Fig. 3
PROVIDING OF CHANNEL QUALITY INFORMATION IN COMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

The exemplary and non-limiting embodiments of this invention relate generally to providing channel quality information in a communications system.

BACKGROUND ART

The following description of background art may include insights, discoveries, understandings or disclosures, or associations together with disclosures not known to the relevant art prior to the present invention but provided by the invention. Some of such contributions of the invention may be specifically pointed out below, whereas other such contributions of the invention will be apparent from their context.

In a communications system based on LTE Rel'8 (long term evolution release 8), a base station is arranged to transmit data on a shared channel to the user terminal. The shared channel is mapped to a set of physical resource blocks (PRB) in a frequency domain. The user terminal is arranged respond by transmitting information on a respective channel quality indicator (CQI). LTE-A (long term evolution advanced) in 3GPP (third generation partnership project) enables the utilization of multiple component carriers where the system bandwidth contains a set of component carrier signals that may be contiguous or non-contiguous. Therefore, the scheme used for the reporting of CQI in LTE Rel'8 may not be sufficient for LTE-A.

SUMMARY

The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

Various aspects of the invention comprise a method, system, apparatus, network element, and a computer program as disclosed in the inde-
ependent claims. Further embodiments of the invention are disclosed in the dependent claims.

An aspect of the invention relates to a method for providing channel quality information in a communications system. In the method, an apparatus (such as a user terminal) is arranged to monitor a set component carrier signals transmitted from a network element (such as a base station) to the apparatus. On the basis of said monitoring, the apparatus obtains channel quality information regarding the set of component carriers. On the basis of the channel quality information, the best component carrier signal is identified for the apparatus. Information on the identification and the channel quality of the best component carrier signal is then provided to the network element.

The present solution provides a simple yet efficient scheme for the reporting of channel quality indicator information in an advanced communications system (such as LTE-advanced), where the best component carrier may be identified for the user terminal, and a respective frequency-selective channel quality report may be transmitted to the network.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following the invention will be described in greater detail by means of exemplary embodiments with reference to the attached drawings, in which

Figure 1 shows a simplified block diagram illustrating an exemplary system architecture.

Figure 2 shows a simplified block diagram illustrating exemplary carrier aggregation with non-contiguous bands.

Figure 3 shows a messaging diagram illustrating an exemplary messaging event according to an embodiment.

Figure 4 shows a schematic diagram of a current mirror according to an exemplary embodiment.

Figure 5 shows a schematic diagram of a current mirror according to an exemplary embodiment.

Figure 6 is a block chart illustrating an apparatus according to an exemplary embodiment.
DETAILED DESCRIPTION OF SOME EMBODIMENTS

Exemplary embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be constructed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Although the specification may refer to "an", "one", or "some" embodiment(s) in several locations, this does not necessarily mean that each such reference is to the same embodiment(s), or that the feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments. Like reference numerals refer to like elements throughout.

The present invention is applicable to any user terminal, server, corresponding component, and/or to any communication system or any combination of different communication systems that support component carriers. The communication system may be a fixed communication system or a wireless communication system or a communication system utilizing both fixed networks and wireless networks. The protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment.

In the following, different embodiments will be described using, as an example of a system architecture wherein the embodiments may be applied, an architecture based on a E-UTRAN network without restricting the embodiment to such an architecture, however.

A general architecture of a communication system providing an example of an environment where the present solution may be used, is illustrated in Figure 1. Figure 1 is a simplified system architecture only showing some elements and functional entities, all being logical units whose implementation may differ from what is shown. The connections shown in Figure 1 are logical connections; the actual physical connections may be different. It is apparent to a person skilled in the art that the systems also comprise other functions and structures. It should be appreciated that the functions, structures, elements
and the protocols used in or for group communication, are irrelevant to the actual invention. Therefore, they need not to be discussed in more detail here.

