(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 May 2006 (18.05.2006)

PCT

(10) International Publication Number
WO 2006/051256 A1

(51) International Patent Classification:
H04L 12/28 (2006.01) *H04Q 7/38* (2006.01)

(21) International Application Number:
PCT/GB2005/004018

(22) International Filing Date: 19 October 2005 (19.10.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0424779.7 10 November 2004 (10.11.2004) GB

(71) Applicant *(for all designated States except US)*: **SIEMENS AKTIENGESELLSCHAFT** [DE/DE]; Wittelsbacherplatz 2, D-80333 München (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **BOOKER, Philip** [GB/GB]; Flat 35, Tennyson Court, Winn Road, Southampton Hampshire SO17 1ER (GB). **CHAPMAN, Thomas Malcolm** [GB/GB]; 68 Montgomery Road, Bitterne, Southampton Hampshire SO18 4RY (GB). **KRAUSE, Jörn** [DE/DE]; Freibergstr. 28-30, D-12107 Berlin (DE). **PROCTOR, Toby, Kier** [GB/GB]; 30 St Ann Street, Salisbury Wiltshire SP1 2DP (GB).

(74) Agents: **PAYNE, Janice Julia** et al.; Siemens Aktiengesellschaft, Postfach 22 16 34, D-80506 Munich (DE).

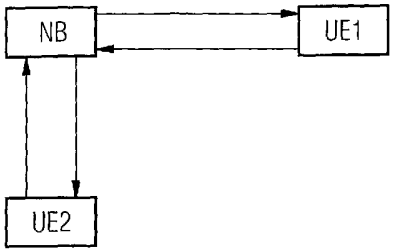
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

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.

(54) **Title:** A METHOD OF CONTROLLING ONE OR MORE TERMINALS FROM A BASE STATION



(57) **Abstract:** A method of controlling one or more terminals (UE1, UE2) from a base station (NB) comprises setting one or more identifiers (UEID1, UEID2) for each terminal and allocating a priority ranking to each identifier to determine priority of one scheduling command relative to any other scheduling command. A data block is transmitted from the base station to the, or each, terminal, including the scheduling command and at least one identifier. Each terminal indicated by the identifier adapts its power level or data rate in accordance with the scheduling command.

WO 2006/051256 A1

A METHOD OF CONTROLLING ONE OR MORE TERMINALS FROM A BASE STATION

This invention relates to a method of controlling one or more terminals from a base station.

In the third generation partnership project (3GPP) work is ongoing relating to enhanced uplink (or enhanced dedicated channel (E-DCH)) for frequency division duplex (FDD). Improvements provide a feature for universal mobile telecommunication system (UMTS) that enhances uplink (UL) transmissions from the mobile station or user equipment (UE) to the base station, or Node B by the Node B scheduling the interference, transmit power received at the Node B and transport formats used. These three parameters are coupled. Furthermore, a hybrid automatic repeat request (HARQ) mechanism sends acknowledgements (ACK) or non-acknowledgements (NACK) from a Node B, or in case of soft handover, more than one Node B, to the UE to trigger retransmissions. There is also some consideration of implementing a shorter transmission time interval (TTI) of 2ms, rather than a 10ms TTI which is more usually considered to be standard. The effect of all these changes is to improve coverage and throughput, as well as to reduce delay in the UL.

However, it is necessary to provide a way of scheduling commands from the base station to the terminal.

In accordance with a first aspect of the present invention, a method of controlling one or more terminals from a base station comprises setting one or more identifiers for each terminal; allocating a priority ranking to each identifier to determine priority of one scheduling command relative to any other scheduling command; and transmitting a data block from the base station to the, or each, terminal, including the scheduling command and at least one identifier; wherein each terminal indicated by the identifier adapts its power level or data rate in accordance with the scheduling command.

This ensures that changes in power level or data rate of a terminal can be controlled without having to apply the same changes to all terminals.

Preferably, each scheduling command includes a validity period.

This reduces the need for the base station to send commands, because the terminal will automatically revert to a default value on expiry of the validity period.

The default value could be one which is preset for all terminals, but preferably, each terminal indicated by an identifier in a scheduling command reverts to the power level and data rate of its lowest priority identifier, on expiry of the validity period of that scheduling command.

Certain terminals may have a need for a higher basic power level and data rate, so this can be set individually, as the lowest priority identifier.

The terminal could respond substantially instantaneously to a change indicated by a scheduling command, but preferably, each terminal indicated by an identifier in a new scheduling command changes its power level or data rate in accordance with the new scheduling command, only when a validity period for a previous scheduling command for that terminal expires.

