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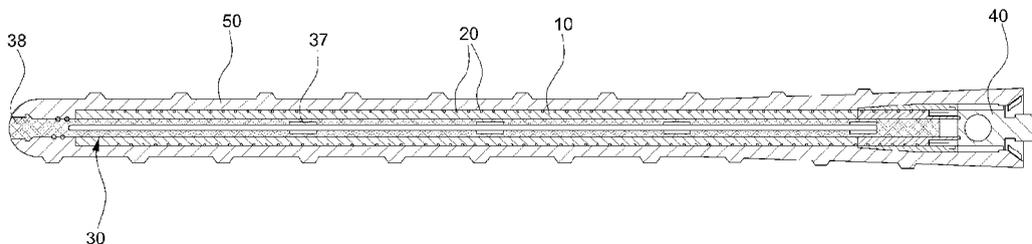
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(54) **Dual band antenna for vehicle**

(57) The present invention relates to a dual band antenna for vehicle, comprising a cylindrical member (10) with a hollow bore formed therein; a coil member (20) wound along outer surface of the cylindrical member (10); a coupling member (30) inserted in the hollow bore of the cylindrical member (10); a connector (40) positioned at an end of the coil member (20); and a cover member (50). The coil member (20) receives a frequency band for radio, and receives a frequency band for TDMB (Ter-

restrial Digital Multimedia Broadcasting) or DAB III (Digital Audio Broadcasting Band III) by means of secondary resonance due to coupling between the coupling member (30) and the coil member (20). Accordingly, the dual band antenna for vehicle can multiply receive signals of frequency bands for radio and TDMB or DAB III as a single antenna. Furthermore, efficiencies of production and installation can be enhanced corresponding to single antennas for radio and TDMB or DAB III.

Fig. 4



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**Description**FIELD OF THE INVENTION

5 **[0001]** The present invention relates to a dual band antenna for vehicle, more specifically, a dual band antenna for vehicle that can multiply receive signals of frequency bands for radio and TDMB or DAB III as a single antenna by inserting the coupling member within the cylindrical member with the coil member wound thereon for receiving a signal of frequency band for radio and thus realizing the secondary resonance due to the coupling phenomenon between the coil member and coupling member.

BACKGROUND OF THE INVENTION

**[0002]** Generally used in a vehicle is a pole-type antenna for allowing a radio in the vehicle to receive signals.

15 **[0003]** In this regard, a conventional helical antenna is an antenna having a spiral coil structure such that resonance may be generated at its length shorter than the length( $\lambda/4$ ) of pole-type antenna, and such a helical antenna exhibits a resonance at a specific frequency according to the length and pitch of the antenna.

**[0004]** However, the helical antenna is difficult to exhibit a resonance at another resonance frequency desired by users as the resonance is generated at a specific frequency of single band.

20 **[0005]** That is to say, in the case of the conventional helical antenna, primary resonance is possible, but secondary resonance is difficult to be generated at a desired frequency, and thus there is a problem that two frequencies cannot be selected.

**[0006]** Furthermore, there are problems that tuning is difficult, large error is generated, the return value of resonance frequency is subject to much losses, and in injecting the coil by means of an insert injection method, a state of the tuning is changed, and therefore a desired resonance frequency is not provided.

25 **[0007]** Meanwhile, recently, as various services such as mobile communication are commercialized, such new electronic products are developed, and equipped in vehicle are devices to which corresponding mobile communication technologies are applied.

**[0008]** In addition, in order to satisfy various desires of consumers, electronic devices for new application such as internet, TV signal reception, navigation system, DMB (Digital Multimedia Broadcasting), DAB etc. for use in vehicle are developed.

30 **[0009]** That is to say, only function of vehicle is to simply provide the consumer with transportability, but the function has been extended recently to a concept of providing of safe, convenient and efficient transportation means.

**[0010]** Therefore, antenna system for vehicle for new application is required for various wireless services provided in vehicle such as internet, TV signal reception, navigation system, DMB, DAB etc. for use in vehicle, and the actual circumstance is that the antenna system gradually become more complex and is diversified due to the development of information and communication technology.

