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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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(54) **Title:** DIN CONNECTOR END CAP

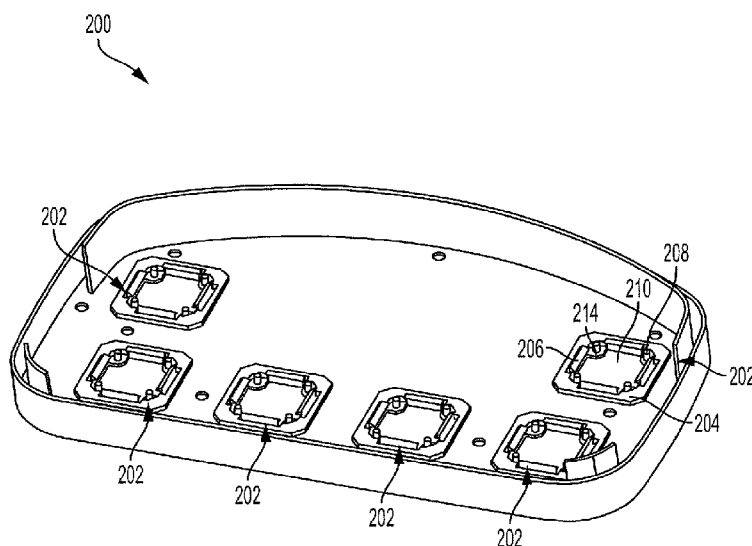


FIG. 2

(57) **Abstract:** Aspects of the present disclosure may be directed to an end cap of a base station antenna for securing cable connectors to the end cap. The end cap may include a plurality of retaining assemblies formed integrally with the cap, and are dimensioned to retain a respective plurality of cable connectors to the end cap. The end cap may be capable of supporting numerous antenna models and configurations. The end cap may include molded features allowing for DIN connectors for various antenna models to be snapped into the end cap, without the use of other hardware and formed end bracket assemblies.

TITLE

DIN Connector End Cap

5 CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/148,436, filed on April 16, 2015, the entire contents of which are incorporated herein by reference in their entirety.

BACKGROUND

10 [0002] Various aspects of the present disclosure relate to antennae, and, more particularly, to apparatus for securing a DIN connector to an end cap to an antenna.

[0003] Currently, there exists many antenna types, shapes, and sizes. An end cap of an antenna may snap onto a radome to seal and protect the antenna from adverse environmental conditions. The end cap may have a plurality of Deutsches Institut für Normung (or “DIN”) connectors attached thereto, to electrically connect other components (e.g., dipoles) of the antenna with an external device such as a receiver or transmitter. Due to the wide variation of antennae and antenna configurations, brackets, end caps, and other hardware may need to be customized for each antenna configuration, at least for securing DIN connectors to the end cap for connection to other components. Design and implementation of this additional hardware may be burdensome and costly.

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[0004] As such, it would be desirable to have an end cap capable of supporting numerous antenna configurations and securing DIN connectors without the use of additional hardware.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0005] The following detailed description will be better understood when read in conjunction with the appended drawings. For the purpose of illustration, there are shown in the drawings, various embodiments. It should be understood, however, that the disclosure is not limited to the precise arrangements and instrumentalities shown.

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[0006] In the drawings:

[0007] Fig. 1 is a plan view of a cell site having antennae, according to an aspect of the present disclosure;

[0008] Fig. 2 is a perspective view of an inside of an end cap of one of the antennae,
5 according to an aspect of the present disclosure;

[0009] Fig. 3 is an enlarged view of the inside of the end cap with a DIN connector retained therein, according to an aspect of the present disclosure;

[0010] Fig. 4 is a perspective view of the inside of the end cap with each of the retaining assemblies of the end cap having a DIN connector secured thereto, according to an aspect of the
10 present disclosure;

[0011] Fig. 5 is a perspective view of the outside of the end cap with each of the retaining assemblies of the end cap having a DIN connector secured thereto, according to an aspect of the present disclosure;

[0012] Fig. 6 is an enlarged view of the outside of the end cap with a DIN connector secured
15 within a retaining assembly of the end cap, according to an aspect of the present disclosure; and

[0013] Fig. 7 is a perspective view of DIN connectors secured to the end cap attached to the antenna according to an aspect of the present disclosure.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