This allows the base station to plan ahead in terms of resources.

Although the scheduling command could set a relative change, such as increase or decrease power by a fixed amount, preferably, the scheduling command sets an absolute power level or data rate.

The terminal could be a static terminal, but preferably, the terminal comprises a mobile terminal.

Preferably, the identifiers for a terminal in soft handover are identifiers from different base stations and their relative priorities.

When in soft handover, the terminal may receive scheduling information from more than one base station, so it needs to know which takes precedence.

A method of scheduling one or more terminals from a base station will now be described, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a first example of the present invention;

Figure 2 shows the invention applied during soft handover; and

Figure 3 illustrates how priorities are allocated and used according to the present invention.

In Fig. 1, a node B NB schedules a pair of terminals UE1 and UE2, typically mobile terminals within a cell. If UE1 is causing interference, the node B can send a scheduling command to UE1 which reduces its data rate and power level to the specified lower ones, without affecting UE2. Alternatively, if NB has spare resources

it can send a command, indicating to both UE1 and UE2 that they can increase their power levels and data rate to the same, higher, value.

Fig. 2 illustrates the problem of soft handover, where terminals T1 and T3 might receive scheduling commands from both NB1 and NB2. Using the method of the present invention, the terminals will be given an identifier and priority ranking, so that they know which node B to follow.

Different ways of scheduling commands, or grants, sent from the Node B to the UE are possible. An absolute scheduling grant indicates an absolute setting of UL transmit power limit or UL transport format limit, whereas a relative scheduling grant gives an up or hold or down command for setting UL transmit power limit or UL transport format limit.

For the absolute scheduling grant, a corresponding scheduling identification, currently called UE Id, is sent together with the command to indicate the UE to which the scheduling grant applies. The scheduling grants can affect an individual UE (individual scheduling identification), a configured group of UEs ('group scheduling identification'), or all UEs which are under control of the scheduling Node B ('common scheduling identification'). Thus, there is a hierarchical scheduling identification giving different levels of grants. The UE receives configuration information (e.g. when the E-DCH channel is set up or reconfigured) in which a prioritized list of scheduling identifications is provided to indicate which scheduling identification has a higher priority, if the UE has or receives different grants with overlapping validity periods. Alternatively, the absolute grants may remain valid until the next absolute grant occurs, rather than being given a specific validity period.

One example of using a list of prioritised UE IDs is one in which one of the IDs is used for scheduling a group of UEs. All of the UEs in the group are given a common ID as one of their UE IDs and individual Ids as another of their UE IDs. Their behaviour on receiving an absolute grant containing a UE ID will differ depending on whether the grant contains the common ID or an individual ID and the priority of the common/individual IDs.

In Fig. 3, a UE, e.g. UE1 is allocated 2 IDs with different priorities. The higher priority is UEID1 and the lower priority is UEID2, i.e. ID1 has a higher priority than ID2. The UE receives an absolute grant for UEID1, which has priority 1, so the UE

responds. It also receives an absolute grant for UEID2, with priority 2, but the UE does not respond to this because it already has a valid grant with a higher priority number.

The present discussion assumes that absolute scheduling grants are received only from the serving Node B and relative grants from all cells/Node Bs. Hence non-serving Node Bs could stop interference increasing absolute grants from serving cell/Node B e.g. by an overload indication provided via their relative grants.

Advantages of the proposed invention include a reduction and simplification of scheduling grants. A group or all UEs can be addressed by one grant only which is quicker in overload situations and saves downlink power and radio resources in general. Although the scheduler in the Node B is implementation specific, corresponding signalling for the configuration is needed in the standard and cost savings in the sense of radio resources can be achieved.

CLAIMS

1. A method of controlling one or more terminals from a base station, the method comprising setting one or more identifiers for each terminal; allocating a priority ranking to each identifier to determine priority of one scheduling command relative to any other scheduling command; and transmitting a data block from the base station to the, or each, terminal, including the scheduling command and at least one identifier; wherein each terminal indicated by the identifier adapts its power level or data rate in accordance with the scheduling command.

2. A method according to claim 1, wherein each scheduling command includes a validity period.

3. A method according to claim 2, wherein each terminal indicated by an identifier in a scheduling command reverts to the power level and data rate of its lowest priority identifier, on expiry of the validity period of that scheduling command.

4. A method according to claim 2, wherein each terminal indicated by an identifier in a new scheduling command changes its power level or data rate in accordance with the new scheduling command, only when a validity period for a previous scheduling command for that terminal expires.

