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(54) Monopole antenna

(57) A monopole antenna (1) includes a body (3); and a radiation part (4) extended from the body (3) and having a first bifurcation (41) and a second bifurcation (42) connected to the first bifurcation (41), wherein the first bifurcation (41) is extended from the body (3) with a first direction and the second bifurcation (42) is extended from the first bifurcation (41) with a second direction. The monopole antenna (1) further characterized in that the body (3) is a support part (3), the support part (3) is connected to the feeding part (2) in one end and the radiation part (4) in another end, and the monopole antenna (1) includes a first angle (α) being an included angle of the radiation part (4) and the support part (3) and a second angle (γ) being an included angle of the feeding part (2) and the support part (3).

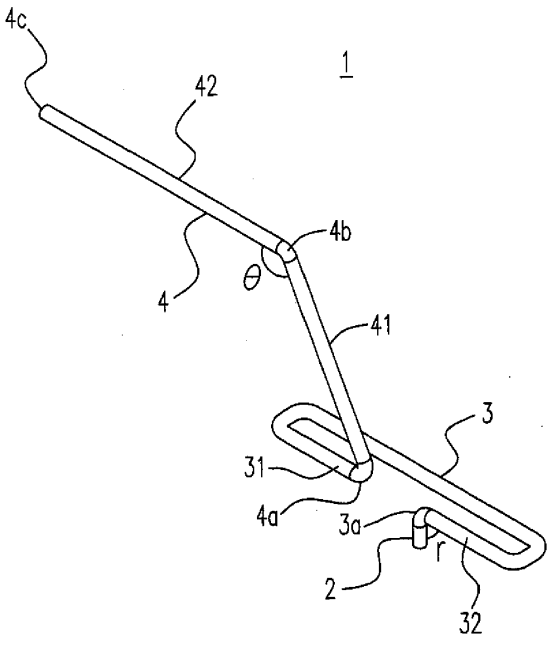

Fig. 1

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Description

[0001] The present invention relates to an antenna. In particular, the present invention relates to a monopole antenna.

[0002] Due to the universal usage of wireless communication apparatus such as cellular phone, notebook and wireless access point device in recent years, the trend of developing antenna to transmit/receive electronic signals has also become emphasis. In particular, a simpler structure of antenna is more welcome by market, wherein the monopole antenna which has the most simplified structure is accepting special attention.

[0003] With the requirement of smaller volume for wireless apparatus, the sizes of antenna have to be as miniaturized as possible for functional accommodation. There are a couple of monopole antenna types which rely on additional supporting appliance to be fixed in position in prior art, for example, as illustrated in U.S. patent document (Utility: 7,327,327 and 7,148,848). These two inventions can prevent the generation of left-hand side and righthand side tilting to cause deformation by the weight of radiation part of antenna that can deteriorate the effectiveness of propagation waves radiated from the antenna. However, the appendix structure of additional supporting appliance which has a cost in increasing the antenna size would lead to the difficulty of achieving antenna miniaturization purpose. Under this circumstance, it will have a pretty harsh limitation to design a monopole antenna constituting with high gain in radiation, miniaturization in size, broadband in frequency, and excellent field type thereof.

[0004] It is therefore attempted by the applicant to resolve the above situation encountered in the prior article.

[0005] Based on the deficiencies in the prior article, a newly structured monopole antenna is provided in the present invention. The radiation field radiated by this monopole antenna can have substantially robotic characteristic on degradation of wave front caused by channel propagation in respond to plan reflection that is existing in various wireless transmission schemes. Furthermore, this invention can be specifically integrated with modem numerical signal decode topology to effectively processing signal for high entropy in wireless transmission.

[0006] In accordance with the first aspect of the present invention, a monopole antenna is provided. The monopole antenna including a body; and a radiation part extended from the body and having a first bifurcation and a second bifurcation connected to the first bifurcation, wherein the first bifurcation is extended from the body with a first direction and the second bifurcation is extended from the first bifurcation with a second direction.

[0007] Preferably, the monopole antenna further includes a feeding part which utilizes an impedance match of a feeding line and the radiation part for a signal transmission.