[0014] Certain terminology is used in the following description for convenience only and is
20 not limiting. The words “lower,” “bottom,” “upper” and “top” designate directions in the drawings to which reference is made. Unless specifically set forth herein, the terms “a,” “an” and “the” are not limited to one element, but instead should be read as meaning “at least one.” The terminology includes the words noted above, derivatives thereof and words of similar import. It should also be understood that the terms “about,” “approximately,” “generally,”
25 “substantially” and like terms, used herein when referring to a dimension or characteristic of a component of the disclosure, indicate that the described dimension/characteristic is not a strict boundary or parameter and does not exclude minor variations therefrom that are functionally similar. At a minimum, such references that include a numerical parameter would include variations that, using mathematical and industrial principles accepted in the art (e.g., rounding,

measurement or other systematic errors, manufacturing tolerances, etc.), would not vary the least significant digit.

[0015] Fig. 1 is a plan view of a cell site having antennae (e.g., base station antennae or other antenna types). The cell site 10 generally comprises a triangular platform 12 which may be mounted atop an antenna tower (not shown), or other suitable structure, such as a building (not shown). The platform includes a first side, a second side, and a third side, each of which have an antenna 11.

[0016] The antenna 11 may be housed by an enclosure such as a radome (not shown). An end cap (shown in Figs. 2-7) may snap onto the radome to seal and protect the antenna from adverse environmental conditions. The end cap may have a plurality of DIN connectors attached thereto, to electrically connect other components (e.g., dipole elements) of the antenna with an external device such as a receiver or transmitter. For example, the connector may couple a cable (e.g., a coaxial cable or other type), which may be connected to one or more components external to the antenna 11, to another cable or line (e.g., a coaxial cable or other type), which may also be connected to one or more components internal to the antenna 11 (e.g., drive shaft, phase shifter(s), and the like). In light of the specification, one of ordinary skill in the art would understand that other types of cable connectors may be used in keeping with the spirit of the disclosure.

[0017] Due at least in part to the large variation of antenna types, shapes, and sizes, implementation can be burdensome and costly. For example, at least because of different antenna configurations, brackets, end caps, and other hardware may need to be customized (e.g., specifically manufactured) for each antenna configuration. Aspects of the present disclosure may include an end cap capable of supporting numerous antenna models and configurations. The end cap may include molded features that may allow for DIN connectors for various antenna models to be snapped into the end cap, without the use of other hardware and formed end bracket assemblies. Consequently, assembly time may be reduced, and passive intermodulation (PIM) attributed to the use of additional hardware may be reduced or otherwise eliminated.

[0018] Figs. 2 and 3 are views of the inside of an end cap according to aspects of the present disclosure. The inside may refer to the side of the end cap facing the antenna 11. As shown, the end cap 200 may include a plurality of retaining assemblies 202 attached thereto or molded therein. As best seen in Fig. 3, each of the retaining assemblies 202 may be configured to secure

a DIN connector 203 to the end cap 200. Each of the retaining assemblies 202 may include an anti-rotation flange 204, one or more retention tabs 206, and one or more alignment posts 208. The anti-rotation flange 204 may be generally rectangular in shape, and may have an exterior portion and an interior portion that defines an opening 210 for receiving a DIN connector 203.

5 The shape of the anti-rotation flange may prevent the DIN connector 203 from rotating during and after attachment of the DIN connector 203 to the retainer assembly 202.

[0019] Each of the retention tabs 206 may be positioned on a respective side of the interior portion of the anti-rotation flange 204. Each of the retention tabs 206 may be configured to have an inward biasing force towards the opening 210 of the respective retaining assembly 202. As
10 such, upon a force on the retention tab 206 in a direction opposite the biasing force, the DIN connector 203 may be inserted through the opening 210 of the respective retaining assembly 202.

[0020] Once fully inserted through the opening, the retention tab 206 may return to its original position, and because of the inward biasing force, the retention tab may at least partially overlap a portion of the mounting tab of the DIN connector 203, aiding in the retention of the

15 DIN connector 203 to the end cap 200.

[0021] Positioned in respective corners of the interior portion, between each of the retention tabs 206, may be alignment posts 208. Each of the alignment posts 208 may extend from an alignment member 214 that may be attached to, or be a part of, a respective corner of the interior portion. Each of the alignment posts 208 may extend in a direction transverse to the plane
20 defined by the end cap 200, and may be configured to engage holes in a mounting bracket of the DIN connector 203 and aid in the proper alignment of the DIN connector 203 to the end cap 200.

