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(54) **ISOTROPIC ELECTRIC FIELD ANTENNA**

(57) The present invention relates to an isotropic electric field antenna comprising three dipole-type antennas (D1, D2, D3) arranged orthogonally to each other,

wherein at least one of the three dipole-type antennas (D1, D2, D3) is a biconical dipole-type antenna.

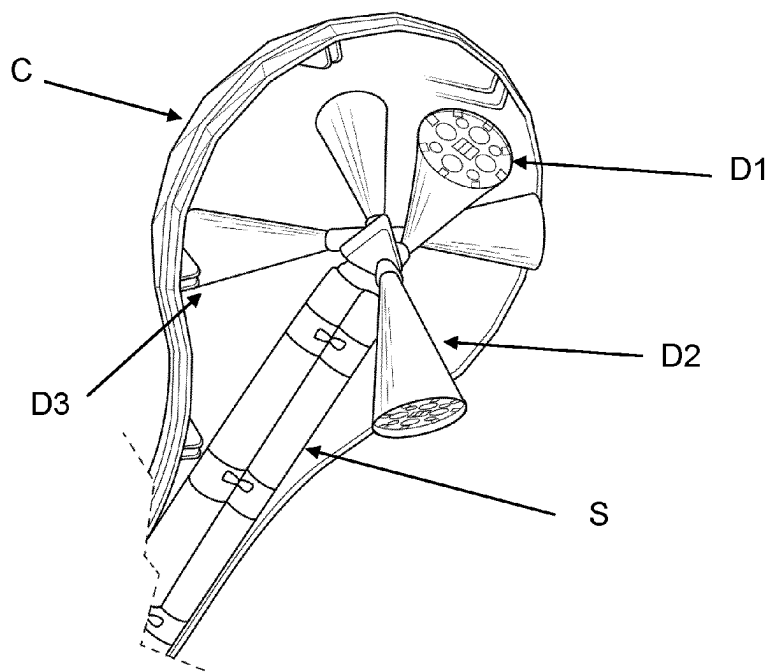


Fig. 2

Description

Field of the invention

[0001] The present invention relates in general to an isotropic electric field antenna comprising three dipole-type antennas arranged orthogonally to each other and, in particular, to an isotropic antenna wherein at least one of the three dipole-type antennas is a biconical dipole-type antenna.

State of the prior art

[0002] Isotropic electric field antennas comprising three straight dipole-type antennas arranged orthogonally to each other are known, but have the drawback that the electric field bandwidth they are capable of measuring is not sufficiently large for some applications. The maximum size of such dipoles is limited by the radiation diagram thereof, which must maintain a toroidal shape so that the assembly of the three antennas has good isotropy. This size limitation does not enable sufficient sensitivity at low frequency.

[0003] Therefore, it is necessary to offer an alternative to the state of the art that covers the gaps found therein, providing an isotropic antenna that improves the features of known antennas with regard to measurement bandwidth and sensitivity.

Description of the invention

[0004] To that end, the present invention relates to an isotropic electric field antenna comprising, in a known manner, three dipole-type antennas arranged orthogonally to each other.

[0005] In contrast to the isotropic antennas known in the state of the art, in the antenna proposed by the present invention, characteristically, at least one of its three dipole-type antennas is a biconical dipole-type antenna.

[0006] According to a preferred embodiment, the three dipole-type antennas are constituted by three respective biconical dipole-type antennas.

[0007] For an embodiment, the isotropic antenna of the present invention comprises at least one adaptation network connected to each of the three dipole-type antennas.

[0008] In general, the isotropic antenna of the present invention comprises three of said adaptation networks, each of which is connected to a respective antenna of the three dipole-type antennas.

[0009] The adaptation network or each of the adaptation networks contains, preferably, resistive elements to attenuate the sensitivity of the antennas.

[0010] In accordance with an embodiment, the isotropic antenna comprises at least one balun connected to the output of each of the aforementioned adaptation networks.

[0011] For a variant of said embodiment, the isotropic antenna comprises at least one voltage balun and one current balun serially connected to the output of each of the adaptation networks.

[0012] The isotropic antenna of the present invention comprises, for an embodiment, three coaxial cables, each having a first end connected to the output of each of said baluns or of said current baluns.

[0013] According to an embodiment, the isotropic antenna of the invention comprises a RF switch with three inputs wherein second ends of said three coaxial cables are connected, opposite said first ends, and an output selectable so that the signal from one of the three dipole-type antennas, selected manually or automatically, exits through said output.

