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(54) **Small antenna for vehicle**

Kleine Antenne für ein Fahrzeug

Petite antenne pour véhicule

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a small antenna for vehicle, more specifically, a small antenna for vehicle wherein by inserting a dielectric body and conductor inside a coil member and at the same time disposing a cylindrical member made of metal material at one end of the coil member, the antenna can enhance the electrical properties (gain, directivity etc.) to thereby obtain the signal reception performance over a fixed level, while reducing the length of the antenna.

BACKGROUND OF THE INVENTION

[0002] GB 2 389 232 A, US 6,107,970 A and WO 2011/004636 A1 disclose antennae.

[0003] Generally used in a vehicle is a pole-type helical antenna which allows a radio in the vehicle to receive signals.

[0004] In this regard, the conventional pole-type helical antenna is an antenna having a spiral coil structure such that resonance may be generated at a shorter length than antenna length ($\lambda/4$), and such a helical antenna exhibits a resonance at a specific frequency according to the length and pitch etc.

[0005] In general, the conventional pole-type helical antenna for vehicle has a length of about 180 - 220 mm for smoothly receiving signal of frequency of AM/FM band.

[0006] However, the conventional pole-type helical antenna has a disadvantage that its length is too long to conform to the design of the vehicle currently launched in the market, and a problem that if the length of the pole-type helical antenna is short, smooth reception of frequency signal is not possible.

[0007] Therefore, attempts have been made to develop a small antenna for vehicle which can smoothly receive the frequency signal while reducing the length of the conventional pole-type helical antenna and reduce cost for production of the antenna and at the same time has a compact structure considering the design of the vehicle.

SUMMARY OF THE INVENTION

[0008] The present invention has been devised for solving the above-mentioned problems, and its object is to provide a small antenna for vehicle wherein by inserting the dielectric body and conductor inside the coil member of helical antenna structure and at the same time disposing the cylindrical member made of metal material at one end of the coil member, the small antenna for vehicle according to the present invention can enhance the electrical properties (gain, directivity etc.) to thereby obtain the signal reception performance over a fixed level, while reducing the length of the antenna.

[0009] Another object of the present invention is to provide a small antenna for vehicle which can receive the frequency of TDMB or DABIII band by means of the resonance due to coupling phenomenon of the signal pin contacting with the connector, and the dielectric body and conductor.

[0010] Yet another object of the present invention is to provide a small antenna for vehicle which can reduce cost for production of the antenna and at the same time have a compact external appearance conforming to the design of the vehicle by reducing the length of the antenna and can multiply receive signals of frequency of radio band and TDMB or DABIII band.

[0011] The above-mentioned objects of the present invention are achieved according to the present invention by a small antenna for vehicle, comprising a coil member of helical antenna structure with a plurality of coils formed, a connector disposed at one end of the coil member; a signal pin contacting with the connector; a cylindrical member coupled to the other end of the coil member and made of metal material; a dielectric body inserted inside the coil member and cylindrical member and disposed adjacent to the connector and signal pin; a conductor inserted inside the coil member and cylindrical member and disposed at one end of the dielectric body; and a cover member enclosing the coil member and cylindrical member inside which the dielectric body and conductor are inserted, wherein the cover member has a length of 110 ~ 130 mm, a frequency of radio band is received through the dielectric body, coil member and cylindrical member, a frequency of TDMB (Terrestrial Digital Multimedia Broadcasting) or DABIII (Digital Audio Broadcasting Band III) band is received by means of resonance due to coupling phenomenon of the dielectric body and conductor, and the signal pin receives frequency of band for mobile communication.

[0012] Here, the coil member has a length of 60 - 80 mm, the cylindrical member has a length of 20 - 40 mm, and the ratio of the length of the coil member to that of the cylindrical member may be 6:4 to 8:2.

[0013] Furthermore, the cylindrical member may be made of conductive metal material with electrical properties, and made of copper or aluminum material.

[0014] Here, the conductor is made of any one of coaxial cable, copper and SUS (Steel Use Stainless), and the dielectric body may be made of POM (Poly Oxy Methylene) or Poly Acetal.

[0015] Meanwhile, in the small antenna for vehicle, tuning value of signal reception band is adjusted according to the lengths of the dielectric body and conductor, and the ratio of the length of the dielectric body to that of the conductor may be 5:5 to 7:3.