[0008] Preferably, the body is a support part, the support part is connected to the feeding part in one end and the radiation part in another end, and the monopole antenna includes a first angle (α) being an included angle of the radiation part and the support part and a second angle (γ) being an included angle of the feeding part and the support part.

[0009] Preferably, the support part is configured to be an open stretched loop and the monopole antenna includes a third angle (θ) being an included angle of the first bifurcation and the second bifurcation.

[0010] Preferably, the support part further has a first end arm connected to the first bifurcation and is parallel to the second bifurcation.

[0011] Preferably, the support part can further has a second end arm connected to the feeding part.

[0012] Preferably, a sum of the first angle and the third angle is one of 180 degrees and 360 degrees.

[0013] Preferably, the body is further configured to be an open stretched loop, the radiation part further comprises a first joint and a second joint, the first joint is located between the first bifurcation and the body, the second joint is located between the first bifurcation and the second bifurcation, and the second bifurcation is parallel to the body.

[0014] Preferably, the body further comprises a third joint connected to the feeding part, wherein the feeding part is extended from the body in a third direction.

[0015] Preferably, the body and the radiation part are one-piece formed.

[0016] Preferably, the monopole antenna further includes a plurality of monopole antennas to form an array of the monopole antennas, which can accommodates waves in TE and TM modes to accomplish an anti-interference and wide-band wireless channel transmission through numerical signal detections.

[0017] In accordance with the second aspect of the present invention, a signal transmission method of a monopole antenna with an effective antenna length is provided. The signal transmission method includes modulating an entropy formed signal; and feeding the entropy formed signal to a pedestal type radio frequency stage for radiating the entropy formed signal through a radio frequency region, wherein the pedestal type radio frequency stage represents a portion of the effective antenna length.

[0018] Preferably, the radio frequency region further has a radio frequency segment and the pedestal type radio frequency stage is configured to stably support the radio frequency segment for transmitting/receiving signals.

[0019] Preferably, the entropy formed signal is modulated with a carrier signal being a selective sinusoidal wave.

[0020] Preferably, an optimal entropy of a *b*-ary of the entropy formed signal represented by n alphabets is $\log_b n$, wherein *b* is the total number of different symbols for each alphabet thereof.

[0021] Preferably, the signal transmission method further includes the steps of providing another monopole antenna receiving the entropy formed signal from the monopole antenna and then utilizing a signal demodulation scheme to

recover an information of the entropy formed signal which is interfered by other signals before the another monopole antenna receives the entropy formed signal.

[0022] The above objectives and advantages and efficacy of the present invention will be described in detail below taken from the preferred embodiments with reference to the accompanying drawings, in which:

[0023] Fig. 1 is a diagram illustrating a heterotopia view of the monopole antenna 1 of the embodiment according to the present invention;

[0024] Figs. 2 is a diagram illustrating a side view of the monopole antenna 1 in Fig. 1 according to the present invention;

[0025] Fig. 3 is a diagram illustrating a bottom view of the monopole antenna 1 in Fig. 1 according to the present invention;

[0026] Fig. 4 is a diagram illustrating the Voltage Standing Wave Ratio (VSWR) performance of monopole antenna 1 while communicating in Digital Enhanced Cordless Telecommunications band according to the present invention;

[0027] Fig. 5 is a diagram illustrating the VSWR performance of monopole antenna 1 while communicating in 802.11 b/g transmission band of Wi-Fi access point; and

[0028] Figs. 6 is a diagram illustrating a side view of the monopole antenna 1 of Fig. 2 in dimensions according to the present invention.

[0029] The present invention will now be described more specifically with reference to the following embodiments. However, it is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only; it is not intended to be exhaustive or to be limited to the precise form disclosed. For purposes of clarity, the same reference numbers will be used in the drawings to identify similar elements.

[0030] Please refer to Fig. 1, which illustrates a heterotopia view of the monopole antenna 1 of the preferred embodiment of the present invention. The monopole antenna 1 is composed by elements with material having conductivity capability, especially comes from metal, and each element is individually integral. The monopole antenna 1 contains major elements which include a support part 3 and a radiation part 4. The support part 3 is located on a first plane in geometry which is not shown in drawings and is configured as an open stretched loop which is a rectangular type in our embodiment, and is in connection with a signal feeding part 2 and the radiation part 4.