[0022] Fig. 4 is an inside view of the end cap 200 after each of the desired DIN connectors 203 is secured thereto. As shown, each of the openings 210 of the end cap 200 may be filled with a DIN connector 203. However, such a configuration is by way of non-limiting example
25 only. For example, as discussed above, the end cap 200 may be used with various different antenna configurations, some of which may employ fewer DIN connectors 203 than the number of existing openings 210 in the end cap 200. As such, any unused openings 203 may be filled with a filler panel (not shown), which may be snapped, or otherwise secured in place, to seal and protect the antenna from adverse environmental conditions.

30 [0023] As shown in Figs. 5 and 6, an example of an outside of the end cap 200 is shown with DIN connectors 203 connected thereto. The outside may refer to a side of the end cap 200 facing

a direction opposite the antenna 11. As best seen in the exploded view in Fig. 6, the end cap 200 may be configured such that flats 216 of the DIN connector 203 may be exposed. Such exposure may aid in the installation of the DIN connector 203, as well as reduce a risk of twist out or damage to the end cap 200.

5 **[0024]** After the desired DIN connectors 203 are secured to the end cap 200, the end cap 200 may be attached to a radome 218 of antenna 11, an outside view of which is shown in Fig. 7.

[0025] Various aspects of the present disclosure have now been discussed in detail; however, the disclosure should not be understood as being limited to these aspects. It should also be appreciated that various modifications, adaptations, and alternative embodiments thereof may be

10 made within the scope and spirit of the present disclosure.

CLAIMS

What is claimed is:

1. An apparatus comprising:
a cap configured to at least partially enclose an antenna, wherein the cap includes:
5 at least one retaining assembly formed integrally with the cap, the at least one retaining assembly being dimensioned to retain at least one cable connector to the cap.
2. The apparatus of claim 1, wherein the at least one retaining assembly includes at least one flange including an interior portion defining at least one cavity configured to receive a portion of
10 the at least one cable connector.
3. The apparatus of claim 2, wherein the at least one flange is configured to prevent rotation of at least one cable connector secured to the cap.
- 15 4. The apparatus of claim 2, wherein the at least one retaining assembly includes at least one tab biased to overlap a portion of the at least one cable connector upon reception through the at least one cavity.
5. The apparatus of claim 1, wherein the at least one retaining assembly includes at least one alignment post extending in a direction transverse to a plane defined by the cap, the alignment
20 post being configured to engage at least one hole of the at least one cable connector.
6. The apparatus of claim 1, wherein the cap is configured to be connected to a radome of the antenna.
7. The apparatus of claim 6, wherein the antenna includes a base station antenna.
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8. A cap configured to at least partially enclose an antenna, the cap comprising:
at least one retaining assembly formed integrally with the cap, the at least one retaining assembly being dimensioned to retain at least one cable connector to the cap.
9. The cap of claim 8, wherein the at least one retaining assembly includes at least one
30 flange including a polygonal interior portion defining at least one cavity for receiving a portion of the at least one cable connector.

10. The cap of claim 9, wherein the at least one flange is configured to prevent rotation of at least one cable connector secured to the cap.
- 5 11. The cap of claim 8, wherein the at least one retaining assembly includes at least one alignment post extending in a direction transverse to a plane defined by the cap, the alignment post being configured to engage at least one hole of the at least one cable connector.
12. The cap of claim 9, wherein the at least one retaining assembly includes at least one tab
10 biased to overlap a portion of the at least one cable connector upon reception through the at least one cavity.
13. The cap of claim 8, wherein the cap is capable of securing at least one cable connector associated with a first antenna of a first type and a second antenna of a second type different than
15 the first type.
14. The cap of claim 8, wherein the cap is configured to be connected to a radome of the antenna.
- 20 15. The cap of claim 8, wherein the antenna includes a base station antenna.
16. An end cap configured to secure a cable connector to an antenna, the end cap comprising:
at least one retaining assembly formed integrally with the cap, the at least one retaining
assembly being dimensioned to retain at least one cable connector to the cap, the at least one
25 retaining assembly including at least one flange having a polygonal interior portion defining at least one cavity for receiving a portion of the at least one cable connector,
wherein the end cap is configured to be connected to a radome of the antenna.
17. The end cap of claim 16, wherein the at least one flange is configured to prevent rotation
30 of at least one cable connector secured to the end cap.
18. The end cap of claim 16, wherein the at least one retaining assembly includes at least one alignment post extending in a direction transverse to a plane defined by the end cap, the alignment post being configured to engage at least one hole of the at least one cable connector.