5. A method according to any preceding claim, wherein the scheduling command sets an absolute power level or data rate.

6. A method according to any preceding claim, wherein the terminal is a mobile terminal.

7. A method according to claim 6, wherein the identifiers for a terminal in soft handover are identifiers from different base stations and their relative priorities.

FIG 1

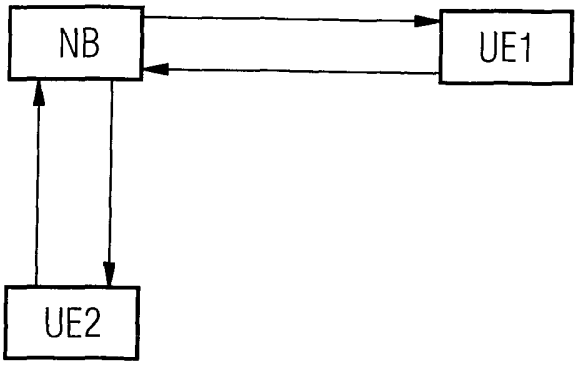
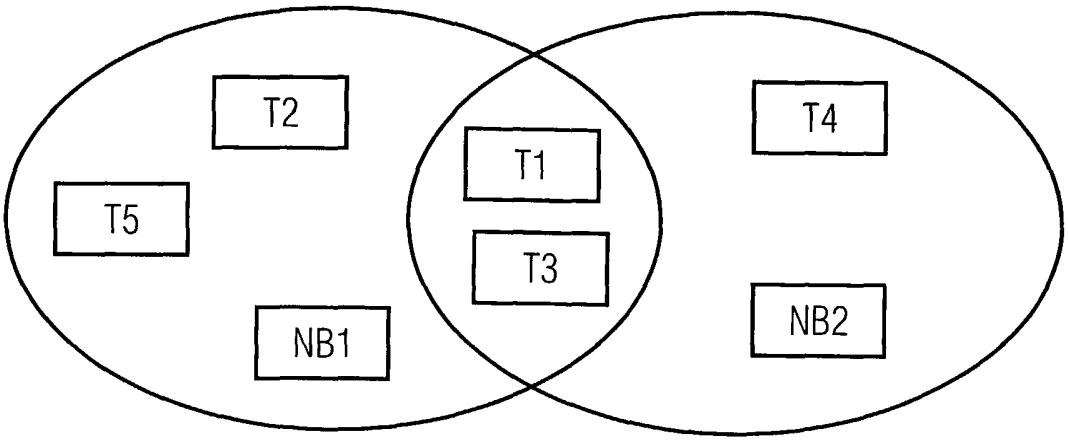