[0031] The radiation part 4 is located on a second plane in geometry which is also not shown in drawings and has a first joint 4a which is in connection with a first end arm 31 of the support part 3. A second end arm 32 of the support part 3 is in connection with the signal feeding part 2 through a third joint 3a. The radiation part 4, which being extended from the support part 3 and having a first bifurcation 41 and a second bifurcation 42 which being connected to the first bifurcation 41, is characterized in that the first bifurcation 41 is extended from the support part 3 with a first direction and the second bifurcation 42 is extended from the first bifurcation 41 with a second direction to a radiation end 4c. The radiation part 4 further comprises of a second joint 4b being located between the first bifurcation 41 and the second bifurcation 42.

[0032] The signal feeding part 2 is used for connection with coaxial transmission cable for receiving a signal from the communication system, thereafter the signal is radiated through the supporting part 3 and the radiation part 4. The signal feeding part 2 is extended from the support part 3 with a third direction, i.e., the signal feeding part 2 is extended from the second end arm 32 of the support part 3 with the third direction.

[0033] Please refer to Fig. 2, which illustrates a side view of the monopole antenna 1 of the preferred embodiment of the present invention, characterized in that a first angle α being an included angle of the radiation part 4 and the support part 3 and a second angle γ being an included angle of the signal feeding part 2 and the support part 3, therewith a third angle θ which being an included angle of the first bifurcation 41 and the bifurcation 42 of the radiation part 4.

[0034] The first angle α and the third angle θ can be any selection in quantity, but it is preferred to have a sum of the first angle α and the third angle θ being one of 180 degrees and 360 degrees, and this represents a parallel characteristic existed between the second bifurcation 42 and the support part 3.

[0035] Furthermore, the second angle r has a quantity between zero and 180 degrees with a preferred 90 degrees.

[0036] The operating frequency bands of the monopole antenna 1 of the present invention can be in Digital Enhanced Cordless Telecommunications band (2.40~2.50GHz) and in 802.11 b/g transmission band (1.88~1.90GHz) of Wi-Fi access point, wherein the dimensions of the signal feeding part 2, the support part 3 and the radiation part 4 can be adjusted to suit the system design necessities for the above mentioned operating bands or the resistance match of the connected elements. That is to say, the length of the monopole antenna 1 should be fit into one quarter of the transmission wave length. By the way, the support part 3 and the radiation part 4 are better yet not to be positioned on the same plane.

[0037] Please refer to Fig. 3, which illustrates a bottom view of the monopole antenna 1 of the preferred embodiment of the present invention. Accordingly, in spite of the radiation part 4 being extending with the first direction and the second direction, the radiation part 4 and the first end arm 31 are belonging to the same plane (the second plane) since the first end arm 31 occluding the first bifurcation 41 and part of the second bifurcation 42 from a bottom aspect view.

[0038] In the other hand, to be an antenna support of the radiation part 4, the support part 3 is configured as an open stretched loop in that the "open stretched loop" framework being designed for the purpose of increasing antenna effective length while having diminution in occupation of space aspect. The support part 3 which is not limited to annular type can

be manufactured instead of quadrilateral, triangular or polygon in framework to be suitable for supporting the stance of antenna radiation division.

[0039] Please refer to Fig. 4, which illustrates the Voltage Standing Wave Ratio (VSWR) performance of monopole antenna 1 while communicating in Digital Enhanced Cordless Telecommunications (DECT) band according to the present invention. In Fig. 4, those triangle marks with number 1-5 have VSWR values being 1.4121 (1.880GHz), 1.4076 (1.890GHz), 1.4094 (1.900GHz), 1.9407 (1.746GHz), and 1.9571 (2.018GHz), respectively.

[0040] Please refer to Fig. 5, which illustrates the VSWR performance of monopole antenna 1 while being operating in 802.11 b/g transmission band of Wi-Fi access point. Those triangle marks with number 1~5 have VSWR values being 1.6453 (2.400GHz), 1.5577 (2.450GHz), 1.4996 (2.500GHz), 2.0150 (1.940GHz), and 1.9994 (2.695GHz), respectively.

