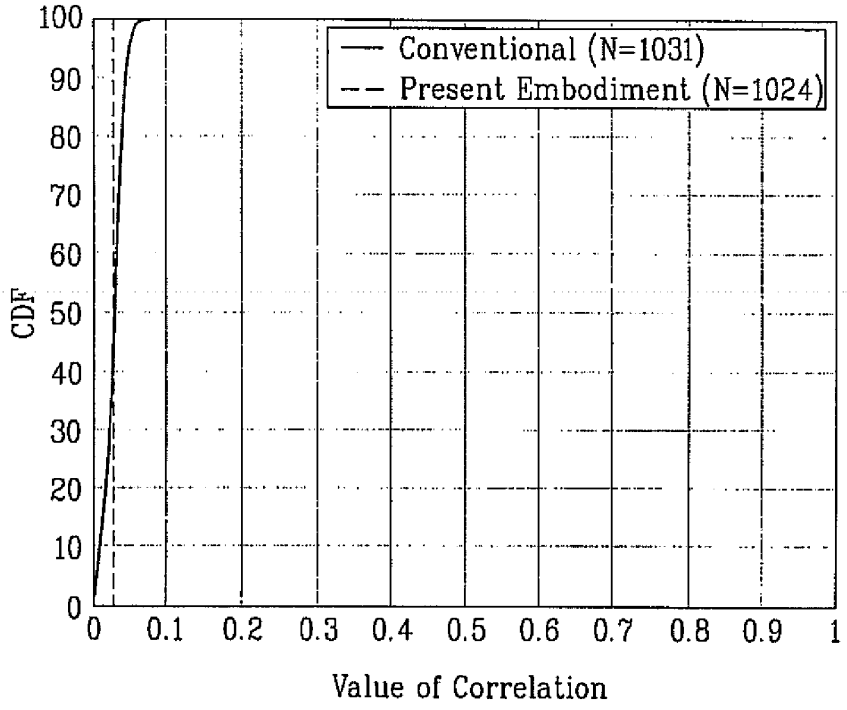

Conventional (N=1031)
Present Embodiment (N=1024)
CDF
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Value of Correlation

FIG. 8

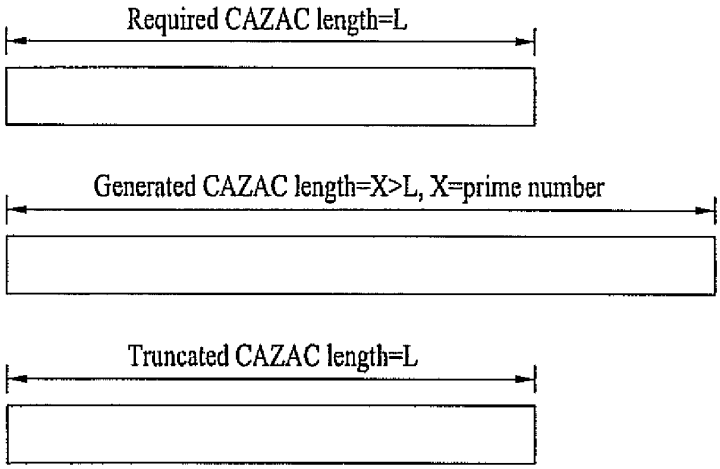

Required CAZAC length=L
Generated CAZAC length=X>L, X=prime number
Truncated CAZAC length=L

FIG. 9

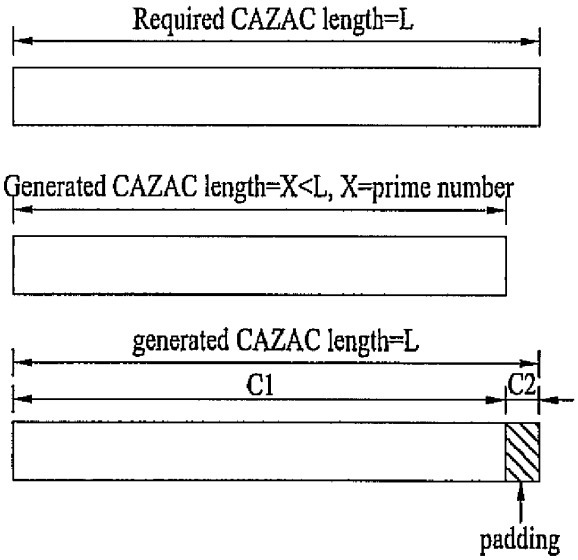

Required CAZAC length=L
Generated CAZAC length=X<L, X=prime number
generated CAZAC length=L
C1
C2
padding