35 **[0011]** By the way, in the case of a conventional antenna system for vehicle, signal-receiving antennas for various wireless services are separately constructed for respective wireless service.

40 **[0012]** However, in the conventional antenna system for vehicle as mentioned above, embodiment of a separate antenna for respective wireless service exhibits a structural problem related with installation in a limited space of vehicle etc.

SUMMARY OF THE INVENTION

45 **[0013]** The present invention has been devised to solve the above-mentioned problems, and its object is to provide a dual band antenna for vehicle that can multiply receive signals of frequency bands for radio and TDMB or DAB III as a single antenna by inserting the coupling member within the cylindrical member with the coil member wound thereon for receiving a signal of frequency band for radio and thus realizing the secondary resonance due to the coupling phenomenon between the coil member and coupling member.

50 **[0014]** Another object of the present invention is to provide a dual band antenna for vehicle where efficiencies of production and installation can be enhanced by multiply receiving the signals corresponding to frequency bands for radio and TDMB or DAB III with a single antenna.

55 **[0015]** The above-mentioned object can be achieved by a dual band antenna for vehicle, comprising a cylindrical member with a hollow bore formed therein; a coil member wound along outer surface of the cylindrical member; a coupling member inserted in the hollow bore of the cylindrical member; a connector positioned at an end of the coil member; and

a cover member enclosing the cylindrical member with the coil member wound thereon and the coupling member inserted therein, wherein the coil member receives a signal of frequency band for radio, and receive a signal of frequency band

for TDMB (Terrestrial Digital Multimedia Broadcasting) or DAB III (Digital Audio Broadcasting Band III) by means of secondary resonance due to a coupling phenomenon between the coupling member and the coil member.

[0016] Here, formed on the outer surface of the cylindrical member along a longitudinal direction thereof may be formed a coil groove of spiral shape in which the coil member is seated.

[0017] Furthermore, the coupling member may comprise a coupler made of metal material and a molding member enclosing the coupler.

[0018] Here, the coupler and molding member may be integrally assembled by insert molding method.

[0019] Furthermore, the coupler extends in straight line structure along a longitudinal direction of the antenna, and its one end portion may be formed with coil structure having a constant pitch.

[0020] Here, the coupler of straight line structure is inserted within the molding member, and the coupler of coil structure may be configured to be wound along outer surface of the molding member.

[0021] On the one hand, the molding member can comprise a plurality of cutouts exposing the coupler molded inside the molding member along the longitudinal direction thereof.

[0022] In addition, integrally formed at an end portion of the molding member may be a cap correspondingly engaging a cap groove formed at an end portion of the cover member.

[0023] According to the present invention, the dual band antenna for vehicle can multiply receive signals of frequency bands for radio and TDMB or DAB III as a single antenna by inserting the coupling member within the cylindrical member with the coil member wound thereon for receiving a signal of frequency band for radio and thus realizing the secondary resonance due to the coupling phenomenon between the coil member and coupling member.

[0024] Furthermore, efficiencies of production and installation can be enhanced by multiply receiving the signals corresponding to frequency bands for radio and TDMB or DAB III with a single antenna.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The attached drawings have a purpose of facilitating the understanding of the technical concepts of the present invention along with the above detailed description of the invention, and thus the present invention should not be interpreted while being limited to the matters illustrated in the attached drawings.

Fig. 1 is a perspective view illustrating a coupling member of a dual band antenna for vehicle according to the present invention, Fig. 1 (a) being a perspective view illustrating a coupler of the present invention, and Fig. 1 (b) being a perspective view illustrating the coupler and a molding member integrally assembled by insert molding.

Fig. 2 is a side view illustrating a coupled state of the coupling member and a cylindrical member of the dual band antenna for vehicle according to the present invention.

Fig. 3 is an exploded side sectional view of the coupling member and a cover member of the dual band antenna for vehicle according to the present invention.

Fig. 4 is a side sectional view of the dual band antenna for vehicle according to the present invention.

Fig. 5 is a graph showing return losses at frequency bands for radio and TDMB or DAB III for the dual band antenna for vehicle according to the present invention.

