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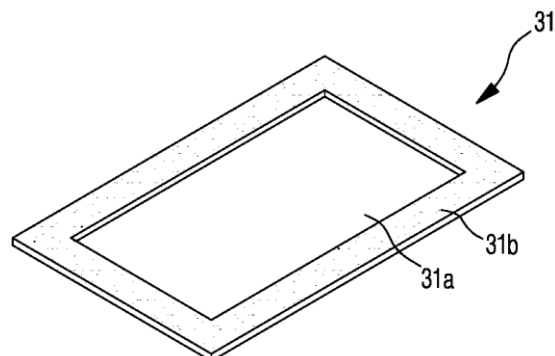
(54) Title of the invention: HYBRID MAGNETIC FIELD SHIELDING SHEET, ANTENNA DEVICE, AND PORTABLE TERMINAL EQUIPMENT USING THE SAME.

(57) Abstract

The present invention relates to a hybrid magnetic field shielding sheet capable of minimizing an influence on an azimuth of a geomagnetic sensor embedded for azimuth display of a portable terminal equipment, blocking an influence of a magnetic field, which is generated when implementing various additional functions such as a near field communication (NFC), a radio frequency identification (RFID), a wireless charger, and a pen tablet in the portable terminal equipment in a contactless (wireless) manner, on the portable terminal equipment, and absorbing electromagnetic waves necessary for performing the additional functions, by configuring an auxiliary magnetic sheet having a low magnetic permeability in combination with a main magnetic sheet having a high magnetic permeability at an outer side of the main magnetic sheet, and an antenna device and a portable terminal equipment using the same.

The hybrid magnetic field shielding sheet includes: a main magnetic sheet having a first magnetic permeability; and an auxiliary magnetic sheet surrounding at least a portion of an outer side of the main magnetic sheet and having a second magnetic permeability lower than the first magnetic permeability of the main magnetic sheet.

Representative drawing- FIG. 6A



Claims

Claim 1

A hybrid magnetic field shielding sheet comprising:
a main magnetic sheet having a first magnetic permeability; and
an auxiliary magnetic sheet surrounding at least a portion of an outer side of the main magnetic sheet and having a second magnetic permeability lower than the first magnetic permeability of the main magnetic sheet.

Claim 2

The hybrid magnetic field shielding sheet of claim 1, wherein the main magnetic sheet has a polygonal shape or a circular shape, and
the auxiliary magnetic sheet has a shape of an infinite loop surrounding the outer side of the main magnetic sheet.

Claim 3

The hybrid magnetic field shielding sheet of claim 1, wherein the auxiliary magnetic sheet extends locally on one side of the main magnetic sheet or on a portion of the main magnetic sheet.

Claim 4

The hybrid magnetic field shielding sheet of claim 1, wherein the auxiliary magnetic sheet extends from the main magnetic sheet while overlapping the main magnetic sheet.

Claim 5

The hybrid magnetic field shielding sheet of any one of claims 1 to 4, wherein any one of an amorphous sheet, a ferrite sheet, a permalloy sheet, and a moly permalloy powder (MPP) sheet is used as the main magnetic sheet, and a polymer sheet made of magnetic powders and a resin is used as the auxiliary magnetic sheet.

Claim 6

The hybrid magnetic field shielding sheet of claim 1, wherein an amorphous ribbon made of any one of an Fe-based amorphous alloy, a Co-based amorphous alloy, and a Ni-based amorphous alloy is used as the amorphous sheet.

Claim 7

The hybrid magnetic field shielding sheet of any one of claims 1 to 4, wherein an amorphous sheet and a ferrite sheet are laminated in the main magnetic sheet.

Claim 8

An antenna device for a portable terminal equipment, comprising:
a hybrid magnetic field shielding sheet including a main magnetic sheet having a first magnetic permeability and an auxiliary magnetic sheet surrounding at least a portion of an outer side of the main magnetic sheet and having a second magnetic permeability lower than the first magnetic permeability of the main magnetic sheet; and
an antenna attached to one surface of the hybrid magnetic field shielding sheet so as to provide an additional function to the portable terminal equipment.