FIG. 10

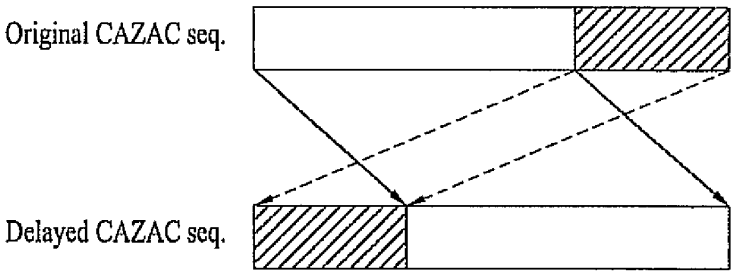


FIG. 11

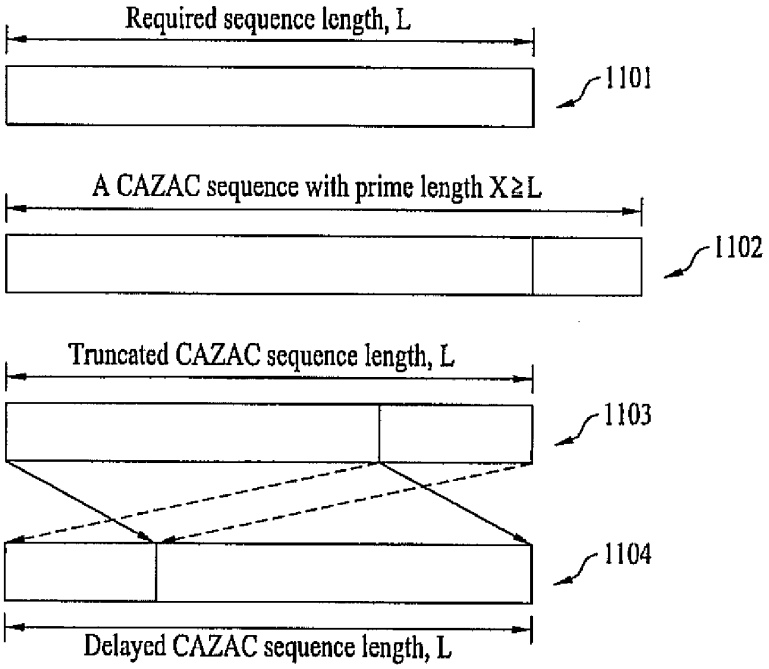

Required sequence length, L
1101
A CAZAC sequence with prime length X≥L
1102
Truncated CAZAC sequence length, L
1103
1104
Delayed CAZAC sequence length, L

FIG. 12

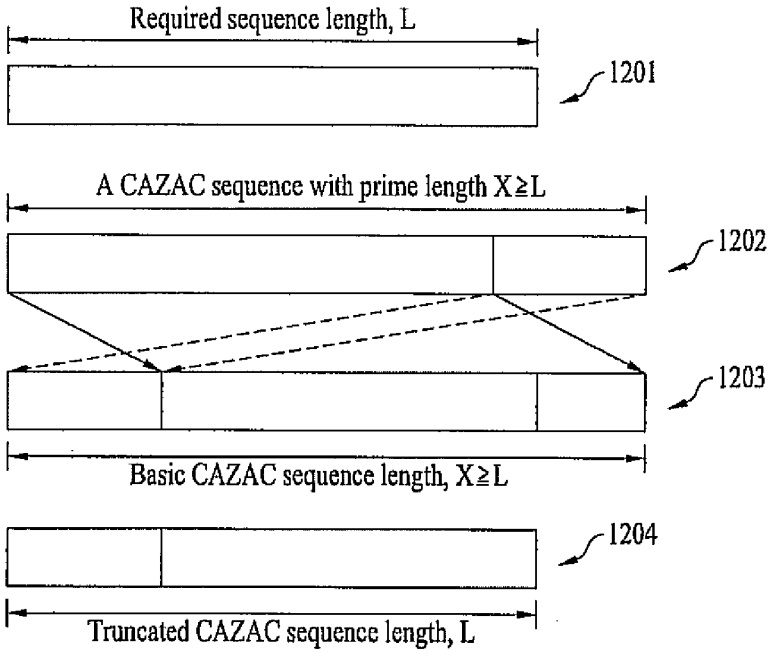

Required sequence length, L
1201
A CAZAC sequence with prime length X≥L
1202
1203
Basic CAZAC sequence length, X≥L
1204
Truncated CAZAC sequence length, L