FIG 2



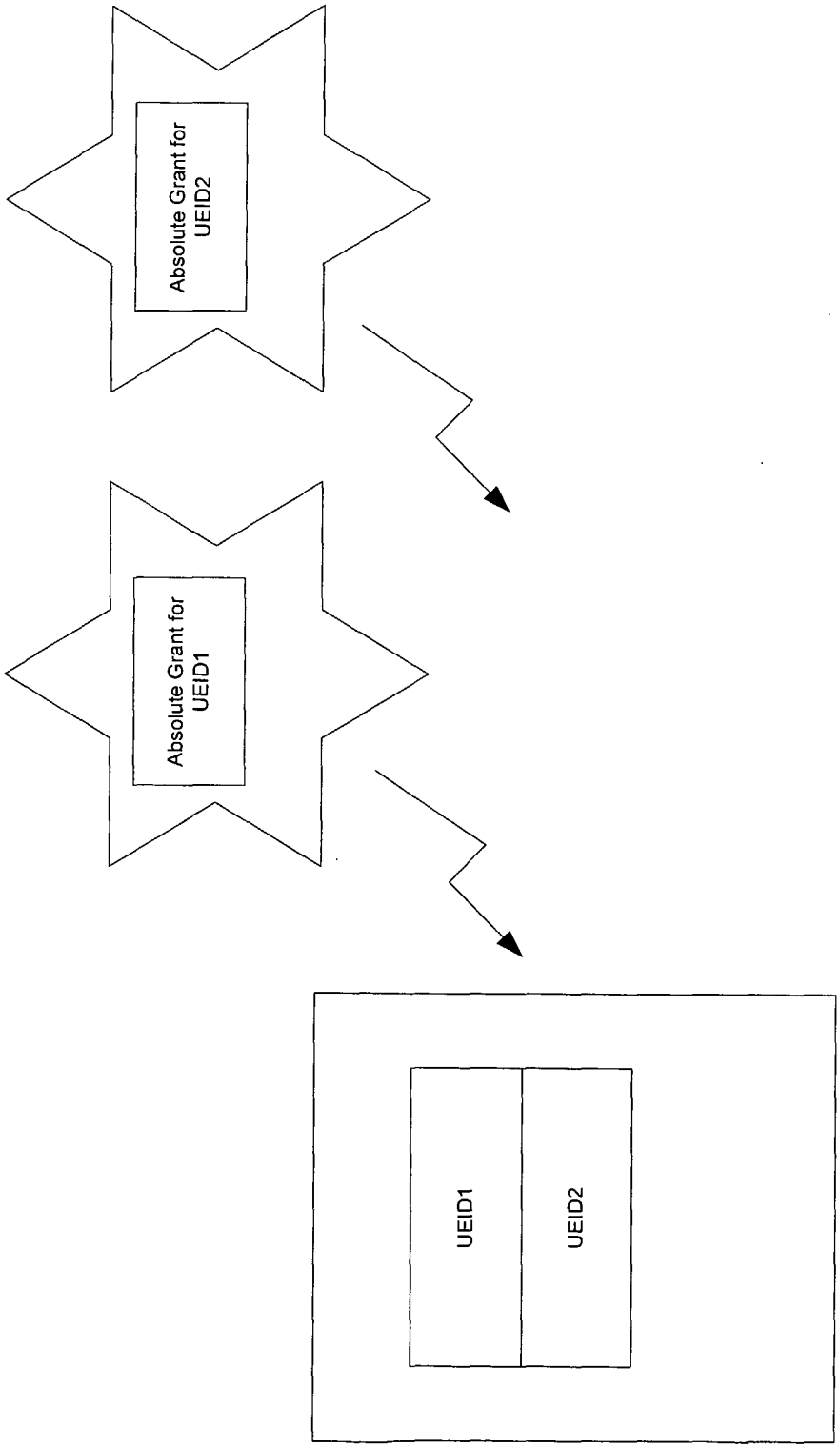

Absolute Grant for UEID2
Absolute Grant for UEID1
UEID1
UEID2

fig. 3

INTERNATIONAL SEARCH REPORT

Inte nal Application No
PC I7GB2005/004018

A. CLASSIFICATION OF SUBJECT MATTER
H04L12/28 H04Q7/38

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)
H04L 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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/064426 A (TELEFONAKTIEBOLAGET LM ERICSSON ; BALASUBRAMANIAN, SRINIVASAN; COMSTOC) 29 July 2004 (2004-07-29) paragraphs '0003! - '0006! paragraphs '0018! - '0024! paragraphs '0032! - '0039! paragraphs '0043! - '0052! claims 1,2,16-25 figures 1-6	1-7
X	EP 1 447 938 A (SAMSUNG ELECTRONICS CO., LTD) 18 August 2004 (2004-08-18) paragraph '0001! paragraphs '0020! - '0028! paragraph '0043! paragraphs '0046! - '0052! claim 1 figures 4-10	1-7

-/--

[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 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
26 January 2006	02/02/2006

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	Pérez, M

INTERNATIONAL SEARCH REPORT

Int[illegible]nal Application No
PCT/GB2005/004018

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"Feasibility study for enhanced uplink for UTRA FDD (Release 6) 3GPP TR 25.896" 3GPP TR 25.896 V6.0.0, March 2004 (2004-03), page complete, XP002322111 paragraph '6.3.1! paragraph '07.1! paragraph '7.1.3!	1-7
A	EP 1 005 243 A (TELEFONAKTIEBOLAGET LM ERICSSON) 31 May 2000 (2000-05-31) paragraphs '0014!, '0015! paragraphs '0024! - '0042! figures 6-8	1-7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2005/004018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004064426 A	29-07-2004	BR 0406654 A	06-12-2005
EP 1447938 A	18-08-2004	AU 2004200541 A1	02-09-2004
		CA 2457285 A1	15-08-2004
		CN 1527504 A	08-09-2004
		JP 2004248300 A	02-09-2004
		US 2005025100 A1	03-02-2005
EP 1005243 A	31-05-2000	AT 274281 T	15-09-2004
		AU 765777 B2	02-10-2003
		AU 1266200 A	13-06-2000
		CN 1328759 A	26-12-2001
		DE 69919574 D1	23-09-2004
		DE 69919574 T2	14-07-2005
		WO 0032000 A1	02-06-2000
		JP 2002531029 T	17-09-2002