Referring to Figure 1, a communications system (S) 1-1 comprises a user equipment (UE) 1-2 that may be e.g. a mobile or wireless user terminal, such as a mobile phone (mobile station), a personal digital assistant (PDA), a game console, a smart phone, a personal computer (PC), a laptop, a desktop computer or the like, capable of receiving component carrier signalling. The system 1-1 further comprises an access network 1-3, such as an evolved UMTS terrestrial radio access network of an enhanced cellular network (E-UTRAN). Although E-UTRAN is discussed as a primary example herein, the present solution is not limited to E-UTRAN, LTE, and/or 3GPP systems. Thus, the present solution may also be applicable to other communications systems such as LTE-A, LTE Rel'10, LTE-TDD, WiMAX (worldwide interoperability for microwave access) and/or WLAN (wireless local area network). E-UTRAN 1-3 comprises an apparatus that may include e.g. a network node or a component, such as an LTE base station (eNB, E-UTRAN node B, eNodeB) 1-4, capable of transmitting component carrier signalling. Here it is assumed that the user equipment (UE) 1-2 is capable of communicating with the base station (eNB) 1-4 by utilizing an air interface (also referred to as a radio interface, illustrated by an arrow in Figure 1).

Figure 2 shows an example of an arrangement using component carrier aggregation (which may also be referred to as channel bonding), where a total system bandwidth contains a set of component carriers BW1, BW2, BWN as illustrated in Figure 2. The component carriers BW1, BW2, BWN may be next to each other (i.e. forming a single contiguous system bandwidth), or they may be arranged to have a carrier frequency f1, f2, fN spacing significantly larger than their individual bandwidths. Supposedly, LTE-advanced in 3GPP is going to assume carrier aggregation to form bandwidths of up to 100 MHz by having aggregation of 5 component carriers of 20 MHz each. Those component carriers may be contiguous or non-contiguous. As LTE-advanced should be backwards compatible with LTE Rel'8, it seems that 3GPP is in favour of having a downlink (DL) radio resource management (RRM) framework, where independent transport blocks are transmitted on different component carriers. This means that different modulation and coding schemes (MCS) may be used on the different component carriers, although transmitted to the same user. In order to facilitate such schemes with efficient frequency domain link adaptation
scheduling, user terminals may provide frequency selective channel quality indicator (CQI) feedback. In order have a reasonable uplink (UL) CQI overhead, new CQI reporting schemes may be required when the system bandwidth is extended from 20 MHz (which is the maximum bandwidth for LTE Rel'8) to 100 MHz. An exemplary embodiment of the present solution relates to an enhanced CQI reporting scheme for LTE-advanced using multiple component carriers.

An exemplary embodiment of the present solution involves designing a reasonable CQI reporting scheme for LTE-A (i.e. for bandwidths of up to 100 MHz), which CQI reporting scheme has a relatively low uplink (UL) signalling overhead, and at the same time providing sufficient information to eNB for performing an efficient frequency domain link adaptation and scheduling.