#### \* LISTS OF REFERENCE NUMERALS IN THE DRAWINGS \*

##### [0026]

10 : cylindrical member	12 : hollow bore
14 : coil groove	20 : coil member
30 : coupling member	31 : coupler
31a : coupler of straight line structure	31b : coupler of coil structure
36 : molding member	37 : cutout
38 : cap	40 : connector
50 : cover member	

#### DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0027] Hereinafter, constructions of the present invention will be described in detail with reference to the attached drawings.

[0028] Prior to this, terms used in the specification and claims should not be limitedly interpreted as lexical meanings,

but should be interpreted as meanings and concepts coinciding to technical concepts of the present invention based on the principle that inventors may properly define the concepts of the terms in order to explain their inventions in a best way.

[0029] Therefore, examples described in the specification and constructions illustrated in the drawings are only preferred examples of the present invention, and do not represent all of the technical concepts of the present invention, and thus it should be understood that various equalities and modifications may be present which can replace them at the time of application of the present invention.

[0030] Fig. 1 is a perspective view illustrating a coupling member of a dual band antenna for vehicle according to the present invention, wherein Fig. 1(a) is a perspective view illustrating a coupler of the present invention, and Fig. 1(b) is a perspective view illustrating the coupler and a molding member integrally assembled by insert molding, Fig. 2 is a side view illustrating a coupled state of the coupling member and a cylindrical member of the dual band antenna for vehicle according to the present invention, Fig. 3 is an exploded side sectional view of the coupling member and a cover member of the dual band antenna for vehicle according to the present invention, Fig. 4 is a side sectional view of the dual band antenna for vehicle according to the present invention, and Fig. 5 is a graph showing return losses at frequency bands for radio and TDMB or DAB III for the dual band antenna for vehicle according to the present invention.

[0031] Referring to Figs. 1 to 5, the dual band antenna for vehicle according to the present invention comprises a cylindrical member 10 with a hollow bore 12 formed therein; a coil member 20 wound along outer surface of the cylindrical member 10; a coupling member 30 inserted in the hollow bore 12 of the cylindrical member 10; a connector 40 positioned at an end of the coil member 20; and a cover member 50 enclosing the cylindrical member 10 with the coil member 20 wound thereon and the coupling member 30 inserted therein, wherein the coil member 20 receives a signal of frequency band for radio, and is arranged to receive a signal of frequency band for TDMB (Terrestrial Digital Multimedia Broadcasting) or DAB III (Digital Audio Broadcasting Band III) by means of secondary resonance due to a coupling phenomenon between the coupling member 30 and the coil member 20.

[0032] Here, the cylindrical member 10 is a component that internally defines the hollow bore 12 in which the coupling member 30 is inserted, and externally provides a space where the coil member 20 is wound and seated, and the cylindrical member can be configured to be disposed within the cover member 50.

[0033] Furthermore, as shown in Fig. 3, formed on the outer surface of the cylindrical member 10 along a longitudinal direction thereof may be formed coil groove 14 in which the coil member 20 is seated, and this coil groove 14 may be arranged in a spiral shape corresponding to the shape of the coil member 20 to be seated.

[0034] Here, the coil member 20 is a component that serves to receive a signal of frequency band for radio and at the same time receives a signal of frequency band for TDMB or DAB III by means of the secondary resonance due to the coupling phenomenon between the coupling member 30 and the coil member, description of the secondary resonance being given below, and the coil member may be provided as a coil spring.

[0035] Furthermore, the coil member 20 serves to transmit a received frequency signal by contacting with the connector 40, and the connector 40 is a component that serves to connect the frequency signal transmitted from the coil member 20 to various devices at the rear end portion of the connector. Meanwhile, the coupling member 30 is a characteristic component allowing the dual band antenna for vehicle according to the present invention to receive signals of frequency bands for radio and TDMB or DAB III simultaneously by means of the secondary resonance due to the coupling phenomenon between the coil member 20 and the coupling member.

[0036] Here, as shown in Fig. 1, the coupling member 30 can comprise a coupler 31 made of metal material and a molding member 36 enclosing the coupler 31.

[0037] Furthermore, as shown in Fig. 1(a), the coupler 31 comprises a coupler 31 a of straight line structure extending along the longitudinal direction of the antenna and a coupler 31 b of coil structure wound with a constant pitch at an end portion of the coupler 31 a of straight line structure.

