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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

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(54) **Title:** PHY-LEVEL WIRELESS SECURITY

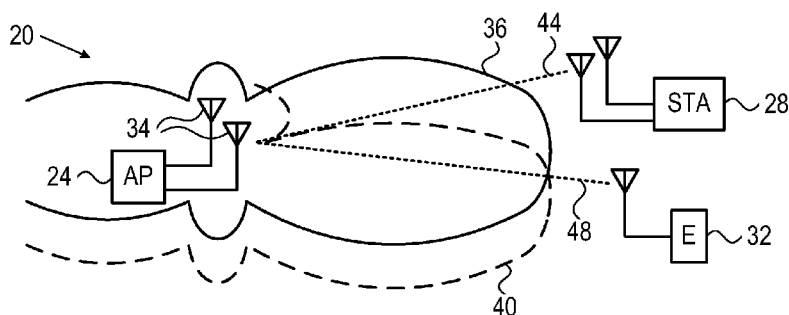


FIG. 1

(57) **Abstract:** A method for communication includes generating one or more data streams for transmission to respective target receivers (28), and one or more jamming streams. At least one parameter, selected from a group of parameters consisting of power ratios for allocation to the jamming streams and Modulation and Coding Schemes (MCSs) for assigning to the data streams, is calculated based on a criterion that is set to reduce a probability of the data streams being decoded by at least one eavesdropping receiver (32). The data streams and the jamming streams are transmitted using an antenna array (34) while applying the at least one parameter.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB12/50714

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01S 7/36, 7/38 (2012.01)

USPC - 455/1; 380/28, 35

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(8): G01S 7/36, 7/38, 7/282, 7/285 (2012.01)

USPC: 455/1; 713/168, 194; 380/28, 35, 37, 255

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)

MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); IEEE.org; Google Scholar; IP.com; jamming, jamming stream, jamming transmission, antenna, eavesdrop, intrusion, detect, monitor, PHY-level, modulation coding scheme, MCS, power ratio, power, calculate, measure, determine, transmission, communicate, receiver, wireless, mobile, prevent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Jam: Jamming Oneself for Secure Wireless Communication (GOLLAkota S et al.) June 07, 2010, MIT CSAIL, page 4, section 5, page 5, column 1, first paragraph, column 2, paragraph 2 and last paragraph, page 6, column 1, paragraphs 2-4	1-5, 6/1, 6/2/1, 7/1, 7/2/1, 8-12, 13/8, 13/8/9, 14/8, 14/8/9, 15-17, 19, 20/15, 20/16/15, 20/17/15, 20/19/15, 21/15, 21/16/15, 21/17/15, 21/19/15, 22-24, 26, 27/22, 27/23/22, 27/24/22, 27/26/22, 28/22, 28/23/22, 28/24/22 and 28/26/22
Y		18, 20/18/15, 21/18/15, 25, 27/25/22 and 28/25/22
Y	US 6272640 B1 (SOKOL M) August 7, 2001, column 6, lines 7-28	18, 20/18/15, 21/18/15, 25, 27/25/22 and 28/25/22

☐ Further documents are listed in the continuation of Box C.

* 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

24 August 2012 (24.08.2012)

Date of mailing of the international search report

18 SEP 2012

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB12/50714

Box No. 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(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 No. 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:

Group I: Claims 1-28; Group II: Claims 29-40; Group III: Claims 41-64

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-28 are directed toward a method for communication generating jamming streams; calculating parameter based on a probability of the data streams and transmitting the data streams and the jamming streams using an antenna array.

Group II: Claims 29-40 are directed toward a method for communication generating jamming streams; calculating beamforming vectors for the jamming streams by applying QR factorization and transmitting the data streams and the jamming streams using an antenna array.

-***-Continued Within the Extra Page-***-

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 additional fees, this Authority did not invite payment of additional fees.
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.:
1-28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB12/50714

-Continued from Box No. III: Observations where unity of invention is lacking-

Group III: Claims 41-64 are directed toward a method for communication generating jamming streams; holding a definition of at least first and second transmission modes and transmitting the data streams and the jamming streams using an antenna array.

The common technical feature shared by Groups I, II and III are a method for communication comprising generating jamming streams and transmitting data streams and the jamming streams using an antenna array. However, this common feature is previously disclosed by US 7,076,009 B2 (Wieck). Wieck discloses a method for communication generating jamming streams (jamming signals are generated and received by a receiver, abstract, claim 1 and figure 5) and transmitting data streams (data signals are generated and received by a receiver, abstract, claim 1 and figure 5) and the jamming streams using an antenna array (antenna 501, figure 5).

Since the common technical feature is previously disclosed by the Wieck reference, this common feature is not special and so Groups I, II and III lack unity.