Figure 3 shows a messaging diagram illustrating an exemplary messaging event according to an embodiment. Referring to Figure 2, an apparatus (which may be e.g. a user terminal UE) monitors, in step 3-2, a set "A" of different component carrier signals transmitted, in a message 3-1, from a network element (which may be e.g. a base station such as an LTE base station eNB). The set "A" may include all the component carrier frequencies in the total system bandwidth, or it may be reduced to only include a sub-set of the component carrier frequencies. Information on the configuration of the set "A" may be provided 3-1 from the base station eNB to the user terminal UE by using higher layer signalling, e.g. radio resource control (RRC) signalling may be used. UE and eNB should both have a common understanding of the set "A". The set of component carriers monitored by UE for CQI reporting is "A". eNB only uses the set "A" of component carriers for scheduling of user data. The user terminal UE is arranged to identify, in step 3-2, the best component carrier among those in the set "A". The best component carrier identified by the user terminal UE may be referred to as a component carrier "a". The identifying of the best component carrier may be based on (but is not limited to) average signal-to-interference-plus-noise-ratio (SINR) measurements per component carrier, or it may also be based on reference signal received quality (RSRQ) measurements. In LTE, UE monitors so-called reference symbol (RS) signals when estimating CQI. For example, the best component carrier may be identified as the one with the highest SINR. SINR may be best when measuring the signals on the different component carriers on RS. A frequency selective CQI report, in coherence with the LTE Rel'8 definitions, is then transmitted, in step
3-3, to the base station eNB serving the user terminal UE, wherein the report may include e.g. identification information and channel quality information on the best component carrier "a". This kind of reporting may be carried out according to a so-called average best-M scheme, or it may include full CQI reporting for individual sub-bands of k contiguous physical resource blocks (PRB), as well as a wideband CQI measure for the component carrier. Anyway, the idea is that a Rel'8 compliant CQI report can be sent for the best component carrier (e.g. best-M or other modes). In addition to sending the detailed CQI report reporting the best component carrier "a" within the set "A", the user terminal UE is also arranged to transmit 3-3 information expressing an average channel quality of the remaining worse component carriers. Such information may be sent by having individual wideband CQI reports for the worse component carriers, or by expressing the relative wideband CQI of the worse component carriers compared to the wideband quality of the best component carrier. It should be noted that if the set "A" for UE is defined to be limited to a single component carrier, the signaling of "a" is not necessary, and in that case UE may simply sent a "normal" Rel'8 CQI report. Thus, eNB receives, in step 3-4, detailed frequency selective channel quality information on the best component carrier, as well as wideband channel quality information on the remaining component carriers in the set "A". This may be considered sufficient in most cases, where eNB primarily aims at scheduling a single component carrier (i.e. the best) for each UE, if the data amount to be delivered to the user terminal does not require larger transmission bandwidth. Thus, eNB performs, in step 3-4, a frequency domain link adaptation and scheduling of resource blocks for UE on the basis of the received CQI report (i.e. on the basis of the channel quality information on the best component carrier and/or on the basis of the average channel quality information on the "worse" component carriers). In cases where a much larger transmission bandwidth than a single component carrier is needed for the user terminal UE, it may be sufficient to know the average channel quality of the component carriers, as in that case the base station eNB anyway schedules 3-4 the user terminal UE over large bandwidths. The exemplary contents of the CQI reports that may be provided by UE for different configurations of the set "A", are illustrated in Table 1.
For example, configurations 2) and 3) (and potentially 4) and 5)) may be sent using the same 3-bit field for a more generalized reporting format. Configurations 2) to 5) may be transmitted using a single generalized format.

For example, the present solution enables defining the set of component carrier frequencies in connection with CQI reporting. For example, the CQI reporting description may cover a set of component carrier frequencies which may be used as reference for the measurement. Especially, the present solution may be related to specific reporting options, e.g. maintaining a good CQI reporting accuracy of the good (i.e. the best) component carrier (including indication of this) as well as providing an average CQI reporting for the remaining component carriers.

In an exemplary embodiment, UE may comprise means for measuring the channel quality between UE and eNB, and means for transmitting a respective CQI report to eNB. In a further exemplary embodiment, eNB may
comprise means for receiving the CQI report from UE, and for performing a
frequency domain link adaptation and scheduling on the basis of the received
CQI report.

For example, the present solution results in a tolerable size of the
CQI reporting in uplink for LTE-advanced, while still providing the required in-
formation for the system to benefit from the frequency domain link adaptation
and scheduling. In the present solution, the CQI word size is significantly
smaller than the CQI word size of the scheme where the detailed CQI report
according to LTE Rel'8 is simply repeated for each component carrier.

For example, the present solution enables configuring a CQI report
for LTE-A where multiple carriers are aggregated. UE may indicate the best
carrier, and frequency-selective information for the best carrier. A wideband
CQI for the "non-best" carrier(s) may also be configured.

For example, additional CQI information on the other component
carriers may be provided, wherein the additional CQI information may result in
a reduced overhead.