[0016] According to the present invention, by inserting the dielectric body and conductor inside the coil member of helical antenna structure and at the same time disposing the cylindrical member made of metal material at one end of the coil member, the small antenna for vehicle according to the present invention can enhance the electrical properties (gain, directivity etc.) to thereby obtain the signal reception performance over a fixed level, while reducing the length of the antenna.

[0017] Furthermore, the small antenna for vehicle can receive the frequency of TDMB or DABIII band by means of the resonance due to coupling phenomenon of the signal pin contacting with the connector, and the dielectric body and conductor.

[0018] Furthermore, by reducing the length of the antenna, cost for production of the antenna can be reduced and at the same time a compact external appearance conforming to the design of the vehicle can be obtained, and signals of frequency of radio band and TDMB or DABIII band can be received multiply.

BRIEF DESCRIPTION OF THE DRAWING

[0019] 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 as being limited to the matters illustrated in the attached drawings.

Fig. 1 is an exploded perspective view illustrating a small antenna for vehicle according to the present invention.
Fig. 2 is a graph comparing the signal reception performances of the small antenna for vehicle according to the present invention and the conventional pole-type antenna having a 200 mm length.

* LISTS OF REFERNECE NUMERALS IN THE DRAWINGS *

[0020]

10 : coil member	20 : connector
30 : dielectric body	40 : cylindrical member
50 : cover member	60 : conductor
70 : signal pin	100 :small antenna for vehicle
D1 : the sum of the lengths of the coil member and cylindrical member	
D2: the length of the cylindrical member	

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0021] Hereinafter, constructions of the present invention will be described in detail with reference to the attached drawings.

[0022] Prior to description, it should be noted that 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.

[0023] 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.

[0024] Fig. 1 is an exploded perspective view illustrating a small antenna for vehicle according to the present invention.

[0025] Referring to Fig. 1, the small antenna 100 for vehicle according to the present invention comprises a coil member 10 of helical antenna structure with a plurality of coils formed; a connector 20 disposed at one end of the coil member 10; a signal pin 70 contacting with the connector 20; a cylindrical member 40 coupled to the other end of the coil member 10 and made of metal material; a dielectric body 30 inserted inside the coil member 10 and cylindrical member 40 and disposed adjacent to the connector 20 and signal pin 70; a conductor 60 inserted inside the coil member 10 and cylindrical member 40 and disposed at one end of the dielectric body 30; and a cover member 50 enclosing the coil member 10 and cylindrical member 40 inside which the dielectric body 30 and conductor 60 are inserted, wherein the cover member 50 has a length of 110 ~ 130 mm, a frequency of radio band is received through the dielectric body 30, coil member 10

and cylindrical member 40, a frequency of TDMB (Terrestrial Digital Multimedia Broadcasting) or DABIII (Digital Audio Broadcasting Band III) band is received by means of resonance due to coupling phenomenon of the dielectric body 30 and conductor 60, and the signal pin 70 may receive frequency of band for mobile communication.

[0026] Here, the coil member 10 is a component which serves to receive the frequency of radio band by means of the resonance through the cylindrical member 40 and dielectric body 30, and may be provided as a spring with coil pitch wound, as shown in Fig.1.

[0027] Furthermore, the coil member 10 serves to transmit the received frequency signal by contacting with the connector 20.

[0028] Here, the connector 20 is a component which serves to connect the frequency signal transmitted from the coil member 10 to a variety of equipment at rear end.

[0029] Here, the signal pin 70 is a component which serves as an antenna for receiving the frequency of band for mobile communication, and the dielectric body 30 and conductor 60 are components which receive the frequency of TDMB (Terrestrial Digital Multimedia Broadcasting) or DABIII (Digital Audio Broadcasting Band III) band by means of the coupling resonance.

[0030] Here, as shown in Fig. 1, the signal pin 70 contacts with one end of the connector 20, and a portion of the signal pin 70 may be inserted into the coil member 10.

[0031] Furthermore, the dielectric body 30 and conductor 60 are components inserted in inner space defined by the coil member 10 and cylindrical member 40, and serve to transmit the received frequency signal to the connector 20 by means of the resonance and at the same time support the coil member 10 to prevent a play thereof, thereby enhancing a signal receiving rate of the antenna.

[0032] Here, as shown in Fig. 1, the dielectric body 30 is inserted in the inner space of the coil member 10 and disposed adjacent to the connector 20, and the conductor 60 is disposed at one end of the dielectric body 30 and the coil member 10 has a length of 60 - 80 mm.