FIG. 13

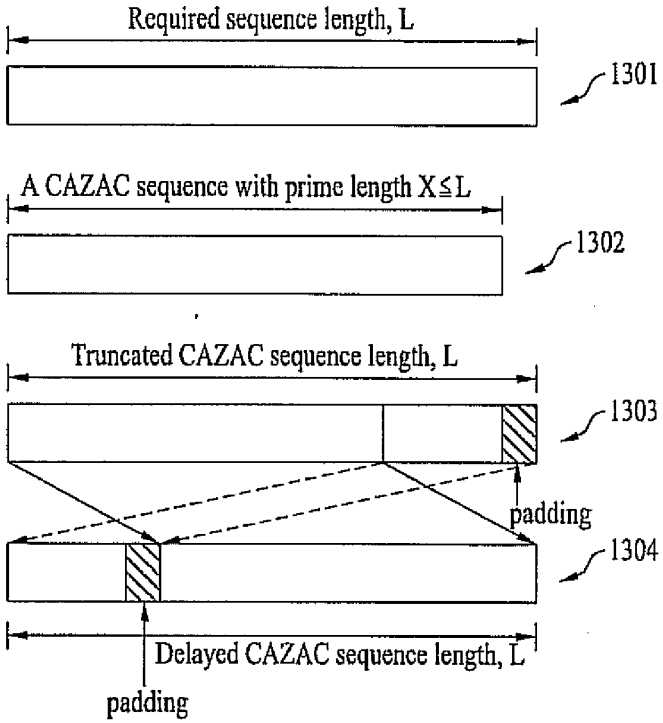

Required sequence length, L
1301
A CAZAC sequence with prime length X≤L
1302
Truncated CAZAC sequence length, L
1303
padding
1304
Delayed CAZAC sequence length, L
padding

FIG. 14

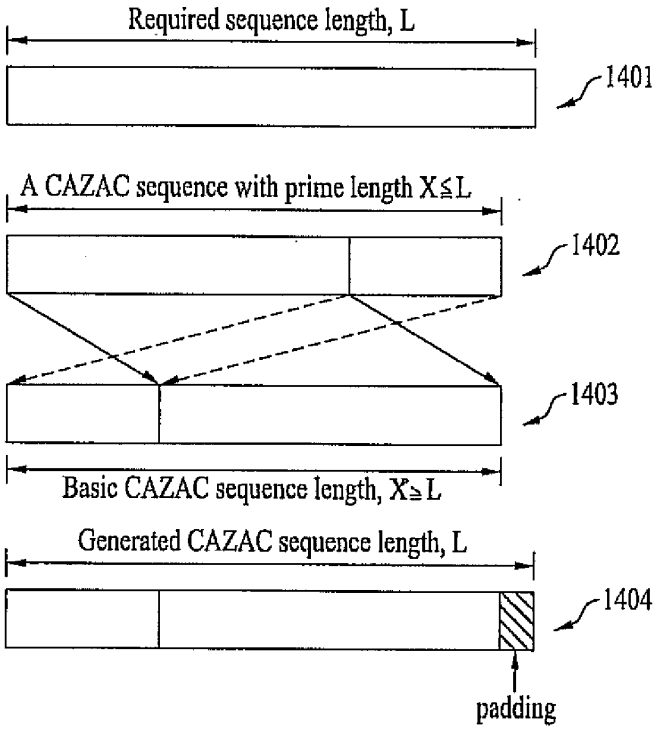

Required sequence length, L
1401
A CAZAC sequence with prime length X≦L
1402
1403
Basic CAZAC sequence length, X≧L
Generated CAZAC sequence length, L
1404
padding