Figure 4 is a flow chart illustrating the functioning of an apparatus
according to an exemplary embodiment of the present solution. Referring to
Figure 4, as the process starts, the apparatus (which may be e.g. a user termi-
nal UE) monitors, in step 4-1, a set "A" of different component carriers received
4-1 from a network element (which may be e.g. a base station such as an LTE
base station eNB). The set "A" may include all the component carrier frequen-
cies in the total system bandwidth, or it may be reduced to only include a sub-
set of the component carrier frequencies. Configuration of the set "A" may be
signalled from the base station eNB to the user terminal UE by using higher
layer signalling, e.g. radio resource control (RRC) signalling may be used. UE
should have a common understanding with eNB of the set "A". The user termi-
nal UE is arranged to identify, in step 4-2, the best component carrier among
those in the set "A". The best component carrier identified by the user terminal
UE may be referred to as a component carrier "a". The identifying of the best
component carrier may be based on (but is not limited to) average signal-to-
interference-plus-noise-ratio (SINR) measurements per component carrier, or it
may also be based on reference signal received quality (RSRQ) measure-
ments. A frequency selective CQI report, in coherence with the LTE Rel'8 defi-
nitions, is then transmitted, in step 4-3, to the base station eNB serving the
user terminal UE, the report including information on the identifying of the best
component carrier "a". This kind of reporting may be carried out according to a
so-called average best-M scheme, or it may include full CQI reporting for indi-
vidual sub-bands of k contiguous physical resource blocks (PRB), as well as a
wideband CQI measure for the component carrier. In addition to sending the
detailed CQI report reporting the best component carrier "a" within the set "A",
the user terminal UE may also be arranged to identify 4-2 the other component
carriers, and transmit 4-3 information expressing an average channel quality of
the remaining "worse" component carriers. Such information may be sent by
having individual wideband CQI reports for the worse component carriers, or
by expressing the relative wideband CQI of the worse component carriers
compared to the wideband quality of the best component carrier. It should be
noted that if the set "A" for UE is defined to be limited to a single component
carrier, the signalling of "a" is not necessary, and in that case UE may simply
sent a "normal" Rel'8 CQI report.

Figure 5 is a flow chart illustrating the functioning of a network ele-
ment according to an exemplary embodiment of the present solution. Referring
to Figure 5, as the process starts, the network element (which may be e.g. a
base station such as a LTE base station eNB) transmits, in step 5-1, signalling
to an apparatus (which may be e.g. a user terminal UE) by using a set "A" of
different component carriers. The set "A" may include all the component carrier
frequencies in the total system bandwidth, or it may be reduced to only include
a sub-set of the component carrier frequencies. Configuration of the set "A"
may be signalled 5-1 from the base station eNB to the user terminal UE by us-
ing higher layer signalling, e.g. radio resource control (RRC) signalling may be
used. eNB should have a common understanding with UE of the set "A". In
step 5-2, a frequency selective CQI report, in coherence with the LTE Rel'8
definitions, is received from the user terminal UE, the report including informa-
tion on the identifying of the best component carrier. The best component car-
rier identified by the user terminal UE may be referred to as a component car-
ier "a". In addition to receiving the detailed CQI report reporting the best com-
ponent carrier "a" within the set "A", the base station eNB may also be ar-
ranged to receive 5-2 information expressing an average channel quality of the
remaining worse component carriers. Such information may include individual
wideband CQI reports for the worse component carriers, or it may express the
relative wideband CQI of the worse component carriers compared to the wide-
band quality of the best component carrier. It should be noted that if the set "A"
for UE is defined to be limited to a single component carrier, the signalling of "a" is not necessary, and in that case a "normal" Rel'8 CQI report may simply be received 5-2. Thus, eNB receives, in step 5-2, detailed frequency selective channel quality information on the best component carrier, as well as wideband channel quality information on the remaining component carriers in the set "A". This is considered to be sufficient in most cases, where eNB primarily aims at scheduling a single component carrier (i.e. the best) for each UE, if the data amount to be delivered to the user terminal does not require larger transmission bandwidth. Thus, eNB is able to perform, in step 5-3, a frequency domain link adaptation and scheduling of UE on the basis of the received CQI report. In cases where a much larger transmission bandwidth than a single component carrier is needed for the user terminal UE, it may be sufficient to know the average channel quality of the component carriers, as in that case the base station eNB anyway schedules 5-3 the user terminal UE over large bandwidths. In the exemplary embodiment, UE may identify the best component carrier and signals information on the identification to eNB. A packet scheduler in eNB is able to use this information when it decides at which component carriers it wishes to schedule the different user terminals.