[0033] Here, if the length of the coil member 10 is less than 60 mm, frequency reception performance is reduced, and the length of the coil member 10 is more than 80 mm, the total length of the antenna is increased.

[0034] Furthermore, the dielectric body 30 may be made of any one of polyoxymethylene or acetal polymer and may be in the form of a bar with a constant length.

[0035] Here, the polyoxymethylene or acetal polymer are engineering plastics that are excellent in mechanical properties, such as fatigue resistance, toughness, wear resistance etc., which are not exhibited in another material, and have permittivity of more than a fixed level.

[0036] Furthermore, the conductor 60 may be made of any one of coaxial cable, copper and SUS (Steel Use Stainless), preferably the coaxial cable.

[0037] Here, the coaxial cable is a transmission line consisting of a long cylindrical outer conductor and one inner conductor arranged on central axis thereof, and the inner and outer conductors are concentric with each other as viewed in a cross section, and a space between the inner and outer conductors is filled with resin, and the outer conductor is covered with a sheath.

[0038] Here, in the small antenna for vehicle, tuning value of signal reception band is adjusted according to the lengths of the dielectric body 30 and conductor 60, and the ratio of the length of the dielectric body 30 to that of the conductor 60 is 5:5 to 7:3, preferably 6:4.

[0039] Meanwhile, the cylindrical member 40 is a component coupled to the other end of the coil member 10, as shown is Fig. 1, and is in the form of a cylinder made of conductive metal material with electrical properties, and with the dielectric body 30 and conductor 60 inserted inside the coil member 10 and cylindrical member 40, the dielectric body 30, conductor 60, coil member 10 and cylindrical member 40 can be resonated to receive a signal of radio frequency band.

[0040] Furthermore, with the dielectric body 30 and conductor 60 disposed inside the coil member 10 and cylindrical member 40, the small antenna 100 for vehicle according to the present invention can have enhanced electrical properties (gain, directivity), whereby a smooth reception of signal can be realized while the length of the antenna is reduced.

[0041] Here, the length D2 of the cylindrical member 40 may be 20 ~ 40 mm, wherein if the length of the cylindrical member 40 is less than 20 mm, the frequency reception performance is reduced, and if the length of the cylindrical member 40 is more than 40 mm, the total length of the antenna is increased.

[0042] That is to say, the ratio of the length of the coil member 10 to that of the cylindrical member 40 may be 6:4 to 8:2.

[0043] As described above, the sum D1 of the lengths of the coil member 10 and cylindrical member 40 may be in a range of 80 - 120 mm, and thus the length of the conventional pole-type antenna of about 200 mm can be drastically decreased.

[0044] That is to say, the small antenna 100 for vehicle according to the present invention may be embodied by disposing the connector 20 and signal pin 70 at one end of the coil member 10, coupling the cylindrical member 40 to the other end of the coil member 10, inserting the dielectric body 30 and conductor 60 inside the coil member 10 and cylindrical member 40 and assembling these all components inside the cover member 50.

[0045] Furthermore, the small antenna 100 for vehicle may be adapted to simultaneously receive the frequency of

TDMB or DABIII band by means of the secondary resonance due to coupling phenomenon of the dielectric body 30 and conductor 60 and the tuning.

[0046] In the following, referring to Fig. 2, the signal reception performances of the small antenna for vehicle according to the present invention and the conventional pole-type antenna will be described in more detail.

[0047] Fig. 2 is a graph comparing the signal reception performances of the small antenna for vehicle according to the present invention and the conventional pole-type antenna having a 200 mm length.

[0048] Referring to Fig. 2, the small antenna 100 for vehicle according to the present invention exhibits electrical properties (gain, directivity) approximately equal to the conventional pole-type antenna having a 200 mm length over the whole band of frequency from 88 MHz to 108 MHz.

[0049] Therefore, it can be recognized that the signal reception performance of the small antenna for vehicle according to the present invention is not decreased over FM frequency band, compared to the conventional pole-type antenna.

[0050] As described above, by inserting the dielectric body and conductor inside the coil member of helical antenna structure and at the same time disposing the cylindrical member made of metal material at one end of the coil member, the small antenna for vehicle according to the present invention can enhance the electrical properties (gain, directivity etc.) to thereby obtain the signal reception performance over a fixed level, while reducing the length of the antenna.