[0014] For an alternative embodiment, the isotropic antenna of the present invention does not include the aforementioned RF switch and each of the aforementioned second ends of the three coaxial cables is configured (including corresponding appropriate connectors) to connect directly to three respective spectrum analysers or RF receivers, providing them with three respective RF signals.

[0015] The isotropic antenna of the present invention is configured to measure electric fields of up to 6 GHz.

Brief description of the drawings

[0016] The foregoing and other advantages and characteristics will be more fully understood from the following detailed description of examples of embodiment with reference to the attached drawings, which must be taken in an illustrative and nonlimiting way, wherein:

Figure 1 shows a schematic view of the antenna proposed by the present invention, for an embodiment, illustrating the structural arrangement of the three dipole-type antennas thereof.

Figure 2 shows a photograph showing the antenna proposed by the present invention housed in a protective casing (radome), which in this case is formed by two semi-casings that can be coupled therebetween, showing only one of said two semi-casings.

Figure 3 shows, at block level, the antenna proposed by the present invention for another embodiment, illustrating a schematic view of the biconical dipole-type antennas thereof without being assembled to form the isotropic antenna.

Figure 4 is a plot showing the results obtained in the measurements made using a prototype of the isotropic antenna proposed by the invention.

Detailed description of examples of embodiment

[0017] Figure 1 shows an embodiment of the isotropic electric field antenna proposed by the present invention that comprises three biconical dipole-type antennas D1, D2, D3 arranged orthogonally to each other, in this case

by mediation of the support S shown, which in turn acts as or supports printed circuit boards that include the electric/electronic circuitry connected to each of the dipoles, i.e. at least part of that shown in figure 3.

[0018] Figure 2 shows the same antenna of figure 1 for a prototype manufactured by the inventors, including the protective casing C.

[0019] Figure 3 shows, at block level, the antenna proposed by the present invention for another embodiment, for which each of the antennas is connected to an adaptation network containing resistive elements for attenuating the sensitivity of the antennas, particularly in the form of a filter π , and to a serial arrangement of a voltage balun and a current balun, the output of each of which is connected, through a coaxial cable, to the input of a RF switch, whose output is selectable so that the signal from one of the three dipole-type antennas D1, D2, D3, selected manually or automatically, leaves said output.

[0020] Figure 4 shows the results obtained in the measurements made using a prototype of the isotropic antenna proposed by the invention, where it can be observed how it operates adequately for an approximate frequency range of between 20 MHz and 3 GHz. For other prototypes of the antenna of the invention, good results have been obtained for a frequency of up to 6 GHz.

[0021] A person skilled in the art could introduce changes and modifications to the described embodiments without exceeding the scope of the invention as defined in the attached claims.

Claims

1. An isotropic electric field antenna comprising three dipole-type antennas (D1, D2, D3) arranged orthogonally to each other, **characterised in that** at least one of said three dipole-type antennas (D1, D2, D3) is a biconical dipole-type antenna. 35
2. The isotropic antenna, according to claim 1, wherein the three dipole-type antennas are constituted by three respective biconical dipole-type antennas (D1, D2, D3). 40
3. The isotropic antenna, according to any one of the preceding claims, comprising at least one adaptation network connected to each of the three dipole-type antennas (D1, D2, D3). 45
4. The isotropic antenna, according to claim 3, comprising three of said adaptation networks, each of which is connected to a respective antenna of the three dipole-type antennas (D1, D2, D3). 50
5. The isotropic antenna, according to claim 3 or 4, wherein said or each of said adaptation networks contain resistive elements for attenuating the sensitivity of the antennas. 55

6. The isotropic antenna, according to claim 3, 4 or 5, comprising at least one balun connected to the output of each of said adaptation networks.
7. The isotropic antenna, according to claim 6, comprising at least one voltage balun and one current balun serially connected to the output of each of said adaptation networks. 5
8. The isotropic antenna, according to claim 6 or 7, comprising three coaxial cables, each having a first end connected to the output of each of said baluns or of said current baluns. 10
9. The isotropic antenna, according to claim 8, comprising a RF switch with three inputs wherein second ends of said three coaxial cables, opposite said first ends, are connected and an output selectable so that the signal from one of the three dipole-type antennas (D1, D2, D3), selected manually or automatically, exits through said output. 15
10. The isotropic antenna, according to claim 8, wherein respective second ends of said three coaxial cables, opposite said first ends, are configured to be directly connected to three respective spectrum analysers or RF receivers, providing them with three respective RF signals. 20
11. The isotropic antenna, according to any one of the preceding claims, configured to measure electric fields of up to 6 GHz. 25