[0041] Without ambiguity to speaking and based on both Figs. 4 and 5, the two operating bands of the monopole antenna 1 of the present invention have VSWRs which are not great than value 2 or even are lower than value 1.5, and that is pretty close to ideal situation.

[0042] Please refer to Table 1, which illustrates the measurement data of gains of the monopole antenna 1 of the present invention in communication bands residing within frequencies of both 1.89GHz and 2.45GHz. As shown in Table 1, the largest gain of the monopole antenna 1 of the present invention has reached a 3dBi value in qualifying the operating bands of wireless communication normal specification, and this performance is fully conforming to wireless market requirement and is containing relative perfect characteristic in regarding of the monopole antenna 1.

Table 1

Frequency Band (GHz)	1.89			2.45		
Plane	XY	YZ	XZ	XY	YZ	XZ
Largest Gain (dBi)	2.54	1.18	3.00	1.72	1.91	3.35
Average Gain (dBi)	-1.74	-0.89	-0.69	-1.55	-1.28	-0.55

[0043] Please refer to Fig. 6, which illustrates a side view of the monopole antenna 1 of Fig. 2 in dimensions according to the present invention. From the inspection of Fig. 6, it is noticeable that the monopole antenna 1 should have a preferred configuration in dimensions for that the thickness of the radiation part 4 is larger than that of the support part 3, the length of the second bifurcation 42 is approximately equal to that of the longer side of the support part 4, and the lengths of the first end arm 31 and the second end arm 32 of the support part 3 are approximately equal, too.

[0044] In another preferred embodiment of the present invention, the monopole antenna including a body 3; and a radiation part 4 extended from the body 3 and having a first bifurcation 41 and a second bifurcation 42 connected to the first bifurcation 41, wherein the first bifurcation 41 is extended from the body 3 with a first direction and the second bifurcation 42 is extended from the first bifurcation 41 with a second direction.

[0045] In a further preferred embodiment of the present invention, a signal transmission method of a monopole antenna 1 with an effective antenna length is provided. The signal transmission method includes modulating an entropy formed signal; and feeding the entropy formed signal to a pedestal type radio frequency stage 3 for radiating the entropy formed signal through a radio frequency region 4, wherein the pedestal type radio frequency stage 3 represents a portion of the effective antenna length.

[0046] The radio frequency region 4 further has a radio frequency segment 41, 42 and the pedestal type radio frequency stage 3 is configured to stably support the radio frequency segment 41, 42 for transmitting/receiving signals. The entropy formed signal is modulated with a carrier signal being a selective sinusoidal wave and an optimal entropy of a *b*-ary of the entropy formed signal represented by n alphabets is $\mathbf{log}_{\boldsymbol{b}}\ \boldsymbol{n}$, wherein *b* is the total number of different symbols for each alphabet thereof.

[0047] The signal transmission method further includes the steps of providing another monopole antenna receiving the entropy formed signal from the monopole antenna 1 and then utilizing a signal demodulation scheme to recover an information of the entropy formed signal which is interfered by other signals before the another monopole antenna receives the entropy formed signal.

[0048] The present invention can be implemented in applications of wireless communication apparatus which ranging from notebook, tablet computer, mobile phone, wireless access device, and for those of monitor and video/audio display device with Wi-Fi function.

[0049] While the invention has been described by way of example and in terms of the preferred embodiments, it is to be understood that the invention is not limited thereto. To the contrary, it is intend to cover various modifications and similar arrangement (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangement.

Claims

1. A monopole antenna (1), **characterized by** comprising:

   a body (3); and
   a radiation part (4) extended from the body (3) and having a first bifurcation (41) and a second bifurcation (42) connected to the first bifurcation (41), wherein the first bifurcation (41) is extended from the body (3) with a first direction and the second bifurcation (42) is extended from the first bifurcation (41) with a second direction.

2. The monopole antenna (1) according to Claim 1, further **characterized by** comprising a feeding part (2) which utilizes an impedance match of a feeding line and the radiation part (4) for a signal transmission.

3. The monopole antenna (1) according to Claim 1 or 2, further **characterized in that** the body (3) is a support part (3), the support part (3) is connected to the feeding part (2) in one end and the radiation part (4) in another end, and the monopole antenna (1) includes a first angle (α) being an included angle of the radiation part (4) and the support part (3) and a second angle (γ) being an included angle of the feeding part (2) and the support part (3).