[0051] Furthermore, the small antenna for vehicle can receive the frequency of TDMB or DABIII band by means of the resonance due to coupling phenomenon of the signal pin contacting with the connector, and the dielectric body and conductor.

[0052] Furthermore, by reducing the length of the antenna, cost for production of the antenna can be reduced and at the same time a compact external appearance conforming to the design of the vehicle can be obtained, and signals of frequency of radio band and TDMB or DABIII band can be received multiply.

[0053] 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 small antenna (100) for vehicle, comprising:

   a coil member (10) of helical antenna structure with a plurality of coils formed;
   a connector (20) disposed at one end of the coil member (10);
   a signal pin (70) contacting with the connector (20); and
   a cylindrical member (40) coupled to the other end of the coil member (10);
   characterized by
   the cylindrical member (40) made of metal material;
   a dielectric body (30) inserted inside the coil member (10) and the cylindrical member (40) and disposed adjacent to the connector (20) and signal pin (70);
   a conductor (60) inserted inside the coil member (10) and cylindrical member (40) and disposed at one end of the dielectric body (30); and
   a cover member (50) enclosing the coil member (10) and cylindrical member (40) inside which the dielectric body (30) and the conductor (60) are inserted,
   wherein the cover member (50) has a length of 110 - 130 mm, a frequency of radio band is received through the dielectric body (30), coil member (10) and cylindrical member (40), a frequency of TDMB (Terrestrial Digital Multimedia Broadcasting) or DABIII (Digital Audio Broadcasting Band III) band is received by means of resonance due to coupling phenomenon of the dielectric body (30) and conductor (60), and the signal pin (70) receives frequency of band for mobile communication.

2. The small antenna (100) for vehicle according to claim 1, wherein the coil member (10) has a length of 60 - 80 mm, the cylindrical member (40) has a length of 20 ~ 40 mm, and the ratio of the length of the coil member (10) to that of the cylindrical member (40) is 6:4 to 8:2.

3. The small antenna (100) for vehicle according to claim 1, wherein the cylindrical member (40) is made of conductive metal material with electrical properties, and made of copper or aluminum material.

4. The small antenna (100) for vehicle according to claim 1, wherein the conductor (60) is made of any one of coaxial cable, copper and SUS (Steel Use Stainless), and the dielectric body (30) is made of POM (Poly Oxy Methylene)

or Poly Acetal.

5. The small antenna (100) for vehicle according to claim 1, wherein, in the small antenna (100) for vehicle, tuning value of signal reception band is adjusted according to the lengths of the dielectric body (30) and conductor (60), and the ratio of the length of the dielectric body (30) to that of the conductor (60) is 5:5 to 7:3.

Patentansprüche

1. Kleine Antenne (100) für ein Fahrzeug, umfassend:

ein Wicklungselement (10) mit einer schraubenförmigen Antennenstruktur, gebildet mit einer Vielzahl von Wicklungen;
ein Verbinder (20), der an einem Ende des Wicklungselements (10) angeordnet ist;
einen Signalstift (70), der in Kontakt mit dem Verbinder (20) ist; und
ein zylindrisches Element (40), das an das andere Ende des Wicklungselements (10) gekoppelt ist;
gekennzeichnet durch
das zylindrische Element (40) aus einem metallischen Material;
einen dielektrischen Körper (30), der in das Wicklungselement (10) und das zylindrische Element (40) eingeführt ist und angrenzend bzw. benachbart zu dem Verbinder (20) und dem Signalstift (70) angeordnet ist;
einen Leiter (60), der in das Wicklungselement (10) und das zylindrische Element (40) eingeführt ist und an einem Ende des dielektrischen Körpers (30) angeordnet ist; und
ein Deckelement (50), das das Wicklungselement (10) und das zylindrische Element (40) einschließt, in welches der dielektrische Körper (30) und der Leiter (60) eingeführt sind,
wobei das Deckelement (50) eine Länge von 110 - 130 mm aufweist, eine Funkbandfrequenz **durch** den dielektrischen Körper (30), das Wicklungselement (10) und das zylindrische Element (40) empfangen wird, eine Frequenz im TDMB- (Terrestrial Digital Multimedia Broadcasting) oder DABIII-Band (Digital Audio Broadcasting Band III) mittels Resonanz aufgrund des Kupplungsphänomens des dielektrischen Körpers (30) und des Leiters (60) empfangen wird, und der Signalstift (70) eine Frequenz aus dem Frequenzband für mobile Kommunikation empfängt.

