Title: COMMUNICATION SYSTEM WITH UPLINK SPACE-TIME CODING VIA COORDINATED MOBILE TERMINALS

F₁ = UPLINK FREQUENCY RESOURCE
F₂ = DOWNLINK FREQUENCY RESOURCE
F₃ = RELAY FREQUENCY RESOURCE

Abstract: The present invention provides an effective way to create a virtual MIMO transmission system using mobile terminals that have only one transmit path and antenna. This is accomplished by assigning mobile terminals to a group and assigning certain shared resources and user-specific resources to those mobile terminals in the group. In a synchronized fashion, the mobile terminals will provide uplink transmission in concert, as if they were a single entity having multiple transmission paths and antennas. Preferably, the shared resources bear on how the data is transmitted, and the user-specific resources relate to pilot signals. The data transmitted may be encoded in any number of ways, and in one embodiment, the mobile terminals may relay their information to each other, such that uplink transmissions can incorporate STTD decoding or other space-time codes. The invention is applicable to virtually any multiple access technology, including OFDM, TDMA, and CDMA, preferably synchronous CDMA.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L1/06 H04L25/02 H04L27/26 H04B1/707 H04B7/08

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 H04L H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name or data base and, where practical, search terms used)
EPO-Internal, INSPEC, PAJ, IBM-TDB, 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 ***** -/- -- 5,20,34, 49

X 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
"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 relating 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.
"Z" document member of the same patent family

Date of the actual completion of the international search 17 March 2004

Date of mailing of the international search report 25.06.04

Name and mailing address of the IBA 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) 340-0016

Authorized officer Baltersee, J

Form PCT/ISA/1(2nd sheet) (January 2004)
<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>VANDENNAMEELE P ET AL: &quot;A COMBINED OFDM/SDMA APPROACH&quot; IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 18, no. 11, November 2000 (2000-11), pages 2312-2321, XP001063616 ISSN: 0733-8716 page 2313, left-hand column, Section II. page 2314, left-hand column, Section II. page 2314, Section III. Page 2318, Section V. page 2319 - page 2320, Appendix figure 1</td>
<td>1-3, 8, 10-12, 16-18, 23, 30-32, 37, 39-41, 45-47, 52</td>
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<td>A</td>
<td>EP 1 265 376 A (LUCENT TECHNOLOGIES INC) 11 December 2002 (2002-12-11) paragraph [0037]</td>
<td>5, 20, 34, 49</td>
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INTERNATIONAL SEARCH REPORT

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.:

   1-5, 8, 10-12, 16-20, 23, 30-34, 37, 39-41, 45-49, 52

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: 1-5,8,10-12,16-20,23,30-34,37,39-41,45-49,52
   Space-division-multiple-access for OFDM transmission,
   whereby the orthogonal pilot signals for each mobile
   terminal are created using STTD coding
   ---

2. claims: 6,7,21,22,35,36,50,51
   Space-division-multiple-access for CDMA transmission
   ---

3. claims: 9,38
   Combined space-division-multiple-access and
   space-time-coding system
   ---

   Space-time-coding system, wherein the mobile stations
   interchange transmission data in order to create an uplink
   space-time-coded multiuser signal.
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<td>JP 2000201102 A</td>
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