SYSTEM AND METHOD FOR CONCURRENT OPERATION OF MULTIPLE RADAR OR ACTIVE SONAR SYSTEMS ON A COMMON FREQUENCY

(57) Abstract: A system and corresponding method for the concurrent operation of multiple radar systems on a common frequency and in the same geographical area includes a waveform generator that specifies certain operating parameters for the transmitted radar pulses. In a first instance, the carrier frequency can include an offset for each radar system. In a second instance, complementary codes can be used for the radar pulses such that each radar system operates with a unique code for substantially reducing the cross-talk between the radar systems. In another instance, both carrier frequency offset and complementary coded waveforms can be used to increase the number of radar systems that operate concurrently. Carrier frequency offset can also be used to combat range-wrap by using different carrier frequencies for adjacent radar pulses.
Published:
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
22 December 2005

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.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

| IPC 7 | G01S13/87 | G01S13/28 | G01S13/24 | G01S7/36 |

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbol)

| IPC 7 | G01S |

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**

<table>
<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 3 731 310 A (RITTENBACH O.,US) 1 May 1973 (1973-05-01) column 1, line 56 - column 3, line 39; figures 1-5</td>
<td>1-5, 21-24</td>
</tr>
<tr>
<td>X</td>
<td>US 2003/025629 A1 (BARRICK DONALD E ET AL) 6 February 2003 (2003-02-06) paragraphs [0027] - [0053]; figures 1,2</td>
<td>1-5, 21-24</td>
</tr>
<tr>
<td>X</td>
<td>US 4 513 288 A (WEATHERS ET AL) 23 April 1985 (1985-04-23) column 3, line 11 - column 6, line 33; figures 1-14</td>
<td>6-10, 25-28</td>
</tr>
<tr>
<td>Y</td>
<td>US 4 338 604 A (PETITJEAN ET AL) 6 July 1982 (1982-07-06) column 4, line 59 - column 7, line 20; figures 1-4</td>
<td>11-14, 29-31</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of box C.

| X | 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
- **F**: 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 priority 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
- **Z**: document member of the same patent family

**Date of the actual completion of the international search**

15 September 2005

**Date of mailing of the international search report**

31.10.2005

**Name and mailing address of the ISA**

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 940-0200, Tx. 51 651 epc nl Fax. (+31-70) 940-0013

**Authorized officer**

Fanjul Caudevilla, J
<table>
<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>A</td>
<td>US 4 359 736 A (LEWIS ET AL) 16 November 1982 (1982-11-16) column 2, line 53 - column 5, line 34; figure 1</td>
<td>6, 11, 25, 29</td>
</tr>
</tbody>
</table>
INTERNATIONAL SEARCH REPORT

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(3)(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 III Observations where unity of invention is lacking (Continuation of item 3 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.:

   1-14, 21-31

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14,21-31

   System and method for allowing a pulsed radar system to operate concurrently with other radar systems on a common frequency, by using carrier frequency offsets and/or complementary codes.

   ---

2. claims: 15-20,32-35

   System and method for generating radar pulses adapted to avoid range wrap, by generating adjacent radar pulses having a unique carrier frequency chosen among a set of carrier frequencies.

   ---
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 3731310</td>
<td>01-05-1973</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US 2003025629 A</td>
<td>06-02-2003</td>
<td>DE 10231660 A</td>
<td>06-03-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GB 2383217 A</td>
<td>18-06-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2003121538 A</td>
<td>23-04-2003</td>
</tr>
<tr>
<td>US 4513288</td>
<td>23-04-1985</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US 4338604</td>
<td>06-07-1982</td>
<td>DE 3065998 D1</td>
<td>02-02-1984</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0023458 A</td>
<td>04-02-1981</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR 2462716 A</td>
<td>13-02-1981</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IL 60763 A</td>
<td>23-02-1983</td>
</tr>
<tr>
<td>US 4359736</td>
<td>16-11-1982</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>