2. Kleine Antenne (100) für ein Fahrzeug nach Anspruch 1, wobei das Wicklungselement (10) eine Länge von 60 - 80 mm aufweist, das zylindrische Element (40) eine Länge von 20 - 40 mm aufweist, und das Verhältnis der Länge des Wicklungselements (10) zur Länge des zylindrischen Elements (40) 6:4 bis 8:2 beträgt.

3. Kleine Antenne (100) für ein Fahrzeug nach Anspruch 1, wobei das zylindrische Element (40) aus einem leitfähigen metallischen Material mit elektrischen Eigenschaften hergestellt ist und aus Kupfer- oder Aluminium-Material hergestellt ist.

4. Kleine Antenne (100) für ein Fahrzeug nach Anspruch 1, wobei der Leiter (60) aus einem von Koaxialkabel, Kupfer und SUS-Material (Steel Use Stainless) hergestellt ist, und der dielektrische Körper (30) aus POM (Polyoxymethylen) oder Polyacetal hergestellt ist.

5. Kleine Antenne (100) für ein Fahrzeug nach Anspruch 1, wobei in der kleinen Antenne (100) für das Fahrzeug, der Abstimmwert bzw. Tuning-Wert des Signalempfangsbands an die Länge des dielektrischen Körpers (30) und des Leiters (60) angepasst ist, und das Verhältnis der Länge des dielektrischen Körpers (30) zur Länge des Leiters (60) 5:5 bis 7:3 beträgt.

Revendications

1. Petite antenne (100) pour véhicule, comprenant :

un élément de bobinage (10) ayant la structure d'une antenne hélicoïdale, formé avec une pluralité de bobines ;
un connecteur (20) disposé à une extrémité de l'élément de bobinage (10) ;
une broche de signal (70) en contact avec le connecteur (20) ; et
un élément cylindrique (40) couplé à l'autre extrémité de l'élément de bobinage (10) ;
caractérisé par

l'élément cylindrique (40) en matériau métallique ;
un corps diélectrique (30) introduit dans l'élément de bobinage (10) et l'élément cylindrique (40) et adjacent au connecteur (20) et à la broche de signal (70) ;
un conducteur (60) introduit dans l'élément de bobinage (10) et l'élément cylindrique (40) et disposé à une extrémité du corps diélectrique (30) ; et
un élément de couverture (50) enveloppant l'élément de bobinage (10) et l'élément cylindrique (40) dans lequel le corps diélectrique (30) et le conducteur (60) sont introduits,
étant donné que l'élément de couverture (50) a une longueur de 110 - 130 mm, une fréquence de bande radio est reçue à travers le corps diélectrique (30), l'élément de bobinage (10) et l'élément cylindrique (40), une fréquence de bande TDMB (Terrestrial Digital Multimedia Broadcasting) ou DABIII (Digital Audio Broadcasting Band III) est reçue au moyen de la résonance résultant du phénomène de couplage du corps diélectrique (30) et du conducteur (60), et la broche de signal (70) reçoit une fréquence de la bande de communication mobile.

2. Petite antenne (100) pour véhicule selon la revendication 1, étant donné que l'élément de bobinage (10) présente une longueur de 60 - 80 mm, l'élément cylindrique (40) a une longueur de 20 - 40 mm, et le rapport de la longueur de l'élément de bobinage (10) à celle de l'élément cylindrique (40) est 6:4 à 8:2.

3. Petite antenne (100) pour véhicule selon la revendication 1, étant donné que l'élément cylindrique (40) est fabriqué d'un matériau métallique conducteur avec propriétés électriques et fabriqué en cuivre ou aluminium.

4. Petite antenne (100) pour véhicule selon la revendication 1, étant donné que le conducteur (60) est fabriqué en un matériau quelconque parmi le câble coaxial, le cuivre et le SUS (Steel Use Stainless), et le corps diélectrique (30) est fabriqué en POM (polyoxyméthylène) ou polyacétal.

5. Petite antenne (100) pour véhicule selon la revendication 1, étant donné que, dans la petite antenne (100) pour véhicule, la valeur de syntonisation de la bande de réception de signal est ajustée en fonction des longueurs de du corps diélectrique (30) et du conducteur (60), et le rapport de la longueur du corps diélectrique (30) à celle du conducteur (60) est 5:5 à 7:3.

