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(12) EUROPEAN PATENT APPLICATION

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(54) Space-filling miniature antennas

(57) A novel geometry, the geometry of Space-Filling Curves (SFC) is defined in the present invention and it is used to shape a part of an antenna. By means of this novel technique, the size of the antenna can be reduced with respect to prior art, or alternatively, given a fixed size the antenna can operate at a lower frequency with respect to a conventional antenna of the same size.

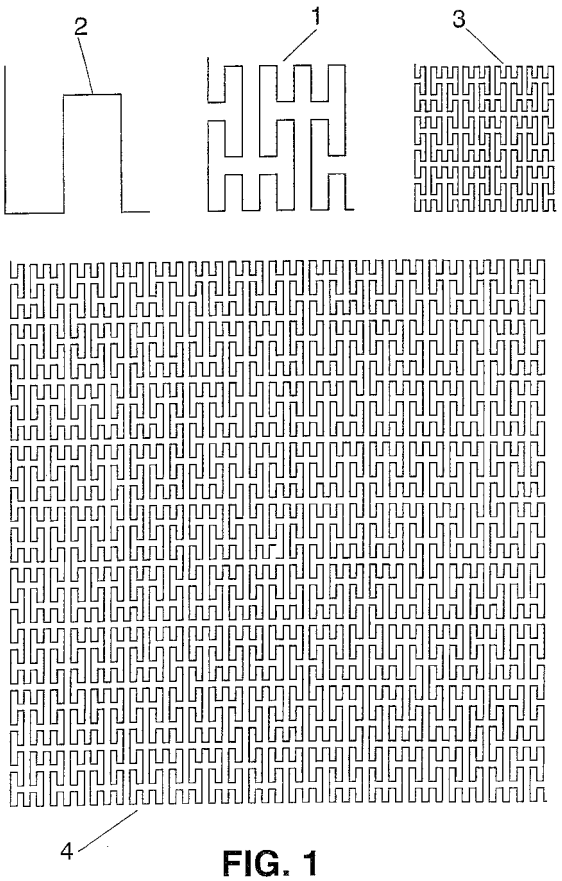

FIG. 1

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 10 18 0798

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 Y	WO 97/06578 A (FRACTAL ANTENNA SYSTEMS, INC; COHEN, NATHAN) 20 February 1997 (1997-02-20) * the whole document * -----	1-5, 14-16 6,7	INV. H01Q1/36 H01Q1/24 H01Q1/38 H01Q9/04
X	WO 99/27608 A (COHEN, NATHAN) 3 June 1999 (1999-06-03) * the whole document * -----	1-5, 14-16	
X	US 4 843 468 A (DREWERY ET AL) 27 June 1989 (1989-06-27) * the whole document * -----	1-5, 14-16	
X	EP 0 969 375 A (SUN MICROSYSTEMS, INC) 5 January 2000 (2000-01-05) * the whole document * -----	1-5, 14-16	
Y	ES 2 112 163 A1 (UNIVERSITAT POLITECNICA DE CATALUNYA) 16 March 1998 (1998-03-16) * the whole document * -----	6,7	
	-/--		

TECHNICAL FIELDS SEARCHED (IPC)

H01Q

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

6

Place of search	Date of completion of the search	Examiner
The Hague	18 March 2011	Wattiaux, Véronique

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

EPO FORM 1503 03.82 (P04E07)

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PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 10 18 0798

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	heinz-otto peitgen, hartmut jurgens, dietmar saupe: "chaos and fractals, new frontiers of science", 1992, springer, new york, XP002608394, ISBN: 0-387-97903-4 * page 231 - page 233 * * page 386 - page 391 * -----	1-5, 14-16	
X	hans lauwerier: "fractals, endlessly repeated geometrical figures", 1991, princeton university press, new jersey, XP002608395, ISBN: 0-691-02445-6 page 1, * page 1 * * page 32 - page 33 * -----	1-5, 14-16	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 0 253 608 A (BRITISH BROADCASTING CORPORATION) 20 January 1988 (1988-01-20) * the whole document * -----	1-7, 14-16	

EPO FORM 1503 03.82 (P04C10)

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INCOMPLETE SEARCH
SHEET C

Application Number
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Claim(s) completely searchable:
1, 3-7

Claim(s) searched incompletely:
16

Reason for the limitation of the search (non-patentable invention(s)):

Article 52 (2)(a) EPC - Mathematical method : claim 16. The method used to determine the shape of the antenna uses algorithms.

Further limitation of the search

Claim(s) completely searchable:
1, 3-7

Claim(s) searched incompletely:
2, 14-16

Reason for the limitation of the search:

Present claims 14, 15 and 16 relate to an extremely large number of possible apparatus. In fact, the claims contain so many options, variables, possible permutations and provisos that a lack of clarity (and conciseness) within the meaning of Article 84 EPC arises to such an extent as to render a meaningful search of the claims impossible. Consequently, the search has been carried out for those parts of the application which do appear to be clear (and concise), namely claims 1 to 5 (taking into account the non-unity).
Moreover, claims 2 and 16
If a person skilled in the art were to construct an antenna comprising all the features of claim 1.
How can this person assess/know whether his antenna features a box-counting dimension larger than one, said box-counting dimension computed as the slope of the straight portion of a log-log graph , wherein said straight portion is substantially defined as a straight segment over at lest an octave of scales on the horizontal axes of the log-log graph ?
This raises concerns over the disclosure of the invention. Even if the claim can be read in the light of the description, it is nowhere disclosed what box-counting dimension is about, it is only said that it is well-known to those skilled in mathematics theory.
The same question arises with claim 16 : a part of the antenna is said to be constructed using algorithms. Despite the fact that the algorithms cited are not part of the jargon of the person skilled in the art of antennas, how could he possibly know whether at least part of his antenna fullfill the criterias of an algorithm such as a multi reduction copy machine etc...
For these reasons, it is not at present possible to assess novelty and/or inventive step of claims 2 and 16.

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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:

6, 7

☐ 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:

☐ 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
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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: 1-5, 14-16

   antenna with parts of it being shaped as space-filling curves.

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2. claim: 8

   dipole antenna.

   ---

3. claim: 6

   monopole antenna.

   ---

4. claim: 9

   slot antenna.

   ---

5. claim: 10

   loop antenna.

   ---

6. claim: 7

   patch antenna.

   ---

7. claim: 11

   aperture antenna.

   ---

8. claim: 12

   horn antenna.

   ---

9. claim: 13

   reflector antenna.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 18 0798

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-03-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		DE 3783525 T2	05-08-1993
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		US 4843468 A	27-06-1989

EPO FORM P0459

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