4. The monopole antenna (1) according to any one of Claims 1 to 3, **characterized in that** the support part (3) is configured to be an open stretched loop and the monopole antenna (1) includes a third angle (θ) being an included angle of the first bifurcation (41) and the second bifurcation (42).

5. The monopole antenna (1) according to any one of Claims 1 to 4, **characterized in that** the support part (3) further has a first end arm (31) connected to the first bifurcation (41) and is parallel to the second bifurcation (42).

6. The monopole antenna (1) according to any one of Claims 1 to 3, **characterized in that** the support part (3) can further has a second end arm (32) connected to the feeding part (2).

7. The monopole antenna (1) according to any one of Claims 1 to 3, **characterized in that** a sum of the first angle and the third angle is one of 180 degrees and 360 degrees.

8. The monopole antenna (1) according to any one of Claims 1 to 6, **characterized in that** the body (3) is further configured to be an open stretched loop, the radiation part (4) further comprises a first joint (4a) and a second joint (4b), the first joint (4a) is located between the first bifurcation (41) and the body (3), the second joint (4b) is located between the first bifurcation (41) and the second bifurcation (42), and the second bifurcation (42) is parallel to the body (3).

9. The monopole antenna (1) according to any one of Claims 1 to 8, **characterized in that** the body (3) further comprises a third joint (3a) connected to the feeding part (2), wherein the feeding part (2) is extended from the body (3) in a third direction.

10. The monopole antenna (1) according to any one of Claims 1 to 8, **characterized in that** the body (3) and the radiation part (4) are one-piece formed.

11. The monopole antenna (1) according to any one of Claims 1 to 10, **characterized by** further comprising a plurality of monopole antennas to form an array of the monopole antennas (1), which can accommodates waves in TE and TM modes to accomplish an anti-interference and wide-band wireless channel transmission through numerical signal detections.

12. A signal transmission method of a monopole antenna (1) with an effective antenna length, **characterized by** comprising:

    modulating an entropy formed signal; and
    feeding the entropy formed signal to a pedestal type radio frequency stage (3) for radiating the entropy formed signal through a radio frequency regio (4), wherein the pedestal type radio frequency stage (3) represents a portion of the effective antenna length.

13. The signal transmission method according to Claim 12, **characterized in that** the radio frequency regio (4) further has a radio frequency segment (41, 42) and the pedestal type radio frequency stage (3) is configured to stably

support the radio frequency segment (41, 42) for transmitting/receiving signals.

14. The signal transmission method according to Claim 12 or 13, **characterized in that** the entropy formed signal is modulated with a carrier signal being a selective sinusoidal wave, and an optimal entropy of a *b*-ary of the entropy formed signal represented by n alphabets is $\log_b n$, wherein *b* is the total number of different symbols for each alphabet thereof.

15. The signal transmission method according to any one of Claims 12 to 14, further **characterized by** comprising the steps of providing another monopole antenna receiving the entropy formed signal from the monopole antenna (1) and then utilizing a signal demodulation scheme to recover an information of the entropy formed signal which is interfered by other signals before the another monopole antenna receives the entropy formed signal.