Claim 9

The antenna device for a portable terminal equipment of claim 8, wherein the antenna includes:
an insulating substrate; and
an antenna coil patterned with a conductive metal material on the insulating substrate.

Claim 10

The antenna device for a portable terminal equipment of claim 9, wherein the insulating substrate is formed of a double-sided tape, and the antenna coil is formed on the double-sided tape in a transfer manner.

Claim 11

The antenna device for a portable terminal equipment of claim 10, wherein a protective film formed of a photo-imageable solder resist (PSR) or a PSI is formed on a surface of the double-sided tape on which the antenna coil is formed.

Claim 12

The antenna device for a portable terminal equipment of claim 8, wherein the additional function for the portable terminal equipment is any one of a near field communication (NFC), a radio frequency identification (RFID), a wireless charging function, and a pen tablet.

Claim 13

The antenna device for a portable terminal equipment of claim 12, wherein when the additional function for the portable terminal equipment is the NFC or the RFID, the main magnetic sheet is formed of a ferrite sheet.

Claim 14

The antenna device for a portable terminal equipment of claim 12, wherein when the additional function for the portable terminal equipment is the wireless charging function or the pen tablet, the main magnetic sheet is formed of an amorphous sheet.

Claim 15

The antenna device for a portable terminal equipment of claim 12, wherein when the additional function for the portable terminal equipment is the wireless charging function or the pen tablet and the NFC or the RFID, the hybrid magnetic field shielding sheet is formed of a laminate in which an amorphous sheet and a ferrite sheet are laminated.

Claim 16

The antenna device for a portable terminal equipment of claim 12, wherein when the additional function for the portable terminal equipment is the wireless charging function or the pen tablet and the NFC or the RFID, the hybrid magnetic field shielding sheet includes an amorphous sheet disposed at a central portion and a ferrite loop surrounding the amorphous sheet.

Claim 17

The antenna device for a portable terminal equipment of claim 15 or 16, wherein when the additional function for the portable terminal equipment is the wireless charging function or the pen tablet and the NFC or the RFID, the antenna includes a first antenna coil for the wireless charging function or the pen tablet and a second antenna coil for the NFC or the RFID simultaneously formed on one insulating substrate.

Claim 18

The antenna device for a portable terminal equipment of any one of claims 8 to 16, wherein the hybrid magnetic field shielding sheet is installed in a battery cover of the portable terminal equipment.

Claim 19

The antenna device for a portable terminal equipment of any one of claims 8 to 16, wherein the hybrid magnetic field shielding sheet is installed between a liquid crystal display (LCD) panel and a main printed circuit board (PCB) of the portable terminal equipment.

Claim 20

The antenna device for a portable terminal equipment of any one of claims 8 to 16, further comprising a geomagnetic sensor disposed at a distance from the auxiliary magnetic sheet of the hybrid magnetic field shielding sheet and detecting a geomagnetic field for azimuth display of the portable terminal equipment.

Claim 21

A portable terminal equipment comprising:

a portable terminal main body;

a secondary battery supplying power to the portable terminal main body; and

an antenna device coupled to the secondary battery to provide an additional function to the portable terminal equipment, wherein the antenna device includes:

a hybrid magnetic field shielding sheet including a main magnetic sheet having a first magnetic permeability and an auxiliary magnetic sheet surrounding at least a portion of an outer side of the main magnetic sheet and having a second magnetic permeability lower than the first magnetic permeability of the main magnetic sheet; and

an antenna attached to one surface of the hybrid magnetic field shielding sheet so as to provide an additional function to the portable terminal equipment.

Claim 22

The portable terminal equipment of claim 21, wherein the additional function for the portable terminal equipment is any one of a near field communication (NFC), a radio frequency identification (RFID), a wireless charging function, and a pen tablet.