19. The end cap of claim 16, wherein the at least one retaining assembly includes at least one tab biased to overlap a portion of the at least one cable connector upon reception through the at least one cavity.

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20. The end cap of claim 16, wherein the antenna includes a base station antenna.

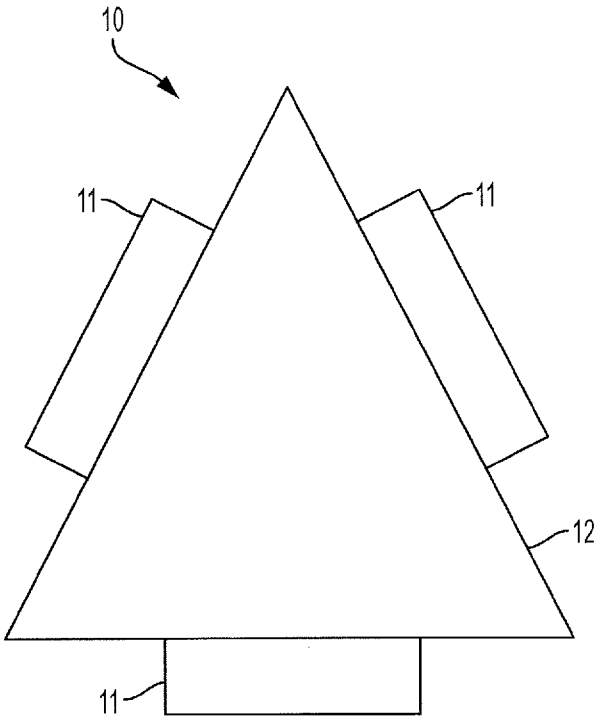


FIG. 1

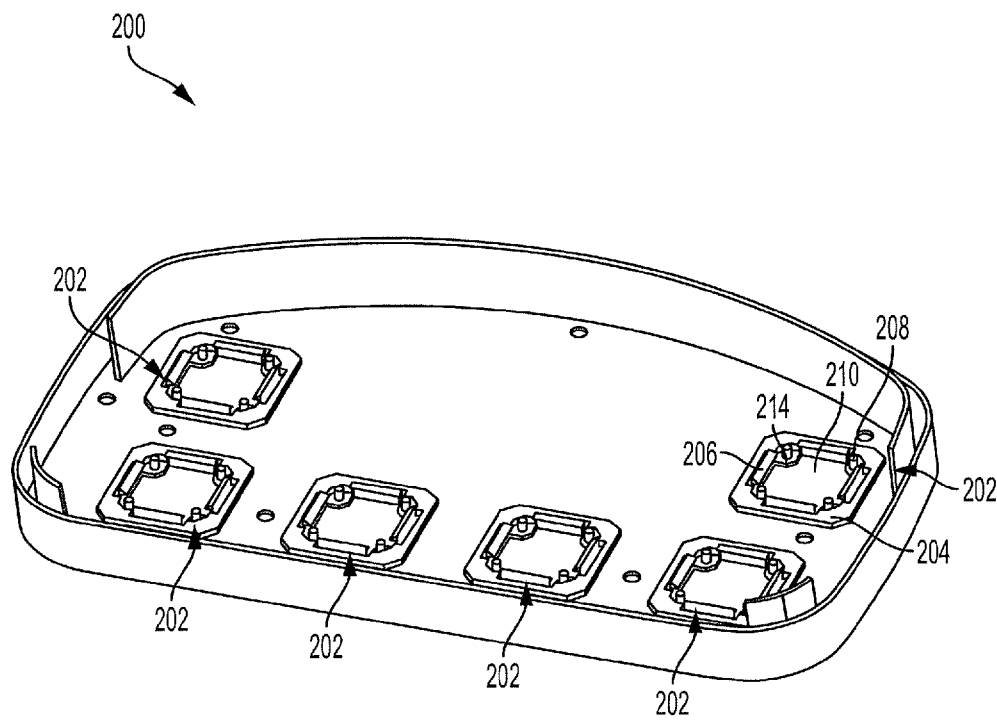


FIG. 2

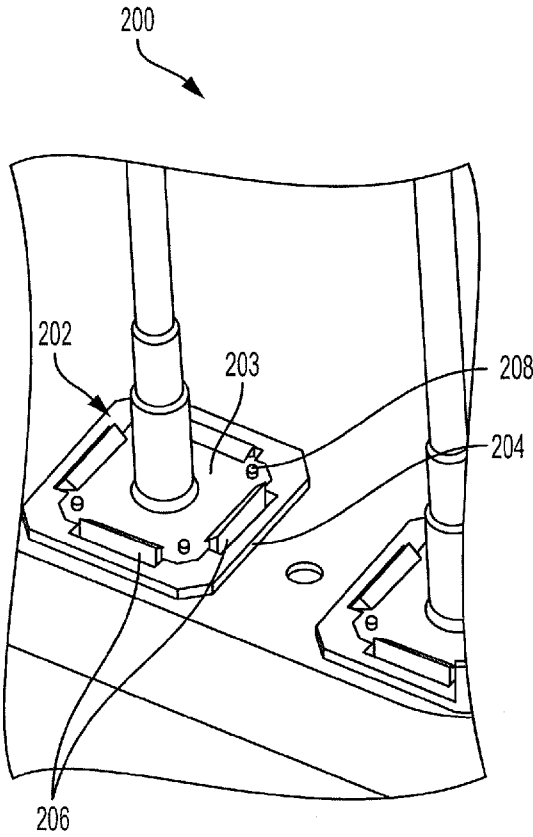


FIG. 3

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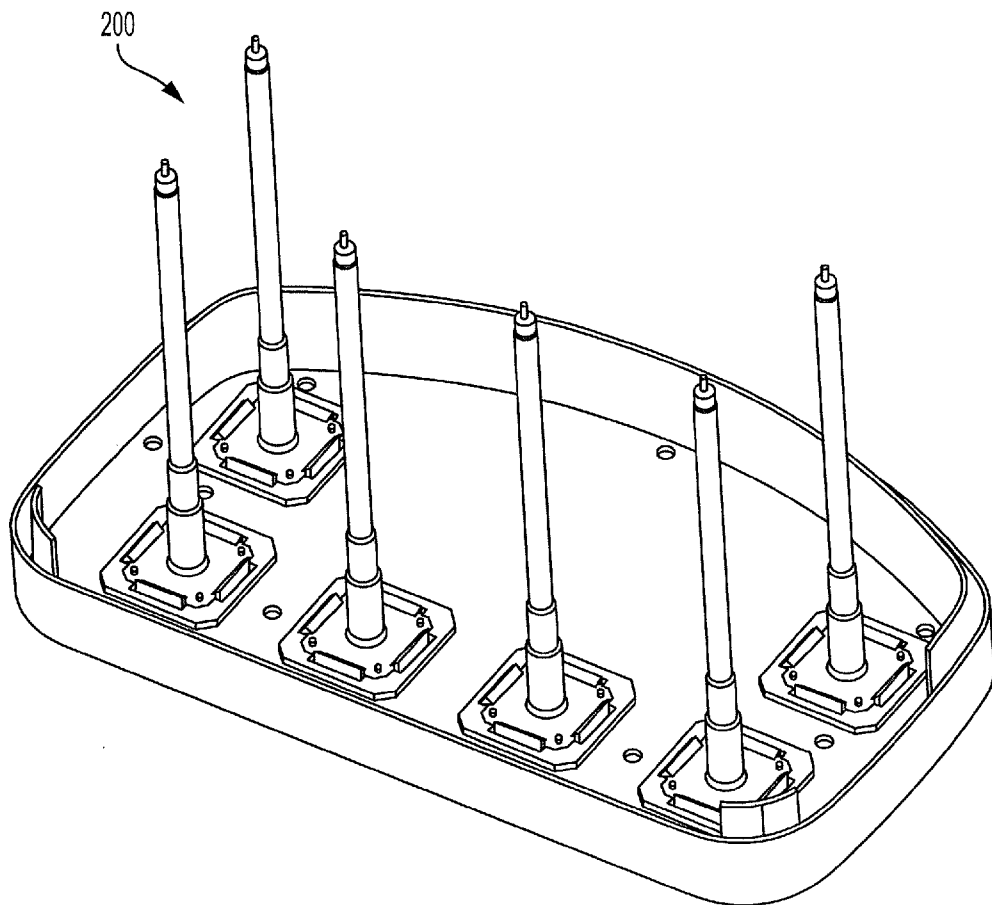