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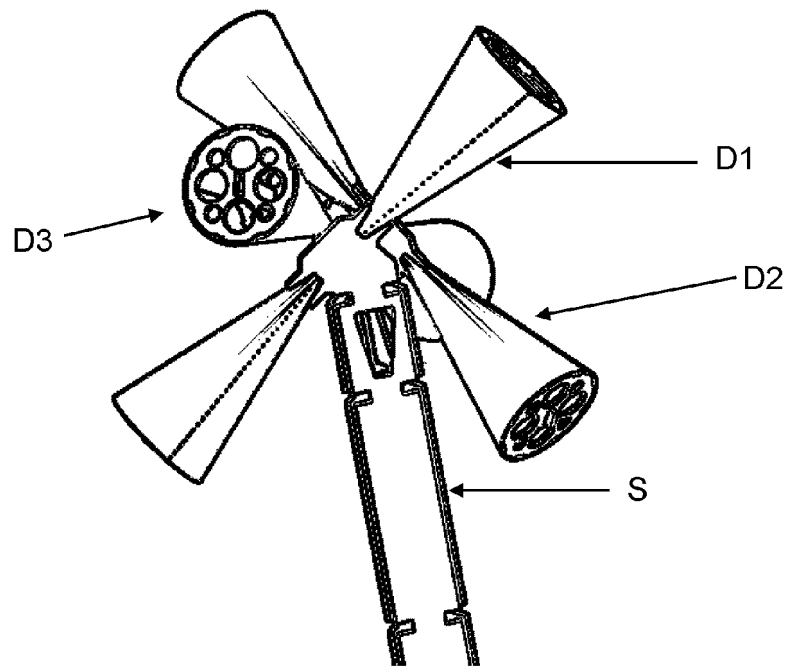