[0038] Here, as shown in Fig. 1(b), the coupler 31 a of straight line structure is inserted within the molding member 36, and the coupler 31 b of coil structure may be configured to be wound along outer surface of the molding member 36.

[0039] That is to say, the dual band antenna for vehicle according to the present invention is a resonance antenna incorporating the helical coil member 20 and the coupling member 30, and can receive signals of frequency bands for radio and TDMB or DAB III simultaneously by means of the secondary resonance induced due to the coupling phenomenon between the coil member 20 and the coupling member 30.

[0040] Here, primary (radio) or secondary (TDMB or DAB III) resonance frequency can be obtained by properly tuning the pitch interval and length of the coil member 20, the length of the coupler 31 a of straight line structure, the number of windings of the coupler 31 b of coil structure and dielectric material constituting the antenna etc.

[0041] Here, the coupler 31 and molding member 36 are integrally assembled by the insert molding method, and the molding member 36 may comprise a plurality of cutouts 37 exposing the coupler 31 molded inside the molding member along the longitudinal direction thereof.

[0042] Here, the cutouts 37 are constructed to expose a portion or all of the coupler 31, thereby serving to prevent the coupler 31 from being pushed or deviated in the process of insert molding.

[0043] Furthermore, as shown in Fig. 3, integrally formed at an end portion of the molding member 36 is a cap 38

correspondingly engaging a cap groove 52 formed at an end portion of the cover member 50, thereby exhibiting effects that easiness of producing associated with assembling and incorporating of the coupling member 30 etc. is enhanced and at the same time the cost of product is reduced.

[0044] Referring to Fig. 5, the dual band antenna for vehicle according to the present invention exhibits a reduced return loss at a frequency band from 88 MHz ~ 108 MHz compared to the return loss at another frequency band, and has a lowest value of the return loss at 100.25 MHz.

[0045] Furthermore, the dual band antenna for vehicle according to the present invention exhibits a reduced return loss at a frequency band from 174 MHz ~ 216 MHz compared to the return loss at another frequency band, and has a lowest value of the return loss at 198.3 MHz.

[0046] As can be seen from the above, the dual band antenna for vehicle according to the present invention exhibits a dual resonance at frequency band for radio and frequency band for TDMB or DAB III, thereby smoothly receiving signals of frequency bands for radio and TDMB or DAB III.

[0047] As described above, the dual band antenna for vehicle according to the present invention can multiply receive signals of frequency bands for radio and TDMB or DAB III as a single antenna by inserting the coupling member within the cylindrical member with the coil member wound thereon for receiving a signal of frequency band for radio and thus realizing the secondary resonance due to the coupling phenomenon between the coil member and coupling member.

[0048] Furthermore, efficiencies of production and installation can be enhanced by multiply receiving the signals corresponding to frequency bands for radio and TDMB or DAB III with a single antenna.

[0049] As mentioned above, though the present invention has been described with the specific examples and drawings, its technical concepts are not limited to them, and therefore the persons having ordinary skills in the art may carry out the present invention in other way by various modifications and alterations thereof without departing from the technical concepts of the present invention and equalities of the following claims.

## Claims

### 1. A dual band antenna for vehicle, comprising:

a cylindrical member with a hollow bore formed therein;  
 a coil member wound along outer surface of the cylindrical member;  
 a coupling member inserted in the hollow bore of the cylindrical member;  
 a connector positioned at an end of the coil member; and  
 a cover member enclosing the connector and the cylindrical member with the coil member wound thereon and the coupling member inserted therein,

wherein the coil member receives a signal of frequency band for radio, and receives a signal of frequency band for TDMB (Terrestrial Digital Multimedia Broadcasting) or DAB III (Digital Audio Broadcasting Band III) by means of secondary resonance due to a coupling phenomenon between the coupling member (30) and the coil member (20).

2. The dual band antenna for vehicle according to claim 1, wherein on the outer surface of the cylindrical member along a longitudinal direction thereof is formed a coil groove of spiral shape in which the coil member to be seated.