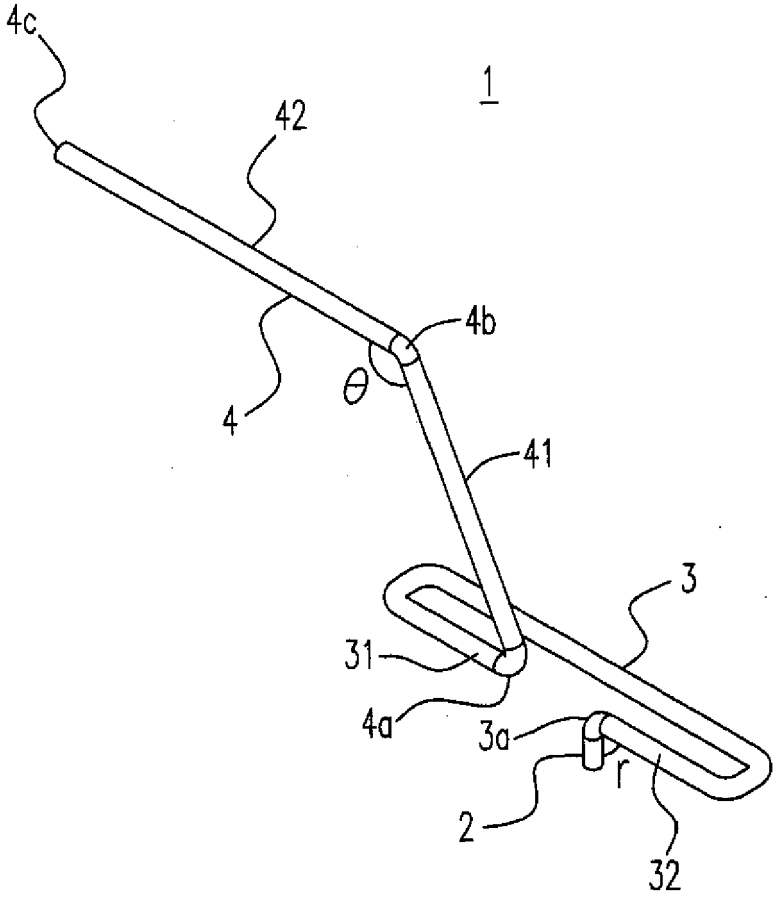

Fig. 1

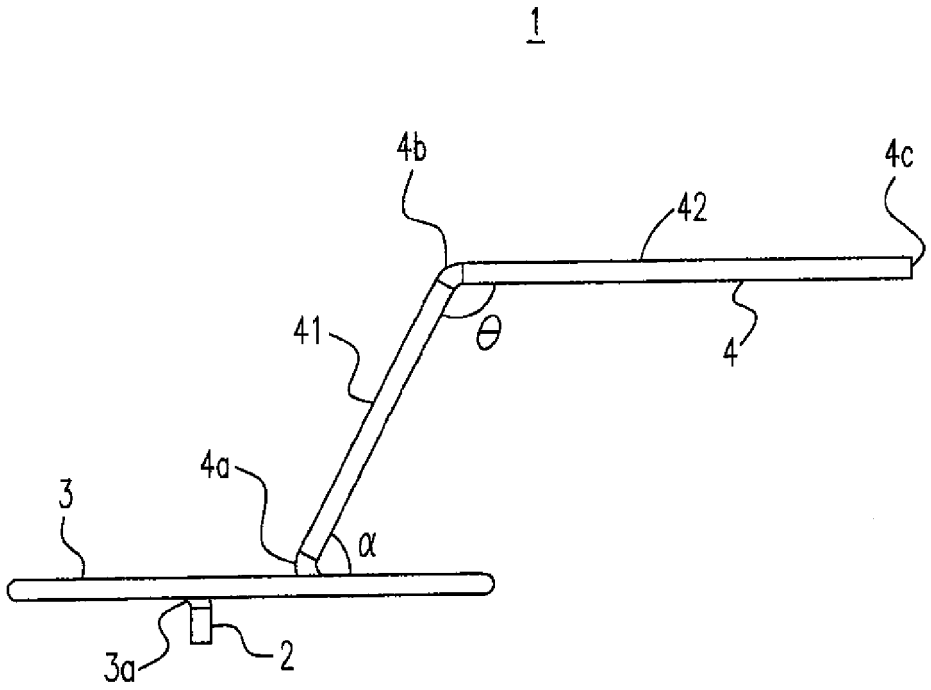

Fig. 2

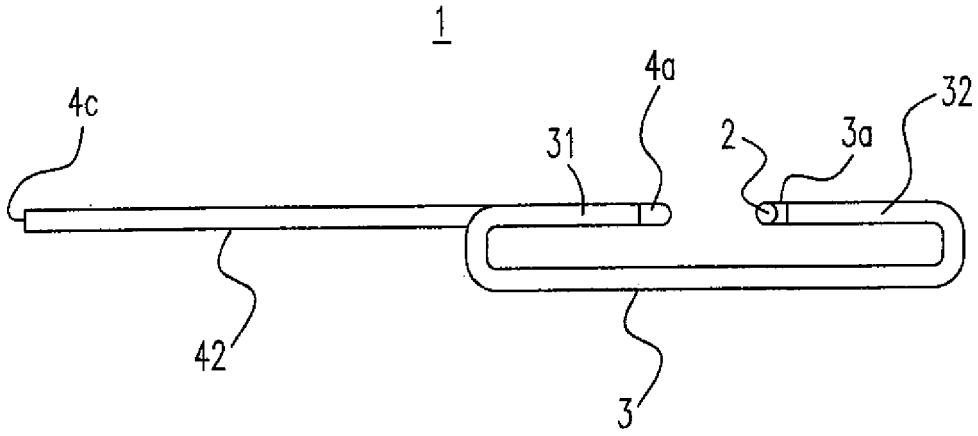

Fig. 3

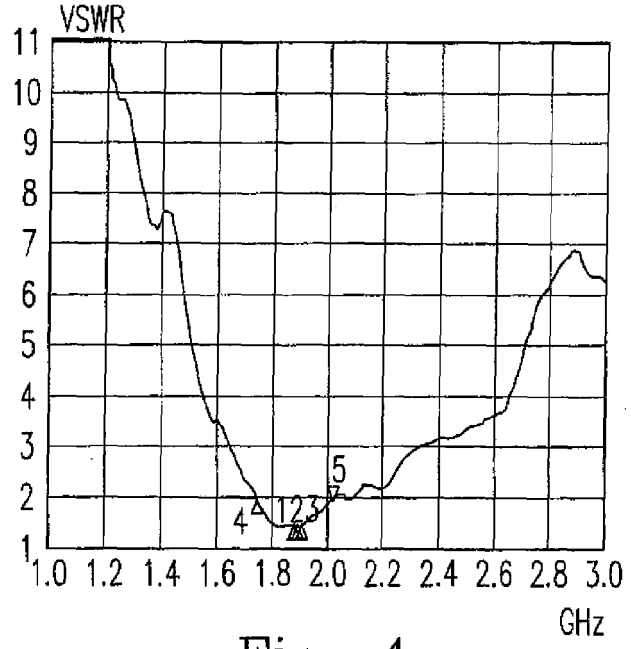