FIG. 4

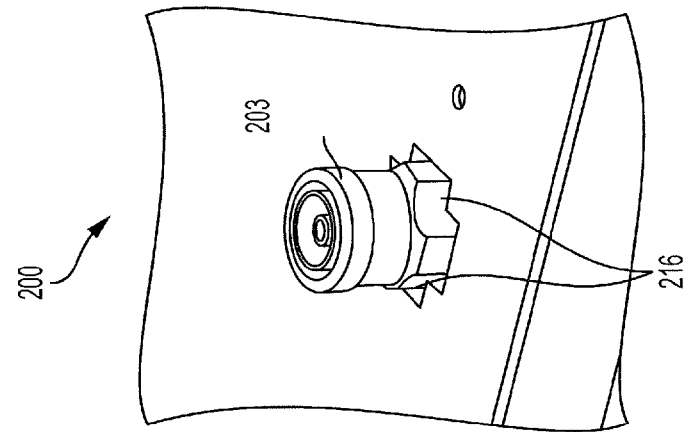


FIG. 6

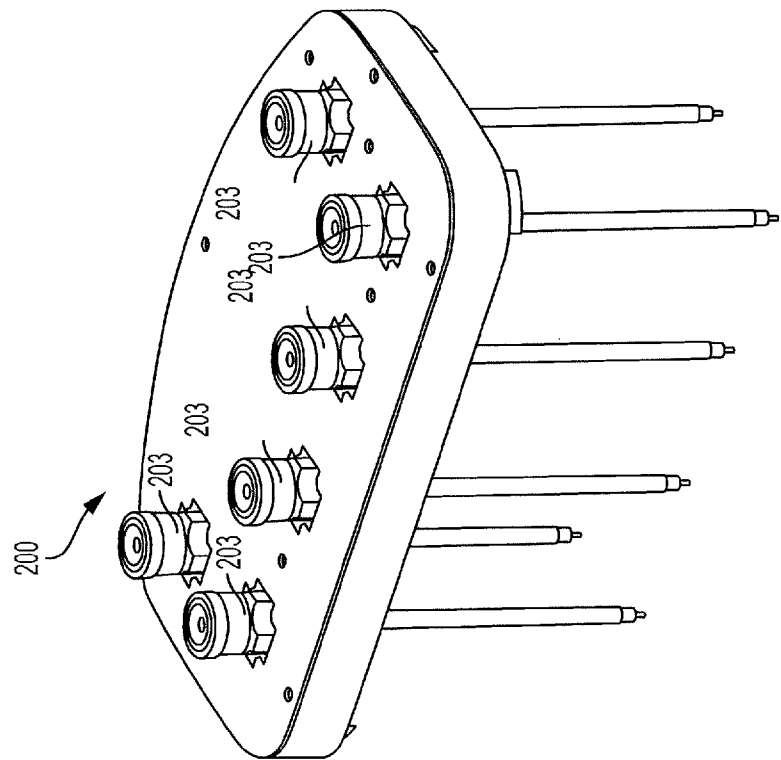


FIG. 5

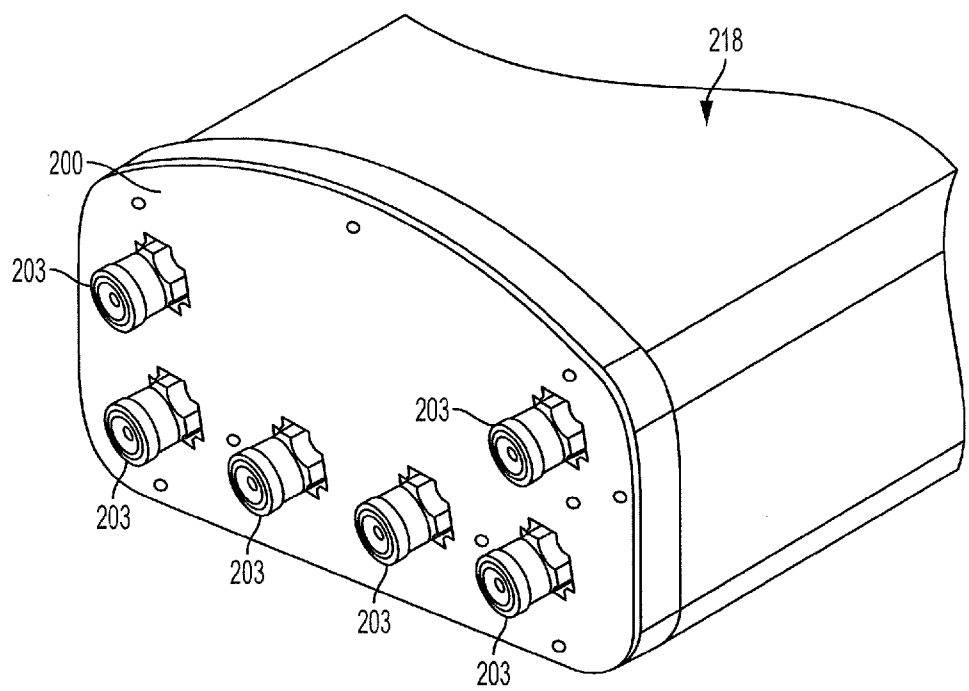


FIG. 7

A. CLASSIFICATION OF SUBJECT MATTER**H01R 13/648(2006.01)i, H01Q 1/12(2006.01)i, H01Q 1/42(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R 13/648; H01R 24/38; G02B 6/38; H01R 13/73; H01R 17/18; H01R 13/6592; H01Q 1/12; H01Q 1/42

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: cap, antenna, retaining assembly, flange, anti-rotation

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 20-1998-0028090 U (DAEWOO ELECTRONIC COMPONENTS CO., LTD.) 05 August 1998 See abstract, page 2 and figure 2.	1-8,11,14-15
Y		9-10,12-13,16-20
Y	US 2014-0134878 A1 (ANDREW LLC.) 15 May 2014 See abstract, paragraph [0054], claim 1 and figure 7.	9-10,12-13,16-20
A	US 2008-0233795 A1 (JAMES P. KUCERA et al.) 25 September 2008 See abstract, paragraphs [0025]-[0032], claim 1 and figure 6.	1-20
A	US 2009-0060421 A1 (RUTESH D. PARIKH et al.) 05 March 2009 See abstract, paragraphs [0095]-[0161], claims 1-13 and figures 16-24B.	1-20
A	US 5059139 A (GEORG SPINNER) 22 October 1991 See abstract, column 2, line 48 - column 3, line 5 and figure 1.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

15 March 2016 (15.03.2016)

Date of mailing of the international search report

15 March 2016 (15.03.2016)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

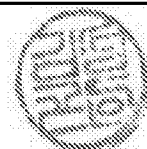