Figure 6 illustrates an apparatus according to an exemplary embodiment the present solution. Although the apparatus has been depicted as one entity, different modules and memory may be implemented in one or more physical or logical entities. For example, the identification of the best component carrier may be implemented as a single functionality, while the estimation of the detailed CQI report for the component carriers may be applied in a separate functionality. In the exemplary embodiment, the apparatus 6-1 comprises a processor 6-2 configured to generate a data signal, wherein the processor may be operably coupled to a memory module 6-3 configured to store a data signal. The processor and/or the memory module may further be operably coupled to e.g. a transmission module 6-4 configured to send a data signal, and/or a receiver module 6-4 configured to receive a data signal. The functionality of the apparatus 6-1 is described in more detail above with Figures 1 to 5. The apparatus 6-1 may be any node or a host which is able to handle component carriers. The apparatus 6-1 may also be a user terminal which is a piece of equipment or a device that associates, or is arranged to associate, the user terminal and its user with a subscription and allows a user to interact with a communications system. The user terminal presents information to the user.
and allows the user to input information. In other words, the user terminal may be any terminal capable of receiving information from and/or transmitting information to the network, connectable to the network wirelessly or via a fixed connection. Examples of the user terminal include a personal computer, a game console, a laptop (a notebook), a personal digital assistant, a mobile station (mobile phone), and a line telephone. The apparatus 6-1 may generally include a processor 6-2, controller, control unit or the like connected to a memory 6-3 and to various interfaces of the apparatus. Generally the processor is a central processing unit, but the processor may be an additional operation processor. The processor 6-2 may comprise a computer processor, application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), and/or other hardware components that have been programmed in such a way to carry out one or more functions of an embodiment. The apparatus 6-1 is configured to perform the method steps as described above with Figures 1 to 5. For this purpose, the apparatus comprises a unit for executing the functionalities of the present solution as described above. The unit may be software and/or software-hardware and/or firmware components (recorded indelibly on a medium such as read-only-memory or embodied in hard-wired computer circuitry). The memory 6-3 may include volatile and/or non-volatile memory and typically stores content, data, or the like. For example, the memory may store computer program code such as software applications (for example for the detector unit and/or for the adjuster unit) or operating systems, information, data, content, or the like for the processor 6-2 to perform steps associated with operation of the apparatus in accordance with embodiments. The memory may be, for example, random access memory (RAM), a hard drive, or other fixed data memory or storage device. Further, the memory, or part of it, may be removable memory detachably connected to the apparatus.

The techniques described herein may be implemented by various means so that an apparatus implementing one or more functions of a corresponding mobile entity described with an embodiment comprises not only prior art means, but also means for implementing the one or more functions of a corresponding apparatus described with an embodiment and it may comprise separate means for each separate function, or means may be configured to perform two or more functions. For example, these techniques may be implemented in hardware (one or more apparatuses), firmware (one or more apparatuses), software (one or more modules), or combinations thereof. For a firm-
ware or software, implementation can be through modules (e.g., procedures, functions, and so on) that perform the functions described herein. The software codes may be stored in any suitable, processor/computer-readable data storage medium(s) or memory unit(s) or article(s) of manufacture and executed by one or more processors/computers. The data storage medium or the memory unit may be implemented within the processor/computer or external to the processor/computer, in which case it can be communicatively coupled to the processor/computer via various means as is known in the art.

Thus, an aspect of the invention relates to a method comprising monitoring a set component carrier signals transmitted from a network element to an apparatus. Based on the monitoring, channel quality information regarding the set is obtained. Based on the information, the best component carrier signal is identified for the apparatus, and information on the best component carrier signal is provided to the network element.

A further aspect of the invention relates to a communications system configured to transmit a set component carrier signals from a network element to an apparatus. The system is configured to monitor the set component carrier signals, and, based on the monitoring, obtain channel quality information regarding the set. Based on the information, the system is configured to identify the best component carrier signal for the apparatus, and provide information on the best component carrier signal to the network element.

A still further aspect of the invention relates to an apparatus configured to monitor a set component carrier signals received from a network element. Based on the monitoring, the apparatus is configured to obtain channel quality information regarding the set. Based on the channel quality information, the apparatus is configured to identify the best component carrier signal for the apparatus, and provide information on the best component carrier signal to the network element.

A still further aspect of the invention relates to a network element configured to transmit component carrier signals to an apparatus, wherein network element is configured to receive information on the best component carrier signal identified for the apparatus.

A still further aspect of the invention relates to a computer program comprising program code means adapted to perform, when run on a processor, the tasks of: monitoring, a set component carrier signals transmitted from a network element to an apparatus, based on the monitoring, obtaining chan-
nel quality information regarding the set, based on the channel quality information, identifying the best component carrier signal for the apparatus, and providing information on the best component carrier signal to the network element.