Claim 23

A portable terminal equipment comprising a liquid crystal display (LCD) panel, a magnetic field shielding sheet, a main printed circuit board (PCB), and a secondary battery,

wherein the magnetic field shielding sheet is a hybrid magnetic field shielding sheet including a main magnetic sheet having a first magnetic permeability and an auxiliary magnetic sheet surrounding at least a portion of an outer side of the main magnetic sheet and having a second magnetic permeability lower than the first magnetic permeability of the main magnetic sheet.

Description

Technical Field

[0001] The present invention relates to a hybrid magnetic field shielding sheet, an antenna device, and a portable terminal equipment using the same, and more particularly, to a hybrid magnetic field shielding sheet capable of minimizing an influence on an azimuth of a geomagnetic sensor embedded for azimuth display of a portable terminal equipment, blocking an influence of a magnetic field, which is generated when implementing various additional functions such as a near field communication (NFC), a radio frequency identification (RFID), a wireless charger, and a pen tablet in the portable terminal equipment in a contactless (wireless) manner, on the portable terminal equipment, and absorbing electromagnetic waves necessary for performing the additional functions, an antenna device, and a portable terminal equipment using the same.

Background Art

[0002] Recently, various functions such as a radio frequency identification (RFID), a near field communication (NFC), a wireless charger, and an interactive pen tablet have been added to portable terminal equipment including mobile phones, tablet personal computers (PCs), and the like.

[0003] The near field communication (NFC) is one of RFIDs, and refers to a technology of transmitting data between terminals at a short distance of 10 cm using a contactless short-range wireless communication module that uses a frequency band of 13.56 Mz. The NFC is a manner for file transmission as well as mobile payment, and is widely used in supermarkets and general stores for transmission of product information or travel information for visitors, transportation, access control lock devices, business cards, and the like.

[0004] In addition, 'Android Beam' provided in smartphones recently disclosed by Google LLC has provided a function of transferring photos, business cards, files, maps, websites, and the like from one phone to another phone as well as a mobile payment function as a near field communication (NFC)-based short-distance information transmission and reception function.

[0005] Antennas serving as a primary coil or a secondary coil, respectively, are provided between a user's portable terminal equipment and a main body (or a reader/writer) or another adjacent portable terminal equipment in order to perform wireless power transmission and/or wireless communication functions.

[0006] In this case, since a voltage induced in the antenna serving as the secondary coil is determined by Faraday's law and Lenz's law, it is advantageous that an amount of magnetic flux interlinked with an antenna coil is large, in order to obtain a high voltage signal. The larger the amount of soft magnetic material included in the antenna coil and the higher the magnetic permeability of the material, the larger the amount of magnetic flux. In particular, since an RFID system is essentially contactless data communication, an absorber sheet made of a magnetic material having a high magnetic permeability is necessary in order to focus a radio electromagnetic wave generated from a reader antenna to a tag antenna.

