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— *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))*

(88) Date of publication of the international search report:
24 March 2011

(54) Title: A METHOD AND APPARATUS FOR MIMO REPEATER CHAINS IN A WIRELESS COMMUNICATION NETWORK

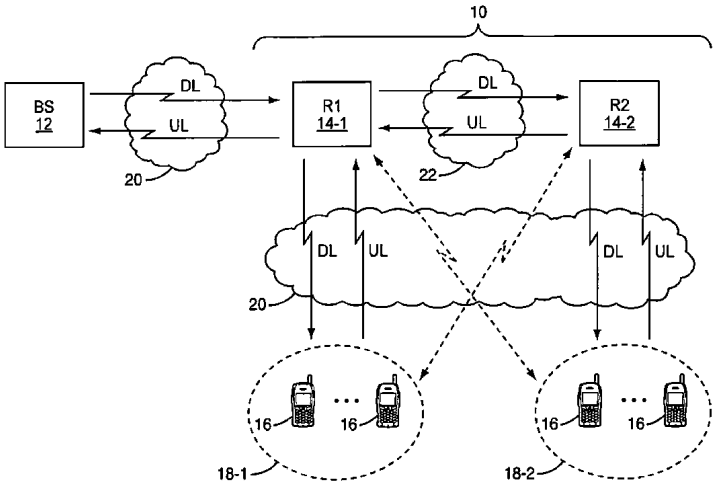

FIG. 1

(57) Abstract: In one or more embodiments taught herein, a multi-band MIMO repeater is configured to translate normal wireless mobile bands into other frequency bands in the physical layer. An advantageous, multi-hop repeater chain includes two or more such repeaters, for propagating downlink signals from a base station, and for propagating uplink signals to the base station. Each such repeater may use paralleled homodyne structure transceivers for better SNR, spectrum combiners for uplink signal aggregation, spectrum separators for downlink signal de-aggregation, water mark signal inserters for optimization, and, among other things, spectrum analyzers for frequency band selection. In at least one such embodiment, a multi-hop repeater chain is configured for MIMO operation in an LTE Advanced or other MIMO network, to deliver high data rate over larger distances — e.g., further away from cell base stations.

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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:

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 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.:

1-3, 25-27

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.

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04B7/26

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)
H04B H04W H04Q

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, 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	EP 1 804 442 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 4 July 2007 (2007-07-04) abstract paragraphs [0053] - [0060] paragraphs [0099] - [0103] figures 10,15 claims -----	1,3,25, 27 2,26
Y	WO 2005/064872 A1 (ERICSSON TELEFON AB L M [SE]; LARSSON PETER [SE]) 14 July 2005 (2005-07-14) the whole document -----	2,26

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

☒ See patent family 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	Date of mailing of the international search report
15 September 2010	28/01/2011

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, Fax: (+31-70) 340-3016	Dejonghe, Olivier

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EP 1804442 A1	04-07-2007	JP 2007184935 A	19-07-2007
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		US 2007160014 A1	12-07-2007

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-3, 25-27

   repeater multi-hop chain with MIMO capability
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2. claims: 6, 7, 18-20, 30, 31, 41-43

   repeater multi-hop chain with frequency band selection capability
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3. claims: 4, 5, 28, 29

   repeater multi-hop chain with diversity capability
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4. claims: 8-15, 17, 32-40

   repeater multi-hop chain with aggregation/de-aggregation capability
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5. claim: 16

   repeater multi-hop chain with colocated base station and repeater
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6. claims: 21, 24, 44, 47

   Frequency spectrum assignments for neighbouring cells comprising a repeater multi-hop chain
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7. claims: 23, 46

   repeater multi-hop chain with beamforming capability