In an embodiment, based on the information on the best component carrier signal, a frequency domain link adaptation is performed for the apparatus.

In a further embodiment, based on the information on the best component carrier signal, a scheduling of resource blocks is performed for the apparatus.

In a yet further embodiment, on the basis of the channel quality information, further component carrier signals are identified for the apparatus, and information on the further component carrier signals is provided to the network element, the information on the further component carrier signals including average channel quality information on the further component carrier signals.

In a yet further embodiment, based on the information on the average channel quality, a frequency domain link adaptation is performed for the apparatus.

In a yet further embodiment, based on the information on the average channel quality, a scheduling of resource blocks is performed for the apparatus.

In a yet further embodiment, the identifying of the best component carrier signal is based on a signal-to-interface-plus-noise-ratio SINR measurement carried out on the set of component carrier signals.

In a yet further embodiment, the identifying of the best component carrier signal is based on a reference signal received quality RSRQ measurement carried out on the set of component carrier signals.

In a yet further embodiment, identification information and channel quality information on the best component carrier signal identified for the apparatus is received in the network element.

The steps/points, signaling messages and related functions described above in Figures 1 to 6 are in no absolute chronological order, and some of the steps/points may be performed simultaneously or in an order differing from the given one. Other functions may also be executed between the steps/points or within the steps/points and other signaling messages sent between the illustrated messages. Some of the steps/points or part of the
steps/points can also be left out or replaced by a corresponding step/point or part of the step/point. The operations illustrate a procedure that may be implemented in one or more physical or logical entities. The signaling messages are only exemplary and may even comprise several separate messages for transmitting the same information. In addition, the messages may also contain other information.

It will be obvious to a person skilled in the art that, as technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

LIST OF ABBREVIATIONS

3GPP 3rd generation partnership project
CQI channel quality indicator
DL downlink
eNB LTE base station
LTE long term evolution
LTE-A LTE-advanced
PRB physical resource block
RSRQ reference signal received quality
TS technical specification
UE user equipment
UL uplink
CLAIMS

1. A method for providing channel quality information in a communications system (S), the method comprising
   monitoring (3-2, 4-2), by an apparatus (UE), a set component carrier signals transmitted from a network element (eNB) to the apparatus (UE);
   on the basis of said monitoring, obtaining (3-2, 4-2) channel quality information regarding the set;
   on the basis of the channel quality information, identifying the best component carrier signal for the apparatus (UE); and
   providing identification information and channel quality information on the best component carrier signal to the network element (eNB).

2. A method according to claim 1, wherein the method further comprises performing, on the basis of the information on the best component carrier signal, a frequency domain link adaptation for the apparatus (UE).

3. A method according to claim 1 or 2, wherein the method further comprises performing, on the basis of the information on the best component carrier signal, a scheduling of resource blocks for the apparatus (UE).

4. A method according to claim 1, 2 or 3, wherein the method further comprises
   on the basis of the channel quality information, identifying one or more further component carrier signals for the apparatus (UE); and
   providing information on the one or more further component carrier signals to the network element (eNB), wherein the information on the one or more further component carrier signals includes average channel quality information on the one or more further component carrier signals.

5. A method according to claim 4, wherein the method further comprises performing, on the basis of the information on the average channel quality, a frequency domain link adaptation for the apparatus (UE).

6. A method according to claim 4 or 5, wherein the method further comprises performing, on the basis of the information on the average channel quality, a scheduling of resource blocks for the apparatus (UE).

7. A method according to any of claims 1 to 6, wherein the identifying of the best component carrier signal is based on a signal-to-interface-plus-noise-ratio SINR measurement carried out on the set of component carrier signals.
8. A method according to claim 1, wherein the identifying of the best component carrier signal is based on a reference signal received quality RSRQ measurement carried out on the set of component carrier signals.

9. A communications system (S) comprising a network element (eNB) capable of transmitting a set component carrier signals to an apparatus (UE), wherein the system (S) is configured to monitor, the set component carrier signals; on the basis of said monitoring, obtain channel quality information regarding the set; on the basis of the channel quality information, identify the best component carrier signal for the apparatus (UE); and provide identification information and channel quality information on the best component carrier signal to the network element (eNB).