Fig. 1

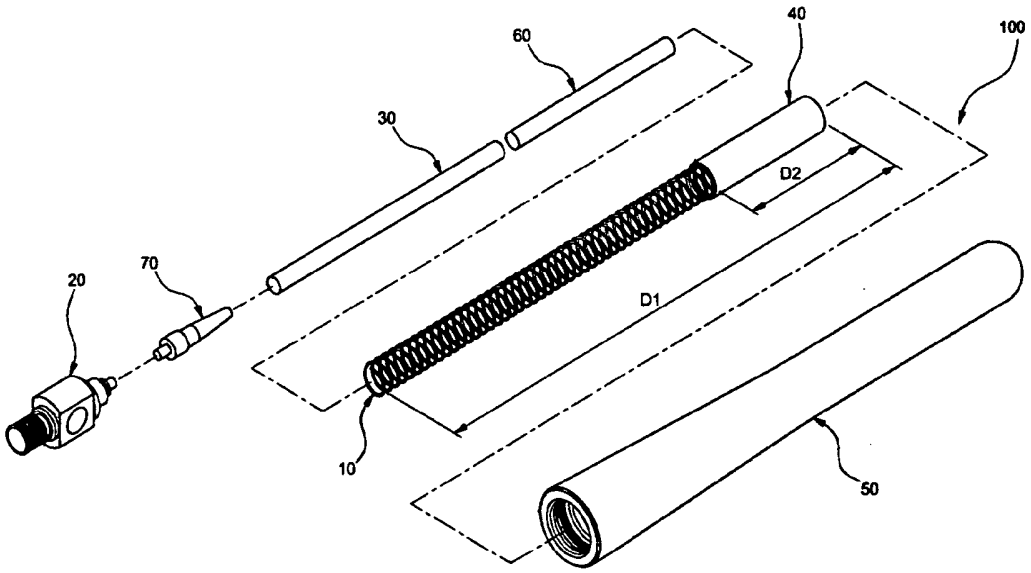
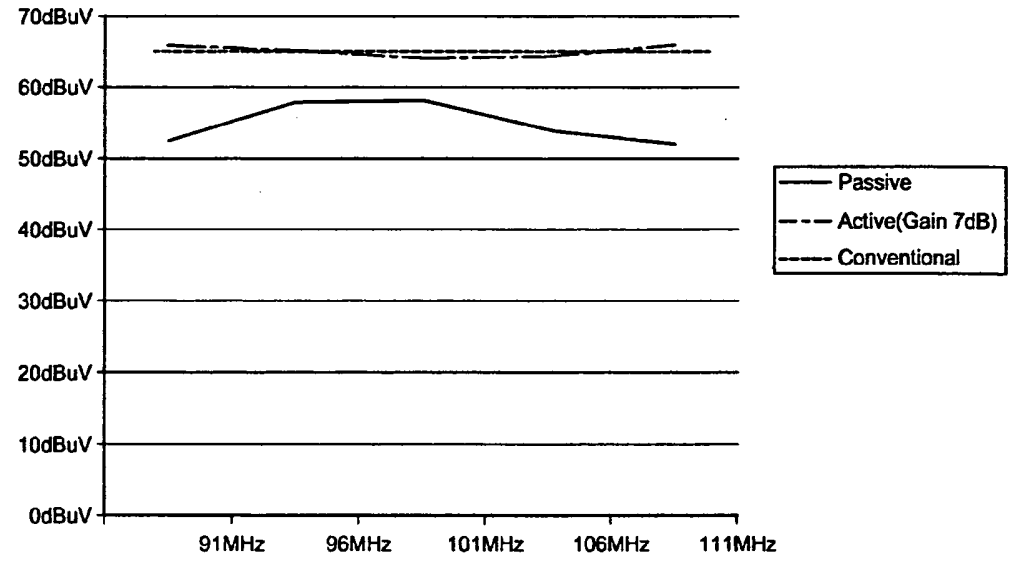

60
40
100
30
D2
20
70
D1
10
50

Fig. 2


70dBuV
60dBuV
50dBuV
40dBuV
30dBuV
20dBuV
10dBuV
0dBuV
91MHz
96MHz
101MHz
106MHz
111MHz
Passive
Active(Gain 7dB)
Conventional

REFERENCES CITED IN THE DESCRIPTION

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