

METHOD FOR COMMUNICATING DOWNLINK CONTROL INFORMATION ~~SIGNAL~~, BASE STATION, AND USER EQUIPMENT

CROSS-REFERENCE TO RELATED APPLICATION

5 ~~[0001]~~ This application claims priority to Chinese Patent Application No. 201210070953.6, filed with the Chinese Patent Office on March 16, 2012, and entitled "METHOD FOR COMMUNICATING DOWNLINK CONTROL SIGNAL, BASE STATION, AND USER EQUIPMENT", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

10 [0002] ~~Embodiments of the~~ The present invention relates to the field of communications technologies, and in particular, to a method for communicating a ~~downlink control signal~~ downlink control information, a base station, and a user equipment.

BACKGROUND

[0003] In a 3GPP (3rd Generation Partnership Project, 3rd Generation Partnership Project) LTE (Long Term Evolution, Long Term Evolution)/LTE-A (LTE-advanced, LTE-advanced) system, a downlink multiple access mode generally used is an OFDMA (Orthogonal Frequency Division Multiple Access, Orthogonal Frequency Division Multiple Access) mode. In terms of time, downlink resources of the system are divided into OFDM (Orthogonal Frequency Division Multiple, Orthogonal Frequency Division Multiple) symbols, and in terms of frequency, the
20 downlink resources of the system are divided into subcarriers.

[0004] In LTE release 8, LTE release 9 and LTE release 10, one downlink subframe includes two timeslots (slots), and each timeslot includes 7 or 6 OFDM symbols, so that a

UE-specific reference signal, and can support 4 ports (that is, DMRS ports 7, 8, 9 and 10 for PDSCH demodulation in LTE release 10). A data part of an E-PDCCH is used to bear modulation symbols of control information after coding and modulation.

[0011] An E-PDCCH CCE, hereinafter called an eCCE, is also defined in LTE release 11.

5 Using a localized E-PDCCH as an example, there are many REs that can be used to transmit an E-PDCCH in a PRB pair, and these REs may further be divided into several eCCEs. An E-PDCCH is formed by one or more eCCEs by means of aggregation, and needs to be blindly detected by a UE. As control information in the E-PDCCH is also obtained by means of convolutional encoding with master code being 1/3 and circular buffering based rate
10 matching, a problem also exists that a UE judges a start position of the E-PDCCH incorrectly.

SUMMARY

[0012] ~~Embodiments of the~~ The present invention provides a method for communicating a ~~downlink control signal~~ downlink control information, a base station, and a user equipment, which can avoid that a UE judges a start position of an E-PDCCH incorrectly.

15 [0013] According to one aspect, a method for communicating a ~~downlink control signal~~ downlink control information is provided, including: mapping, by a base station according to an order of OFDM symbols used by a physical downlink control channel E-PDCCH of a user equipment UE, the E-PDCCH sequentially to resource elements used to transmit the E-PDCCH in each OFDM symbol; and sending, by the base station, the E-PDCCH to the UE by using the
20 resource elements.

[0014] According to another aspect, a method for communicating a ~~downlink control signal~~ downlink control information is provided, including: receiving, by a user equipment UE, a downlink subframe from a base station; and extracting, by the UE in a blind detection process according to an order of OFDM symbols used by a candidate E-PDCCH in the
25 downlink subframe, modulation symbols of the candidate E-PDCCH sequentially from resource elements used to transmit the candidate E-PDCCH in each OFDM symbol, and performing decoding and cyclic redundancy check CRC on the candidate E-PDCCH.

[0015] According to another aspect, a method for communicating a ~~downlink control~~

~~signal~~downlink control information is provided, including: determining, by a base station, a reference signal port according to an aggregation level of a physical downlink control channel E-PDCCH of a user equipment UE, where E-PDCCHs at different aggregation levels correspond to different reference signal ports, and the aggregation level indicates the quantity of control channel elements included in the E-PDCCH; and sending, by the base station, the E-PDCCH to the UE in a subframe, and sending a reference signal of the E-PDCCH to the UE by using the determined reference signal port.