FIG. 15

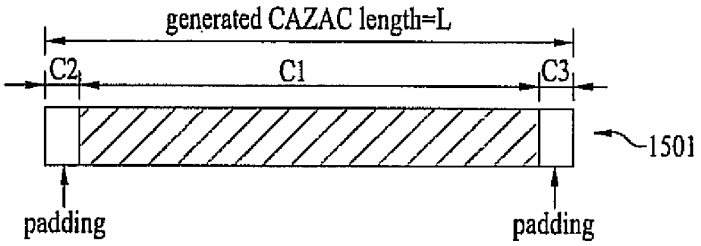


FIG. 16

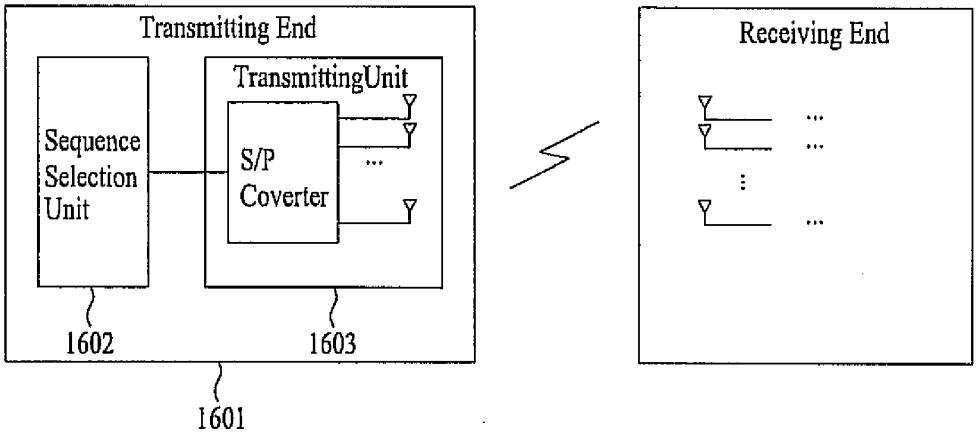

Transmitting End
TransmittingUnit
Sequence Selection Unit
S/P Coverter
1602
1603
1601
Receiving End

FIG. 17

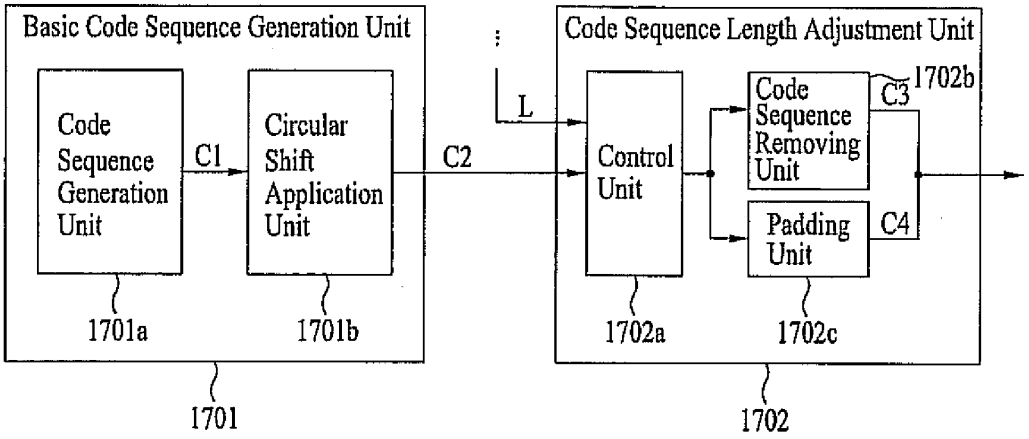

Basic Code Sequence Generation Unit
Code Sequence Generation Unit
C1
Circular Shift Application Unit
C2
L
1701a
1701b
1701
Code Sequence Length Adjustment Unit
Control Unit
Code Sequence Removing Unit
C3
1702b
Padding Unit
C4
1702a
1702c
1702

FIG. 18

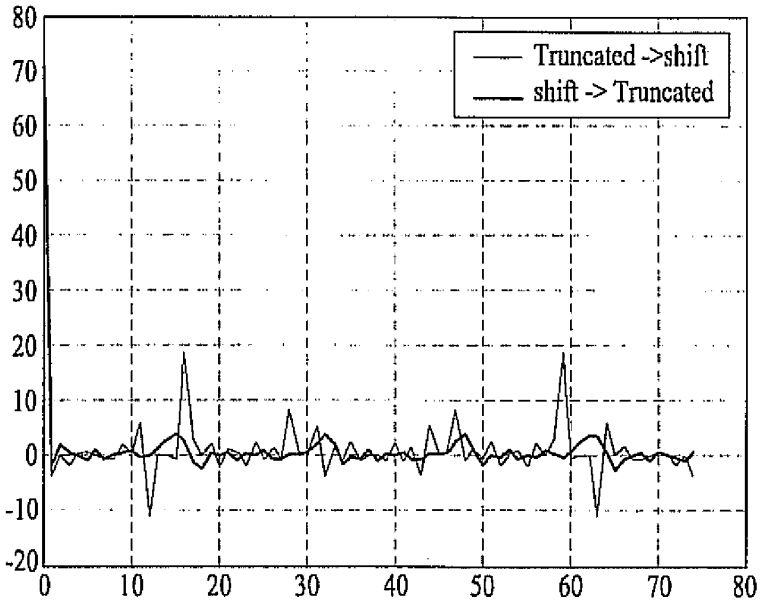

Truncated ->shift
shift -> Truncated
80
70
60
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
60
70
80

