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(71) Applicant *(for all designated States except US)*: ADDISON TECHNOLOGIES, doing business as E-CODE [US/US]; Suite 101, 113 West Hoover Avenue, Mesa, AZ 85210 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: RODGERS, James, L. [-/US]; 2440 South Playa, Mesa, AZ 85202 (US). FOWLER, Billy, C. [-/US]; 4471 East Olney, Phoenix, AZ 85044 (US). PICARD, Paul, A. [-/US]; 1546 South Reseda Circle, Mesa, AZ 85206 (US). JAECKS, Howard, K. [-/US]; 1933 West Main Street, Mesa, AZ 85201 (US). REHMAN, Mohammad, A. [-/US]; 3561 West Golden Lane, Chandler, AZ 85296 (US). COULTHARD, John, J. [-/US]; 10397 East Desert Cove Avenue, Scottsdale, AZ 85260 (US). LASTINGER, Roc, A. [-/US]; 3526 North Desert Oasis, Mesa, AZ 85207 (US).

(74) Agents: LECHTER, Micheal, A. et al.; Squire, Sanders & Dempsey L.L.P., Two Renaissance Square, Suite 2700, 40 North Central Avenue, Phoenix, AZ 85004-4440 (US).

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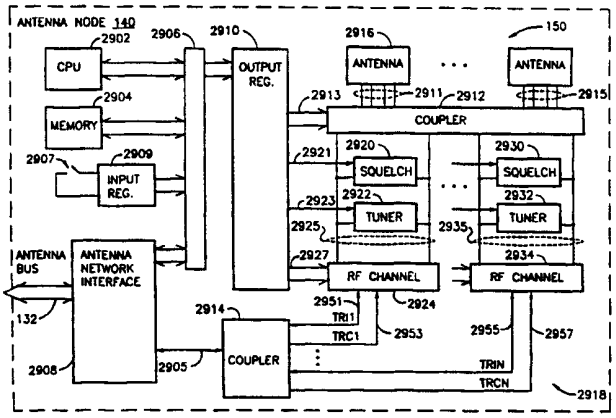
23 November 2000 (23.11.00)

(54) Title: ANTENNA SYSTEM FOR RADIO FREQUENCY IDENTIFICATION



(57) Abstract

An object identification system (100) includes a monitor (124) and a plurality of transceivers (114) that communicate over a common medium. The monitor includes a first transmitter (2424), a first receiver (2416), and a processor (2402). Each transceiver includes a resonant circuit (204), a transmitter (210), a receiver (208), and an antenna (202) coupled to the resonant circuit. The processor performs a method for performing transceiver communication (500) that includes the steps of: (a) transmitting (604) from the first transmitter a first frequency (170) for a first duration; (b) after lapse of the first duration, receiving (608) via the first receiver a response signal (172) from at least one of the resonant circuits; (c) determining (510) a second frequency from the received response signal; and (d) performing (512) transceiver communication using the second frequency. Transceivers of the type having a resonant circuit coupled to an antenna, when operating in close proximity to each other, may interfere with the response from a single transceiver by absorbing the energy intended to be received by the transceiver, absorbing the energy transmitted by the transceiver, or altering the resonant frequency of the resonant circuit. By determining the second frequency for transceiver communication, the monitor may establish communication with the single transceiver at a frequency better suited for transferring operative power (1593, 1597) to the transceiver, conducting an interrogation protocol (912, 1140, 1130) for identifying the transceiver, or for data transfer (914, 916, 918, 920).

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INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 99/28664

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H03H7/40 G01S13/02

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 G01S H03H 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, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	EP 0 210 746 A (MARCONI CO LTD) 4 February 1987 (1987-02-04) abstract; figure 1 column 2, line 27 -column 3, line 41 ---	1,2,8,16 3,16,17 9
X A	US 4 201 960 A (SKUTTA FRANK R ET AL) 6 May 1980 (1980-05-06) abstract; figure 1 column 2, line 35 - line 46 column 3, line 27 - line 52 ---	1,2,8,16 9
Y	US 4 486 722 A (LANDT HARVEY L) 4 December 1984 (1984-12-04) abstract; figure 1 column 2, line 47 - line 52 --- -/--	3

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 July 2000	18. 08. 2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Niemeijer, R

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 99/28664

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 594 448 A (D HONT LOEK) 14 January 1997 (1997-01-14) abstract; figure 9 column 8, line 32 -column 9, line 17	6
X	US 4 358 769 A (TADA MASAHIRO ET AL) 9 November 1982 (1982-11-09)	10-12
Y	abstract; figures 1,3 column 4, line 33 - line 49 column 3, line 6 - line 15	16,17
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/28664

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.:

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: 1-5,8,9,16

   Automated impedance matching

2. Claims: 6,7

   Antenna diversity

3. Claims: 10-15,17-19 (in combination with 16),29

   Loop antenna

4. Claims: 20-28

   Network with antenna nodes

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/US 99/28664

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