3. The dual band antenna for vehicle according to claim 1, wherein the coupling member comprises a coupler made of metal material and a molding member enclosing the coupler.

4. The dual band antenna for vehicle according to claim 3, wherein the coupler and the molding member are integrally assembled by insert molding method.

5. The dual band antenna for vehicle according to claim 4, wherein the coupler extends in straight line structure along a longitudinal direction of the antenna, and its one end portion is formed with coil structure having a constant pitch.

6. The dual band antenna for vehicle according to claim 5, wherein the coupler of straight line structure is inserted within the molding member, and the coupler of coil structure is wound along outer surface of the molding member.

7. The dual band antenna for vehicle according to claim 6, wherein the molding member comprises a plurality of cutouts exposing the coupler molded inside the molding member along

the longitudinal direction thereof.

8. The dual band antenna for vehicle according to claim 7, wherein integrally formed at an end portion of the molding member is a cap correspondingly engaging a cap groove formed at an end portion of the cover member.

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Fig. 1

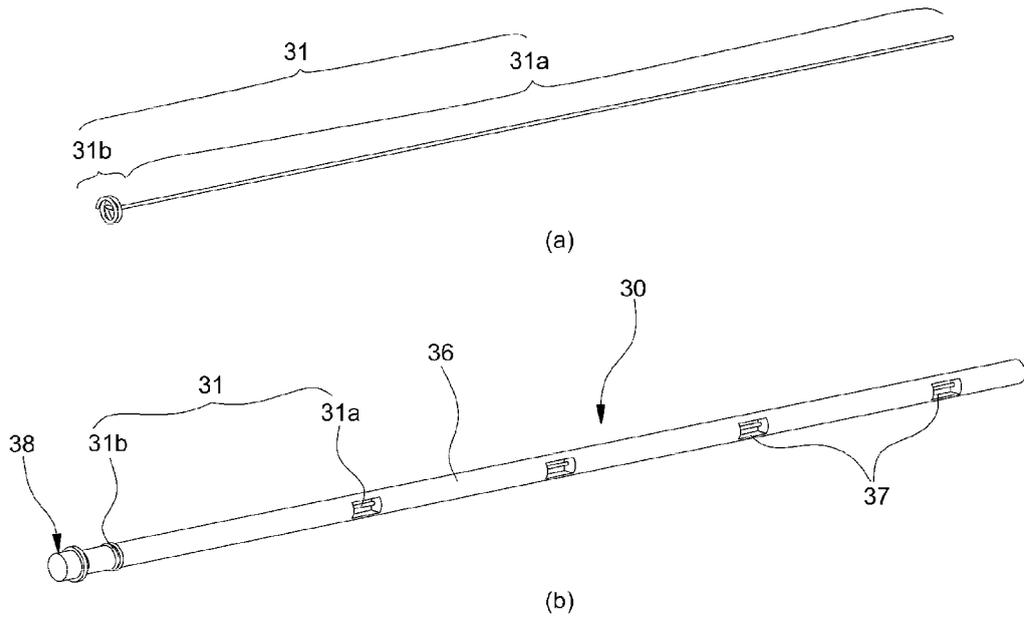


Fig. 2

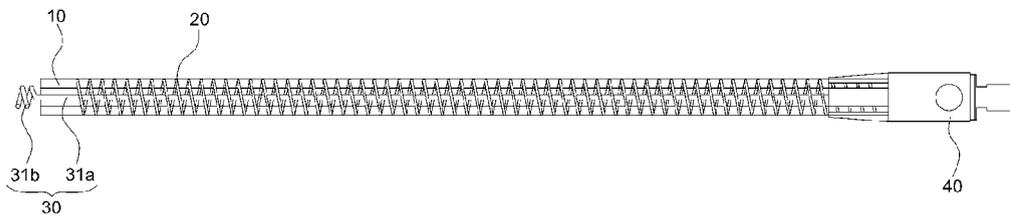


Fig. 3

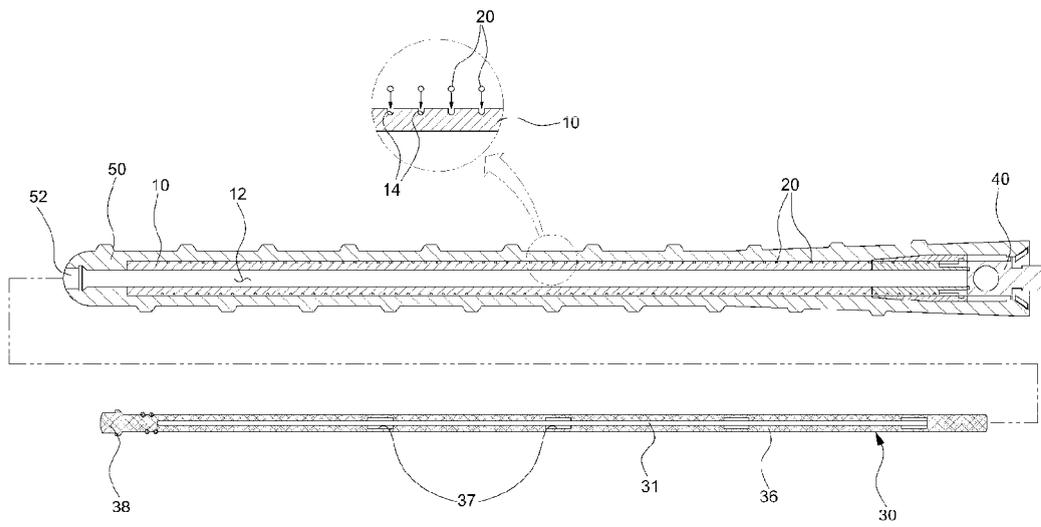


Fig. 4

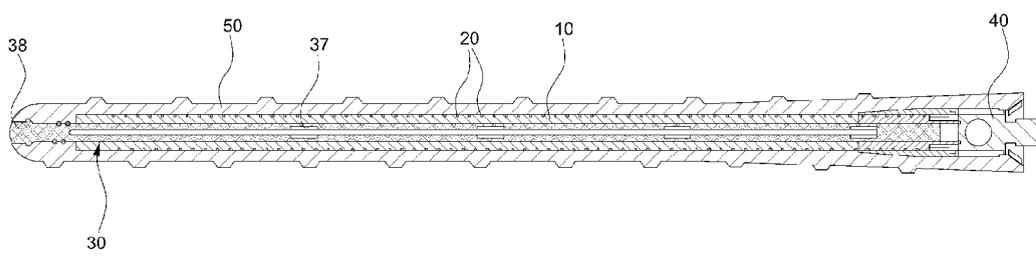
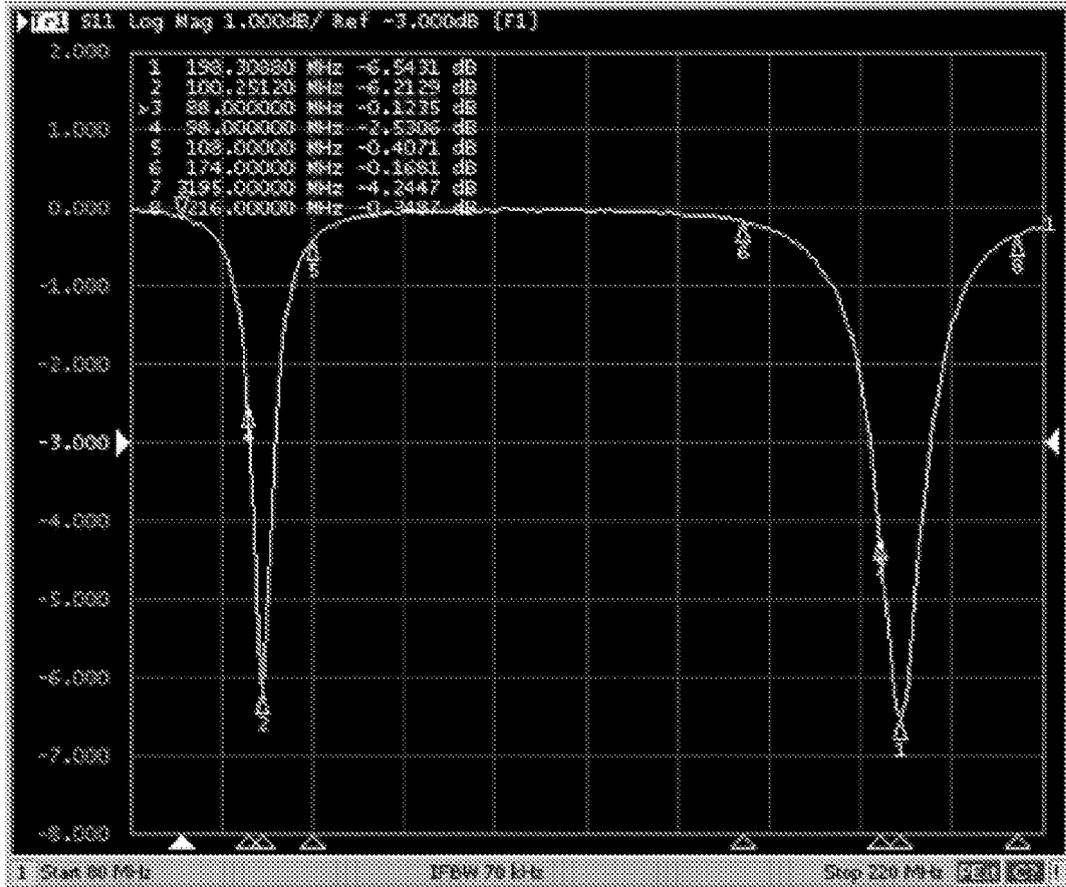