VSWR
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Fig. 4

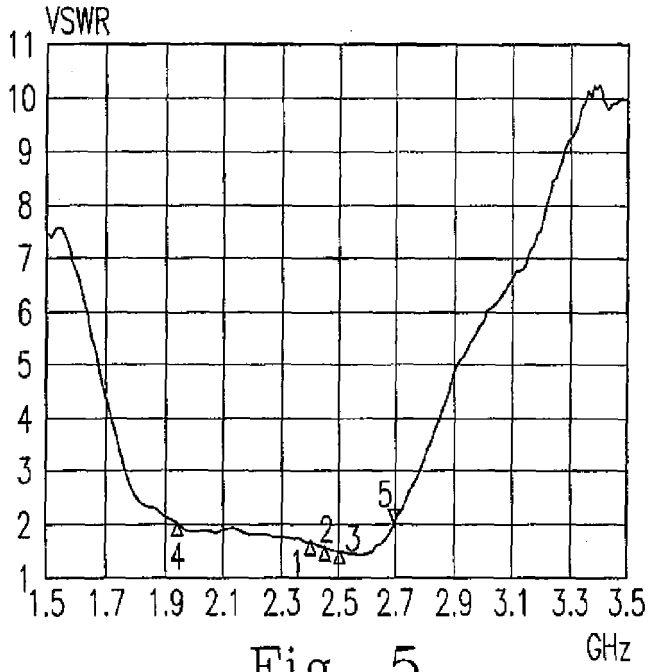
VSWR
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Fig. 5