- [0007] In addition, a magnetic field of 100 kHz to several tens of MHz is generated in the secondary coil provided in the portable terminal equipment when performing a near field communication (NFC) function with an RFID reader or an adjacent terminal.
- [0008] Therefore, in a portable terminal equipment having such an additional function, a magnetic field shielding sheet is necessarily used in order to prevent the magnetic field from affecting components (particularly, a battery) of the portable terminal equipment and maximize performance of the additional function by focusing the magnetic field.
- [0009] As such a magnetic field shielding sheet, a magnetic body such as an amorphous ribbon, ferrite, or a polymer sheet including magnetic powders is generally used. A magnetic field focusing effect for shielding the magnetic field and improving the performance of the additional function is good in the order of the amorphous ribbon having a high magnetic permeability, the ferrite, and the polymer sheet including the magnetic powder.
- [0010] Meanwhile, recently, in the portable terminal equipment, geomagnetic sensors have been widely adopted mainly in smartphones so as to implement azimuth display. However, since the portable terminal equipment to which the magnetic field shielding sheet is applied has a narrow space, the geomagnetic sensor should be disposed adjacent to the magnetic field shielding sheet. Therefore, a problem that the magnetic field shielding sheet distorts a geomagnetic field to decrease azimuth accuracy of the geomagnetic sensor occurs.
- [0011] When a polymer sheet having a low magnetic permeability is used, an influence on the azimuth accuracy of the geomagnetic sensor is small, but conversely, a magnetic field shielding effect and an electromagnetic wave focusing effect are low, such that other components of the portable terminal equipment are affected, and the performance of the additional function is also decreased.
- [0012] Korean Patent No. 10-523313 discloses an absorber for a radio frequency identification (RFID) antenna formed of a magnetic sheet having a composition selected from the group consisting of Fe-Si-B, Fe-Si-B-Cu-Nb, Fe-Zr-B, and Co-Fe-Si-B and including an amorphous alloy, and an RFID antenna and a radio identification device including the same.
- [0013] In addition, Korean Patent Laid-Open Publication No. 10-2010-111409 discloses a technology relating to a radio frequency identification (RFID) antenna that is capable of having a decreased thickness, improving a recognition distance of a radio frequency (RF) signal, and promoting stability of the signal by directly forming a radiator pattern on a magnetic sheet obtained by sintering ferrite or a magnetic sheet obtained by mixing and molding soft magnetic powders and a binder with each other to integrate the magnetic sheet and the radiator pattern with each other, and is thus capable of being manufactured in a simpler process than an existing structure in which an antenna and a magnetic sheet are manufactured separately and then combined with each other using an adhesive layer and having a decreased entire thickness, and a method of manufacturing the same.
- [0014] Meanwhile, in an antenna module having a laminated structure of an antenna coil, a magnetic core member, and a shield plate, the magnetic core member disposed at a central portion not only has a function of deriving communication performance of the antenna coil, but also has an electromagnetic blocking function for allowing the antenna coil so as not to be affected by the shield plate.
- [0015] However, it has been recognized that magnetic properties of the magnetic core member necessary to derive the communication performance required for the antenna coil and electrical properties of the magnetic core member satisfying the electromagnetic blocking function between the antenna coil and the shield plate do not necessarily coincide with each other, and Korean Patent Laid-Open Publication No. 10-2006-120631 discloses a technology of providing a magnetic core member having a configuration that may satisfy both the improvement of communication characteristics of the antenna coil and the sufficient electromagnetic shielding action from the shield plate, an antenna module, and a portable communication terminal including the same.
- [0016] In Korean Patent Laid-Open Publication No. 10-2006-120631, a first surface of the magnetic core member facing the antenna coil and a second surface of the magnetic core member facing the shield plate have different electrical properties.
- [0017] Korean Patent Laid-Open Publication No. 10-2010-31139 discloses a technology capable of preventing a magnetic flux generated from a power supply side spiral coil (primary coil) from being interlinked with a circuit board, a secondary battery, and the like, suppressing noise and heat generation due to an induced electromotive force (electromagnetic induction), and controlling an amount of change in inductance of the primary coil by the presence or absence of a secondary coil to improve resonance performance of a resonance circuit constituted by the primary coil and effectively controlling oscillation, by disposing a composite magnetic body including a plurality of magnetic sheets (magnetic ribbons) at at least one of a position between a spiral coil (power reception side spiral coil: secondary coil) and the secondary battery and a position of between a rectifier and the spiral coil.
- [0018] Meanwhile, in a case of a pen tablet disclosed recently, a function of exchanging information through communication with a terminal has been added to an existing pen role. Therefore, a pen for the pen tablet includes elements for communication embedded therein, and thus receives power in a contactless manner to drive a circuit.
- [0019] To this end, the pen tablet generates a magnetic field in a band of 100 to 200 kHz in a terminal using a wireless charging function to wirelessly transmit power to the pen for the pen tablet, thereby driving internal elements, and performs communication between the terminal and the pen using a frequency of 500 kHz or more.

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