Fig. 5





EUROPEAN SEARCH REPORT

Application Number  
EP 11 18 1754

DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
X	GB 2 410 837 A (HARADA IND CO LTD [GB]) 10 August 2005 (2005-08-10)	1	INV. H01Q1/32 H01Q1/36 H01Q5/00	
Y	* page 1, line 1 - line 5 * * page 1, line 10 - line 22 * * page 7, line 5 - page 10, line 2 * * page 13, line 14 - page 14, line 4 * * page 15, line 21 - page 16, line 5 * * figures 2-5 7, 9, 10 *	2-6		
X	US 2009/284441 A1 (WAKUI MASASHI [JP]) 19 November 2009 (2009-11-19)	1-3		
Y	* paragraph [0061] - paragraph [0065] * * paragraph [0070] - paragraph [0074] * * figures 11-13, 19, 20 *	2,3		
Y	EP 1 014 475 A1 (YOKOWO SEISAKUSHO KK [JP]) 28 June 2000 (2000-06-28) * paragraph [0025] * * figures 5, 9 *	3-6		
X	EP 2 287 966 A1 (DELPHI DELCO ELECT EUROPE GMBH [DE]) 23 February 2011 (2011-02-23)	1		
A	* column 1, line 1 - line 11 * * column 1, line 44 - line 50 * * page 6, line 6 - line 12 * * column 7, line 2 - line 31 * * figure 4 *	2-8		
The present search report has been drawn up for all claims				TECHNICAL FIELDS SEARCHED (IPC)
				H01Q
Place of search		Date of completion of the search		Examiner
Munich		11 July 2012	Köppe, Maro	
CATEGORY OF CITED DOCUMENTS				
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

1 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 18 1754

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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11-07-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2410837 A	10-08-2005	DE 112005000302 T5	04-01-2007
		GB 2410837 A	10-08-2005
		JP 4586028 B2	24-11-2010
		JP 2007520964 A	26-07-2007
		WO 2005078862 A1	25-08-2005
-----			
US 2009284441 A1	19-11-2009	JP 4129038 B2	30-07-2008
		JP 4869273 B2	08-02-2012
		JP 2008172748 A	24-07-2008
		JP 2008182754 A	07-08-2008
		US 2009284441 A1	19-11-2009
-----			
EP 1014475 A1	28-06-2000	EP 1014475 A1	28-06-2000
		US 6256000 B1	03-07-2001
		WO 9833230 A1	30-07-1998
-----			
EP 2287966 A1	23-02-2011	DE 102009037722 A1	24-02-2011
		EP 2287966 A1	23-02-2011
		US 2011193755 A1	11-08-2011
-----			