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/061757

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20-1998-0028090 U	05/08/1998	None	
US 2014-0134878 A1	15/05/2014	CN 103210551 A	17/07/2013
		CN 103210552 A	17/07/2013
		CN 103210552 B	25/11/2015
		CN 103221196 A	24/07/2013
		CN 103222119 A	24/07/2013
		CN 103222124 A	24/07/2013
		CN 103222125 A	24/07/2013
		CN 103222126 A	24/07/2013
		CN 103299491 A	11/09/2013
		CN 103299491 B	16/09/2015
		CN 103380547 A	30/10/2013
		CN 103843207 A	04/06/2014
		CN 103875136 A	18/06/2014
		CN 103907246 A	02/07/2014
		CN 104737386 A	24/06/2015
		CN 104781990 A	15/07/2015
		CN 104781999 A	15/07/2015
		CN 104798265 A	22/07/2015
		CN 104823339 A	05/08/2015
		EP 2643146 A1	02/10/2013
		EP 2643894 A1	02/10/2013
		EP 2643894 B1	23/09/2015
		EP 2643895 A2	02/10/2013
		EP 2643896 A1	02/10/2013
		EP 2643897 A1	02/10/2013
		EP 2643898 A1	02/10/2013
		EP 2643898 B1	23/09/2015
		EP 2643899 A1	02/10/2013
		EP 2643900 A1	02/10/2013
		EP 2643901 A1	02/10/2013
		EP 2777098 A1	17/09/2014
		EP 2777099 A1	17/09/2014
		EP 2777100 A1	17/09/2014
		EP 2904668 A1	12/08/2015
		EP 2917977 A1	16/09/2015
		EP 2917979 A1	16/09/2015
		EP 2917980 A1	16/09/2015
		EP 2917981 A1	16/09/2015
		US 2012-0125513 A1	24/05/2012
		US 2012-0125654 A1	24/05/2012
		US 2012-0129375 A1	24/05/2012
		US 2012-0129383 A1	24/05/2012
		US 2012-0129384 A1	24/05/2012
		US 2012-0129388 A1	24/05/2012
		US 2012-0129389 A1	24/05/2012
		US 2012-0129390 A1	24/05/2012
		US 2012-0129391 A1	24/05/2012

