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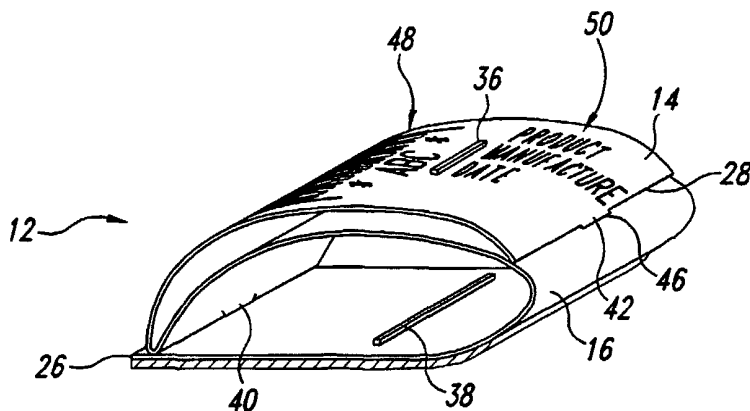
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ANTENNA STRUCTURE FOR WIRELESS COMMUNICATIONS DEVICE, SUCH AS RFID TAG



(57) Abstract: An antenna structure including a driven antenna element is formed on a substrate that is folded to provide a closed surface, causing the substrate to be nonplanar and spacing the driven antenna element from a base of the substrate. Adhesives on an outside surface of the substrate permit fastening of the folded substrate to a container or packaging. The substrate may have one or more resilient elbows formed by folding, to bias the antenna element carrying portion of the substrate from the base of the substrate. A modulation circuit may drive the driven antenna element. The flexible substrate may be folded into any of a

variety of forms such as a substantially O-shape, a substantially oval shape, a substantially coil shape, a substantially spiral shape, and a substantially S-shape. Additional folds in the substrate may provide surfaces for mounting passive or parasitic antenna elements, such as reflectors and directors, to form a Yagi antenna structure. A planar substrate carries a driven antenna element coupled to a driving circuit and at least one passive antenna element to form a directional antenna structure. The antenna structure may include additional passive antenna elements to enhance directionality. A computing system and printer are configured to determine the appropriate spacing and the form of the antenna elements on the substrate.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/08309

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01Q1/38 H01Q1/22 H01Q19/30

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)
IPC 7 H01Q

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 practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 220 335 A (HUANG JOHN) 15 June 1993 (1993-06-15) figures 1,2	1-5,8,9, 13, 60-63,66
Y	---	
A	US 5 786 626 A (FAVREAU NORMAND GILLES ET AL) 28 July 1998 (1998-07-28) column 1, line 11 - line 20 column 5, line 47 - line 51 column 9, line 22 - line 24	1-5,7-9, 13, 60-63,66 10-12, 14-21, 28-42, 67-88
Y	---	
A	EP 0 718 912 A (SEL ALCATEL AG) 26 June 1996 (1996-06-26) column 1, line 48 - line 59	7,43-46, 49 51-53

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* 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 document 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

21 August 2000

Date of mailing of the international search report

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Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/08309

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 710 337 A (GRANT R) 9 January 1973 (1973-01-09)	22-27
Y	figure 1 column 1, line 64 - line 68 column 2, line 17 - line 20 column 3, line 7 - line 15 column 5, line 35 - line 55 -----	43-46,49

INTERNATIONAL SEARCH REPORT

international application No.
PCT/US 00/08309

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-53, 60-88

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-53,60-88

Communications Device.

2. Claims: 54-57

Antenna Synthesis

3. Claims: 58-59

Antenna fabrication

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/08309

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
US 5220335	A	15-06-1993	NONE	

US 5786626	A	28-07-1998	JP 10013296 A	16-01-1998
			KR 216147 B	16-08-1999
			SG 54473 A	16-11-1998

EP 0718912	A	26-06-1996	DE 4446128 A	27-06-1996
			FI 956250 A	24-06-1996

US 3710337	A	09-01-1973	US 3707681 A	26-12-1972
			DE 2146182 A	18-01-1973
			GB 1313019 A	11-04-1973
			GB 1313020 A	11-04-1973