Fig. 1

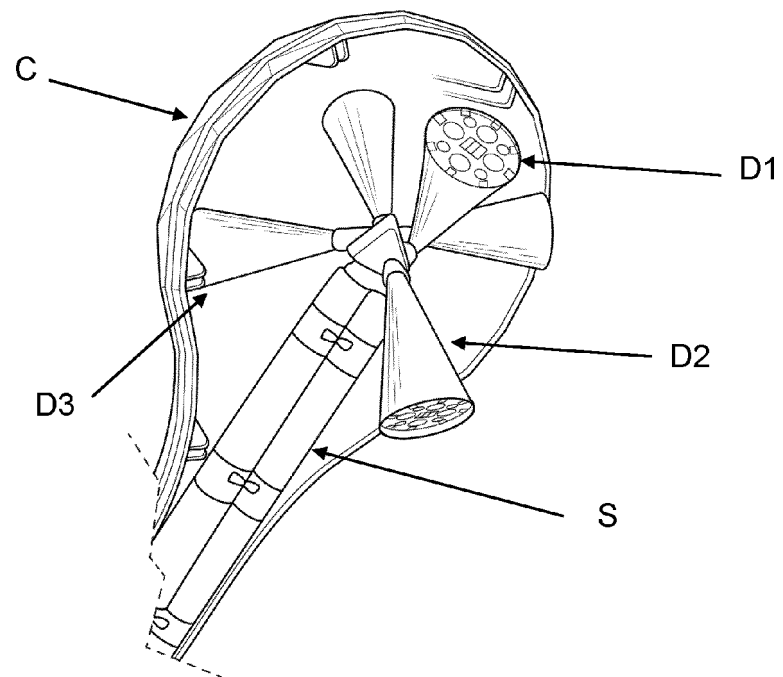


Fig. 2

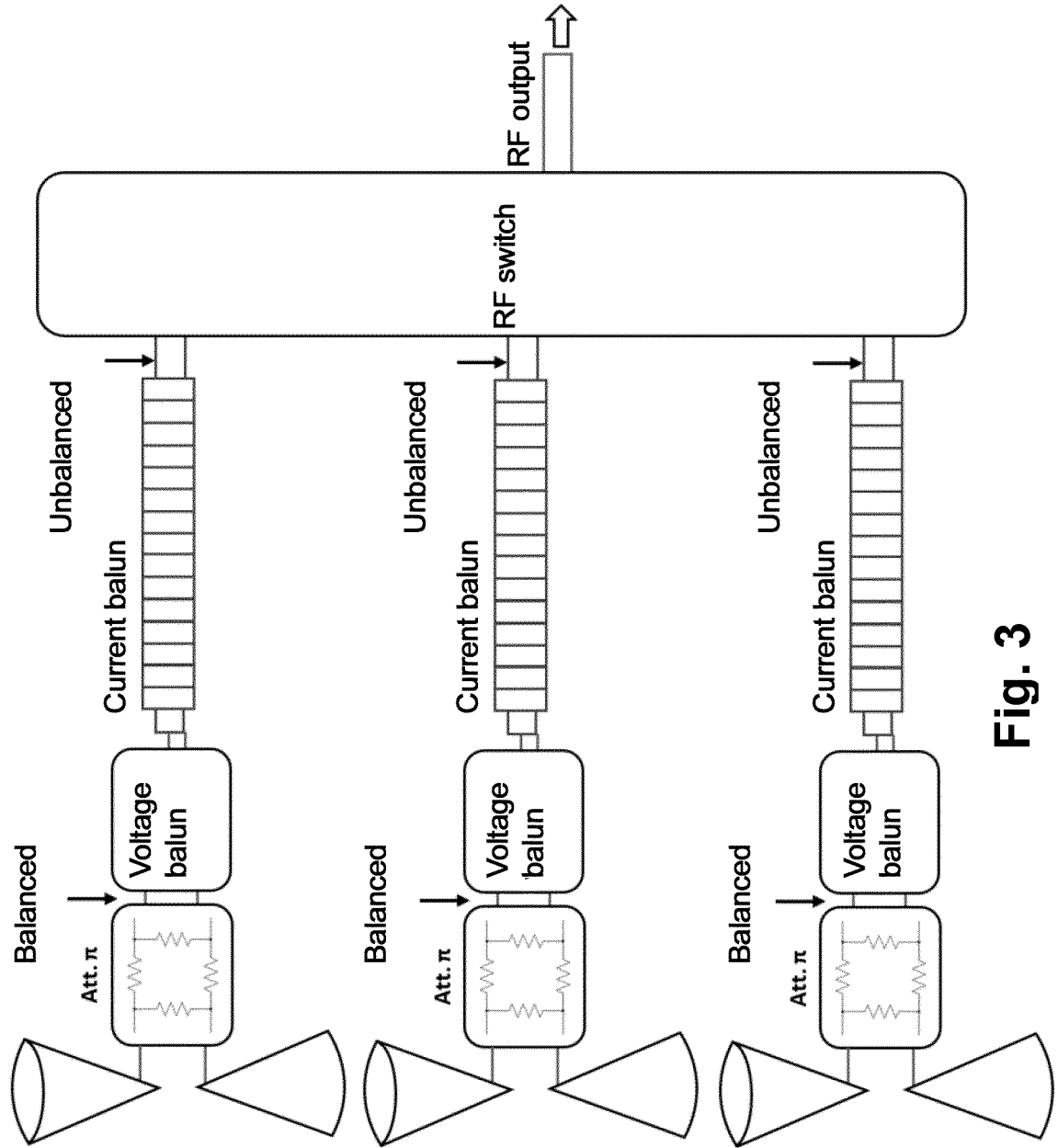


Fig. 3

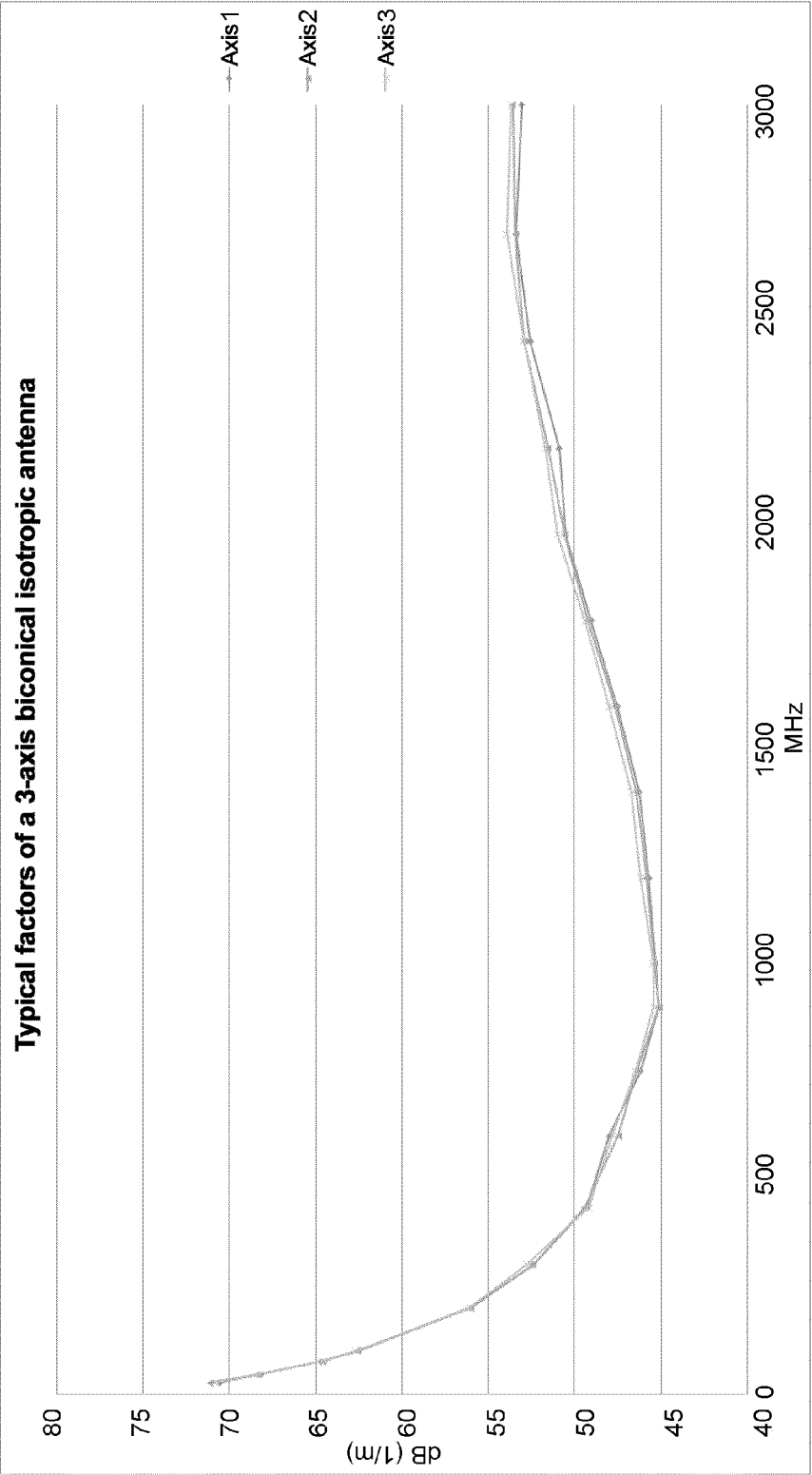


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/ES2017/070274

A. CLASSIFICATION OF SUBJECT MATTER INV. H01Q9/28 G01R29/08 H01Q21/24 H01Q21/28 H01Q25/00 ADD. 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) H01Q G01R Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data																
C. DOCUMENTS CONSIDERED TO BE RELEVANT																
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 4 633 265 A (WHEELER HAROLD A [US]) 30 December 1986 (1986-12-30) column 3, line 50 - column 5, line 30; figure 2</td> <td>1-11</td> </tr> <tr> <td>X</td> <td>US 4 277 744 A (AUDONE BRUNO ET AL) 7 July 1981 (1981-07-07) column 2, line 45 - column 5, line 7; figures 1-3</td> <td>1-11</td> </tr> <tr> <td>A</td> <td>US 3 518 692 A (KUECKEN JOHN A) 30 June 1970 (1970-06-30) column 1, line 65 - column 2, line 66; figures 1-3</td> <td>1-11</td> </tr> <tr> <td></td> <td style="text-align: center;">----- -/--</td> <td></td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 4 633 265 A (WHEELER HAROLD A [US]) 30 December 1986 (1986-12-30) column 3, line 50 - column 5, line 30; figure 2	1-11	X	US 4 277 744 A (AUDONE BRUNO ET AL) 7 July 1981 (1981-07-07) column 2, line 45 - column 5, line 7; figures 1-3	1-11	A	US 3 518 692 A (KUECKEN JOHN A) 30 June 1970 (1970-06-30) column 1, line 65 - column 2, line 66; figures 1-3	1-11		----- -/--		☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.														
X	US 4 633 265 A (WHEELER HAROLD A [US]) 30 December 1986 (1986-12-30) column 3, line 50 - column 5, line 30; figure 2	1-11														
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* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 August 2017	Date of mailing of the international search report 22/08/2017															
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Sípal, Vít															

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Pete Bevelacqua: "Bow Tie Antennas", 19 March 2015 (2015-03-19), XP055398609, Retrieved from the Internet: URL:https://web.archive.org/web/2015031910 3959/http://www.antenna-theory.com/antenna s/wideband/bowtie.php [retrieved on 2017-08-14] Paragraph above Fig. 2; figure 2 -----	1-11

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Information on patent family members

International application No

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