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/061757

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2012-0302088 A1	29/11/2012
		US 2013-0025121 A1	31/01/2013
		US 2013-0037299 A1	14/02/2013
		US 2013-0037300 A1	14/02/2013
		US 2013-0037301 A1	14/02/2013
		US 2013-0037320 A1	14/02/2013
		US 2013-0038410 A1	14/02/2013
		US 2013-0038411 A1	14/02/2013
		US 2013-0038412 A1	14/02/2013
		US 2013-0065415 A1	14/03/2013
		US 2013-0065420 A1	14/03/2013
		US 2013-0065422 A1	14/03/2013
		US 2013-0102178 A1	25/04/2013
		US 2013-0102200 A1	25/04/2013
		US 2014-0134863 A1	15/05/2014
		US 2014-0134875 A1	15/05/2014
		US 2014-0134876 A1	15/05/2014
		US 8302296 B2	06/11/2012
		US 8365404 B2	05/02/2013
		US 8453320 B2	04/06/2013
		US 8479383 B2	09/07/2013
		US 8550843 B2	08/10/2013
		US 8550859 B2	08/10/2013
		US 8563861 B2	22/10/2013
		US 8608507 B2	17/12/2013
		US 8622762 B2	07/01/2014
		US 8622768 B2	07/01/2014
		US 8747152 B2	10/06/2014
		US 8801460 B2	12/08/2014
		US 8826525 B2	09/09/2014
		US 8876549 B2	04/11/2014
		US 8887388 B2	18/11/2014
		US 8888528 B2	18/11/2014
		US 8894439 B2	25/11/2014
		US 9048527 B2	02/06/2015
		US 9209510 B2	08/12/2015
		WO 2012-071079 A1	31/05/2012
		WO 2012-071080 A1	31/05/2012
		WO 2012-071081 A1	31/05/2012
		WO 2012-071082 A1	31/05/2012
		WO 2012-071083 A1	31/05/2012
		WO 2012-071084 A1	31/05/2012
		WO 2012-071085 A1	31/05/2012
		WO 2012-071106 A1	31/05/2012
		WO 2012-071234 A2	31/05/2012
		WO 2012-071234 A3	09/08/2012
		WO 2013-025268 A1	21/02/2013
		WO 2013-025269 A1	21/02/2013
		WO 2013-025488 A2	21/02/2013
		WO 2013-025488 A3	02/05/2013

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/061757

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2013-025500 A2	21/02/2013
		WO 2013-025500 A3	10/05/2013
		WO 2013-025506 A2	21/02/2013
		WO 2013-025506 A3	02/05/2013
		WO 2013-025509 A2	21/02/2013
		WO 2013-025509 A3	25/04/2013
		WO 2013-025514 A2	21/02/2013
		WO 2013-025514 A3	02/05/2013
		WO 2013-025515 A2	21/02/2013
		WO 2013-025515 A3	02/05/2013
		WO 2013-058785 A1	25/04/2013
		WO 2013-071202 A1	16/05/2013
		WO 2013-071204 A1	16/05/2013
		WO 2013-071205 A1	16/05/2013
		WO 2013-071206 A1	16/05/2013
		WO 2014-055215 A1	10/04/2014
		WO 2014-074219 A1	15/05/2014
		WO 2014-074222 A1	15/05/2014
		WO 2014-074223 A1	15/05/2014
		WO 2014-074798 A1	15/05/2014
US 2008-0233795 A1	25/09/2008	US 8152542 B2	10/04/2012
US 2009-0060421 A1	05/03/2009	AR 065744 A1	24/06/2009
		CN 101636679 A	27/01/2010
		CN 101636679 B	18/04/2012
		EP 2130079 A1	09/12/2009
		JP 2010-521707 A	24/06/2010
		MX 2009009595 A	16/09/2009
		TW 200900774 A	01/01/2009
		US 2010-0086260 A1	08/04/2010
		US 7738759 B2	15/06/2010
		US 8879883 B2	04/11/2014
		WO 2008-115795 A1	25/09/2008
US 5059139 A	22/10/1991	None	