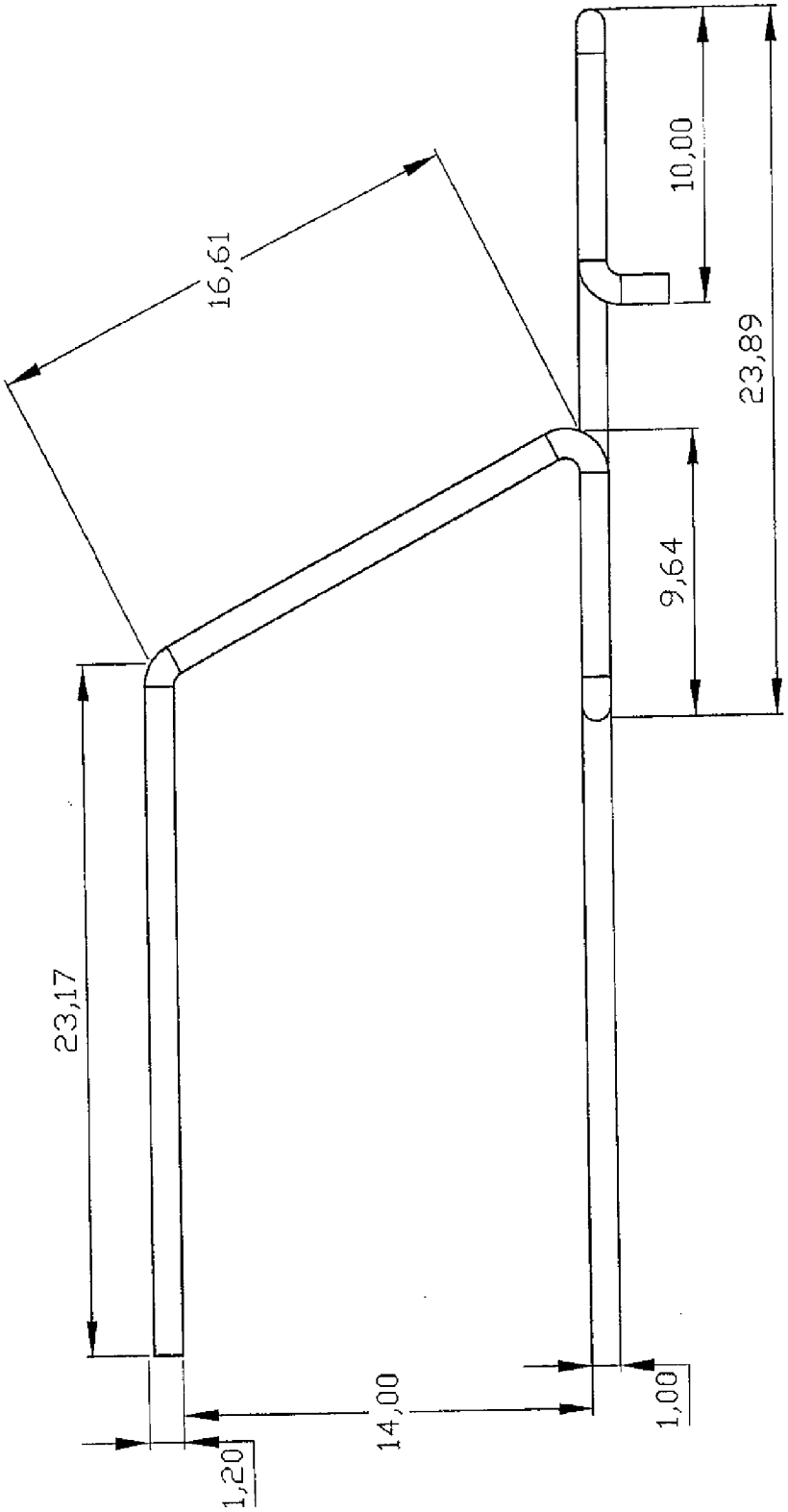

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 6748

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	US 2006/181466 A1 (KRUPA STEVE [US] KRUPA STEVE [GB]) 17 August 2006 (2006-08-17) * figures 1,2 * * paragraphs [0016] - [0022] *	1-4,10, 11	
X	EP 1 933 413 A1 (HIGH TECH COMP CORP [TW]) 18 June 2008 (2008-06-18) * abstract; figures 2,4,7 * * paragraphs [0008] - [0009] *	1,2,7, 10,11	
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			TECHNICAL FIELDS SEARCHED (IPC) H01Q

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	16 August 2012	Unterberger, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 12 16 6748

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-11

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 12 16 6748

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11

A folded monopole antenna

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2. claims: 12-15

A signal transmission method

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 16 6748

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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16-08-2012

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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