FIG. 19

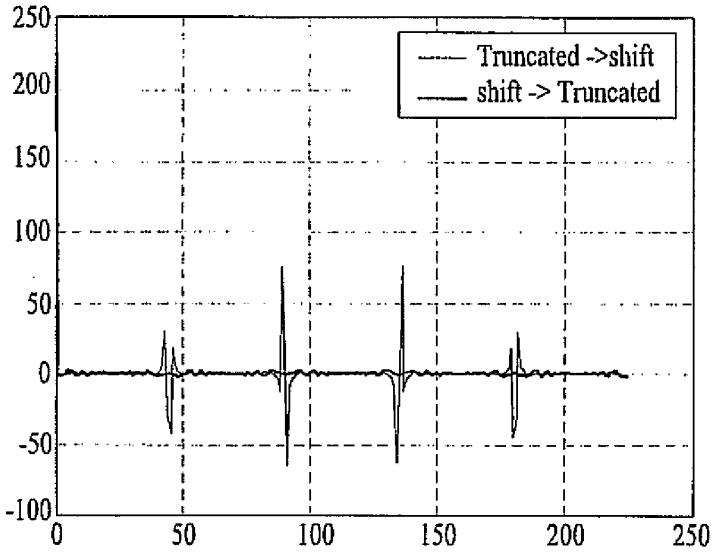
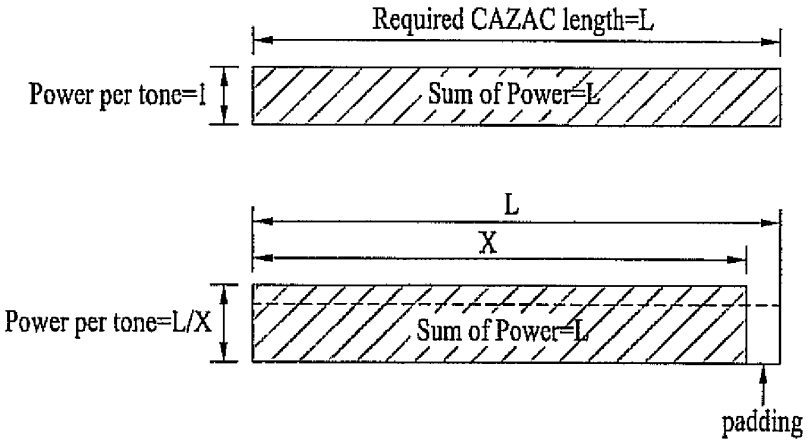

Truncated ->shift
shift -> Truncated
250
200
150
100
50
0
-50
-100
0
50
100
150
200
250

FIG. 20


Required CAZAC length=L
Power per tone=1
Sum of Power=L
L
X
Power per tone=L/X
Sum of Power=L
padding

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Filer:	Lew Edward V. Macapagal/Maggie Wen
Attorney Docket Number:	2101-3280

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	300	300
Utility Search Fee	1111	1	500	500
Utility Examination Fee	1311	1	200	200
Pages:				
Claims:				
Claims in excess of 20	1202	3	50	150
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1150**

Electronic Acknowledgement Receipt

EFS ID:	1337712
Application Number:	11563909
International Application Number:	
Confirmation Number:	1721
Title of Invention:	METHOD AND APPARATUS FOR GENERATING AND TRANSMITTING CODE SEQUENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Seung Hee Han
Customer Number:	35884
Filer:	Lew Edward V. Macapagal/Maggie Wen
Filer Authorized By:	Lew Edward V. Macapagal
Attorney Docket Number:	2101-3280
Receipt Date:	28-NOV-2006
Filing Date:	
Time Stamp:	15:09:01
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$1150
RAM confirmation Number	120
Deposit Account	502290
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	2101-3280_Transmittal.pdf	43080	no	2
Warnings:					
Information:					
2		2101-3280_PatentApplication.pdf	810406	yes	41

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	34
	Claims	35	40
	Abstract	41	41

Warnings:					
Information:					
3	Drawings	2101-3280_Drawings.pdf	165955	no	18
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	8544	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1027985		

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.

PTO/SB/06 (12-04)
Approved for use through 7/31/2006. OMB 0651-0032
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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 11/563,909

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))				150			300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))				250			500
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))				100			200
TOTAL CLAIMS (37 CFR 1.16(i))	23 minus 20 =	3	X$ 25		OR	X$50	150
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	* 0	X$100			X$200	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			180			360	
			TOTAL			TOTAL	1150

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI- TIONAL FEE ($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					180		OR	360	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDI- TIONAL FEE ($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T 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.

This collection of information is required by 37 CFR 1.16. 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, 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 and select option 2.