10. A communications system (S) according to claim 9, wherein the system is configured to identify, on the basis of the channel quality information, one or more further component carrier signals for the apparatus (UE); and provide information on the one or more further component carrier signals to the network element (eNB), wherein the information on the one or more further component carrier signals includes average channel quality information on the one or more further component carrier signals.

11. An apparatus (UE) capable of receiving component carrier signals from a network element (eNB), wherein the apparatus is configured to monitor a set component carrier signals received from the network element (eNB);
obtain, on the basis of said monitoring, channel quality information regarding the set;
identify, on the basis of the channel quality information, the best component carrier signal for the apparatus (UE); and
providing identification information and channel quality information on the best component carrier signal to the network element (eNB).

12. An apparatus (UE) according to claim 11, wherein the apparatus is further configured to identify, on the basis of the channel quality information, one or more further component carrier signals for the apparatus (UE); and
providing information on the one or more further component carrier signals to the network element (eNB), wherein the information on the one or more further component carrier signals includes average channel quality information on the one or more further component carrier signals.

13. An apparatus (UE) according to claim 11 or 12, wherein the apparatus is configured to identify the best component carrier signal on the basis of a signal-to-interface-plus-noise-ratio SINR measurement carried out on the set of component carrier signals.

14. An apparatus (UE) according to claim 11, 12 or 13, wherein the apparatus is configured to identify the best component carrier signal on the basis of a reference signal received quality RSRQ measurement carried out on the set of component carrier signals.

15. An apparatus (UE) according to any of claims 11 to 14, wherein the apparatus is configured to transmit a frequency selective channel quality indicator CQI report to the network element including information on the best component carrier signal.

16. An apparatus (UE) according to any of claims 11 to 15, wherein the apparatus comprises a user terminal (UE).

17. A network element (eNB) capable of transmitting component carrier signals to an apparatus (UE) in a communications system (S), wherein the network element (eNB) is configured to receive, from the apparatus (UE), identification information and channel quality information on the best component carrier signal identified for the apparatus (UE).

18. A network element (eNB) according to claim 17, wherein the network element (eNB) is configured to perform, on the basis of the information on the best component carrier signal, a frequency domain link adaptation for the apparatus (UE).

19. A network element (eNB) according to claim 17 or 18, wherein the network element (eNB) is configured to perform, on the basis of the information on the best component carrier signal, a scheduling of resource blocks for the apparatus (UE).

20. A network element (eNB) according to claim 17, 18 or 19, wherein the network element (eNB) is configured to receive, from the apparatus (UE), information on one or more further component carrier signals identified for the apparatus (UE), wherein the infor-
mation on the one or more further component carrier signals includes average channel quality information on the one or more further component carrier signals.

21. A network element (eNB) according to claim 20, wherein the network element (eNB) is configured to perform, on the basis of the information on the average channel quality, a frequency domain link adaptation for the apparatus (UE).

22. A network element (eNB) according to claim 20 or 21, wherein the network element (eNB) is configured to perform, on the basis of the information on the average channel quality, a scheduling of resource blocks for the apparatus (UE).

23. A network element (eNB) according to any of claims 19 to 22, wherein the network element (eNB) comprises a base station (eNB).

24. A computer program comprising program code means adapted to perform the following tasks when the program is run on a processor:

monitoring, a set component carrier signals transmitted from a network element (eNB) to an apparatus (UE);

on the basis of said monitoring, obtaining channel quality information regarding the set;

on the basis of the channel quality information, identifying the best component carrier signal for the apparatus (UE); and

providing identification information and channel quality information on the best component carrier signal to the network element.

25. A computer program according to claim 24, wherein the program code means are adapted to perform tasks of

identifying, on the basis of the channel quality information, one or more further component carrier signals for the apparatus (UE); and

providing information on the one or more further component carrier signals to the network element (eNB), wherein the information on the one or more further component carrier signals includes average channel quality information on the one or more further component carrier signals.
Fig. 1

Fig. 2
Fig. 4

start

receives/monitors signalling  4-1

identifies best component carrier  4-2

transmits CQI report  4-3

end
Fig. 5
Fig. 6
A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W72/00

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

B. RELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

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>
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<tr>
<th>Category</th>
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<th>Relevant to claim No</th>
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Further documents are listed in the continuation of Box C

X

See patent family annex

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