[0016] According to another aspect, a method for communicating a ~~downlink control signal~~downlink control information is provided, including: receiving, by a user equipment UE from a reference signal port in a subframe, a reference signal of a candidate E-PDCCH sent by a base station, where candidate E-PDCCHs at different aggregation levels correspond to different reference signal ports, and the aggregation level indicates the quantity of control channel elements included in the candidate E-PDCCH; and performing, by the UE, channel estimation according to the reference signal, so as to demodulate the candidate E-PDCCH.

[0017] According to another aspect, a method for communicating a ~~downlink control signal~~downlink control information is provided, including: sending, by a base station, a reference signal of the E-PDCCH by using a first reference signal port v ; sending, by the base station, a reference signal of the PDSCH by using at least one second reference signal port; and determining, by the base station, not to use a second reference signal port $p(v)$ to send the reference signal of the PDSCH, so that a reference signal port of the E-PDCCH and a reference signal port of the PDSCH are processed based on orthogonal time extensions with different lengths, where the first reference signal port is one of the at least one second reference signal port, and v and $p(v)$ are serial numbers of the reference signal ports.

[0018] According to another aspect, a method for communicating a signal is provided, including: receiving, by a user equipment UE, a reference signal of a physical downlink control channel E-PDCCH which is sent by a base station by using a first reference signal port v and a reference signal of a physical downlink shared channel PDSCH which is sent by the base station by using at least one second reference signal port, where the PDSCH is invoked by the E-PDCCH; performing, by the UE, channel estimation by using the reference

[0025] In the technical solutions, the E-PDCCH can be mapped, according to an order of OFDM symbols used by an E-PDCCH of a UE, sequentially to resource elements used to transmit the E-PDCCH in each OFDM symbol, so that different control channel elements will not include a same E-PDCCH modulation symbol, thereby avoiding that the UE incorrectly judges a start position of the E-PDCCH.

BRIEF DESCRIPTION OF DRAWINGS

[0026] To describe the technical solutions ~~in the embodiments~~ of the present invention more clearly, ~~the following briefly introduces the accompanying drawings required for describing the of embodiments of the invention are attached~~ ~~or the prior art~~. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, ~~and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.~~

[0027] FIG. 1 is a schematic diagram of an eCCE division according to an embodiment of the present invention;

[0028] FIG. 2 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 1 of the present invention;

[0029] FIG. 3 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 2 of the present invention;

[0030] FIG. 4 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 3 of the present invention;

[0031] FIG. 5 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 4 of the present invention;

[0032] FIG. 6 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 5 of the present invention;

[0033] FIG. 7 is a schematic flowchart of a method for communicating downlink control information according to Embodiment 6 of the present invention;

[0034] FIG. 8A is a schematic flowchart of a process for communicating downlink control information according to Embodiment 7 of the present invention;

DESCRIPTION OF EMBODIMENTS

[0050] The following clearly and completely describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the of embodiments of the present invention. Apparently, the described embodiments are a part rather than all of the embodiments of the present invention. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

[0051] It should be understood that technical solutions of the present invention may be applied to various communications systems, for example, a GSM (Global System of Mobile communication, Global System of Mobile communication) system, a CDMA (Code Division Multiple Access, Code Division Multiple Access) system, a WCDMA (Wideband Code Division Multiple Access, Wideband Code Division Multiple Access) system, a GPRS (General Packet Radio Service, General Packet Radio Service) system, an LTE (Long Term Evolution, Long Term Evolution) system, an LTE-A (Advanced long term evolution, Advanced Long Term Evolution) system, a UMTS (Universal Mobile Telecommunication System, Universal Mobile Telecommunication System), and the like, which are not limited in the embodiments of the present invention, but for convenience of description, the embodiments of the present invention will be described by using an LTE system network as an example.

[0052] The embodiments of the present invention may be applied to wireless networks under different standards. A radio access network may include different network elements in different systems. For example, network elements of a radio access network in LTE and LTE-A include an eNB (Evolved Node B, that is, eNodeB, evolved base station), while network elements of a radio access network in WCDMA includes an RNC (Radio Network Controller, radio network controller) and a base station Node B. Similarly, a WiMax (Worldwide Interoperability for Microwave Access, Worldwide Interoperability for Microwave Access) and other wireless networks may also use solutions similar to those in the embodiments of the present invention, but a relevant module in a base station system may be different, which is not limited in the embodiments of the present invention, but for