

METHOD, ~~AND APPARATUS, AND DEVICE~~ FOR TRANSMITTING CONTROL CHANNEL

TECHNICAL FIELD

The present invention relates to the field of communications technologies, and in particular to
5 | a method, ~~and an apparatus, and a device~~ for transmitting a control channel.

BACKGROUND

In a wireless communications system such as a long term evolution (Long Term Evolution, LTE) system or a long term evolution advanced (Long Term Evolution Advanced, LTE-Advanced) system, a downlink multiple access mode generally ~~is~~uses an orthogonal frequency division multiple access (Orthogonal Frequency Division Multiple Access, OFDMA) mode. Downlink resources of a system are divided into orthogonal frequency division multiplexing (Orthogonal Frequency Division ~~Multiplexing~~Multiple, OFDM) symbols from the perspective of time, and are divided into subcarriers from the perspective of frequency. In the LTE system, a complete physical downlink control channel (Physical Downlink Control Channel, PDCCH) may be mapped to one or
10 | several control channel elements (Control Channel Element, CCE). According to LTE Release 8/9/10, a PDCCH may be mapped to 1, 2, 4, or 8 CCEs, that is, a PDCCH is formed from 1, 2, 4, or 8 CCEs, which respectively corresponds to an aggregation level 1, 2, 4, or 8 of the PDCCH; furthermore, each CCE is formed from 9 resource element groups (Resource Element Group, REG), and a REG occupies 4 resource elements (Resource Element, RE).

20 | In the LTE or LTE-Advanced system, a physical downlink control channel (Physical Downlink Control Channel, PDCCH) transmitted based on a manner of precoding is introduced, that is, an enhanced physical downlink control channel (Enhanced Physical Downlink Control Channel, ePDCCH). The ePDCCH allows that a user equipment (User Equipment, UE) is capable of carrying out demodulation based on specific reference signals, that is, demodulation reference signals
25 | (Demodulation Reference Signal, DMRS). The ePDCCH is transmitted in a region for transmitting a downlink data channel in a subframe, and frequency division can be performed for it and a physical downlink shared channel (Physical Downlink Shared Channel, PDSCH). A base station may send the ePDCCH on a unit physical resource block (Physical Resource Block, PRB) with a good channel condition according to channel status reported by a terminal. REs forming each PRB

among the multiple eREGs includes a specified number of resource elements REs, resource elements REs included in each PRB pair are divided according to the specified number to obtain multiple groups, and each group is corresponding to an eREG.

In combination with the another aspect or the first possible implementation manner, in a second possible implementation manner,

the eREG attribute information includes resource location information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource location information; or

the eREG attribute information includes resource port number information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource port number information; or

the eREG attribute information includes resource location information and resource port number information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource location information, or that the selected eREGs have different resource port number information, or that the selected eREGs have different resource location information and resource port number information.

In combination with the second possible implementation manner, in a third possible implementation manner, the eREG attribute information further includes the number of punches of an RE; and

that the selected eREGs have different eREG attribute information further includes that the selected eREGs have different numbers of punches.

In combination with the another aspect, the first possible implementation manner, the second possible implementation manner, or the third possible implementation manner, the apparatus further includes:

a selection unit, configured to select at least two eCCEs from the eCCEs generated by the generation unit, where among eREGs of the at least two eCCEs, eREGs belonging to a same PRB pair have different resource port number information; and

the transmission unit is specifically configured to transmit the control channel through the at least two eCCEs selected by the selection unit.

In still another aspect of the present invention, a device for transmitting a control channel is provided, where the device includes:

a processor, configured to generate at least one enhanced control channel element eCCE; and

a transmitter, configured to transmit the control channel through the at least one eCCE

the transmitter is specifically configured to transmit the control channel through the at least two eCCEs selected by the processor.

In the embodiments of the present invention, at least one eCCE is generated and a control channel is transmitted through the at least one eCCE; when each eCCE is generated, at least two PRB pairs for transmitting the control channel are determined, where each PRB pair of the at least two PRB pairs is corresponding to multiple eREGs and the multiple eREGs have eREG attribute information that is not exactly the same; an eREG is selected from the multiple eREGs corresponding to each PRB pair, where the selected eREGs have different eREG attribute information; and an eCCE is formed from the selected eREGs. The embodiments of the present invention are applied to implement generation of an eCCE according to an eREG, so as to transmit an enhanced control channel through the eCCE; because the eREGs of the eCCE for transmitting the enhanced control channel have different eREG attribute information, a feature of full frequency diversity of the eCCE is ensured when these eREGs belong to different PRBs, a feature of full space diversity of the eCCE is ensured when these eREGs belong to different resource ports, and robust performance of the eCCE is ensured when resource locations of RE resources included in these eREGs are different.

BRIEF DESCRIPTION OF DRAWINGS

To illustrate the technical solutions in the embodiments of the present invention or in the prior art more clearly, the following briefly introduces the accompanying drawings required for describing the embodiments 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 the accompanying drawings without creative efforts.

FIG. 1A is a flow chart of an embodiment of a method for transmitting a control channel according to the present invention;

FIG. 1B is a schematic diagram of a PRB pair according to an embodiment of the present invention;

FIG. 2A is a flow chart of another embodiment of a method for transmitting a control channel according to the present invention;

FIG. 2B is a schematic diagram of a manner of numbering eCCEs according to an embodiment of the present invention;

FIG. 3 is a block diagram of an embodiment of an apparatus for transmitting a control channel according to the present invention;

The embodiments in the specification are described in a progressive manner, and reference may be made between the same or similar parts of the embodiments. Every embodiment illustrates in emphasis what is different from the other embodiments. In particular, for the system embodiment, since it is basically similar to the method embodiments, the system embodiment is described simply, and for related parts, reference may be made to a part of the descriptions of the method embodiments.

The above implementation manners of the present invention do not constitute a limitation to the protection scope of the present invention. Any modification, equivalent replacement, and improvement made within the spirit and principle of the present invention should fall within the protection scope of the present invention.

the eREG attribute information further comprises the number of punches of an RE; and
that the selected eREGs have different eREG attribute information further comprises that the selected eREGs have different numbers of punches.

10. The apparatus according to any one of claims 6 to 9, further comprising:

5 a selection unit, configured to select at least two eCCEs from the eCCEs generated by the generation unit, wherein among eREGs of the at least two eCCEs, eREGs belonging to a same PRB pair have different resource port number information; and

the transmission unit is specifically configured to transmit the control channel through the at least two eCCEs selected by the selection unit.

10 ~~11. A device for transmitting a control channel, comprising:~~

~~a processor, configured to generate at least one enhanced control channel element eCCE; and~~

~~a transmitter, configured to transmit the control channel through the at least one eCCE generated by the processor; wherein:~~

15 ~~the processor is specifically configured to determine at least two physical resource block PRB pairs for transmitting the control channel when each eCCE is generated, wherein each PRB pair of the at least two PRB pairs is corresponding to multiple enhanced resource element groups eREGs and the multiple eREGs have eREG attribute information that is not exactly the same; and select an eREG from the multiple eREGs corresponding to each PRB pair, wherein the selected eREGs have different eREG attribute information, and form an eCCE with the selected eREGs.~~

20 ~~12. The device according to claim 11, wherein each eREG among the multiple eREGs comprises a specified number of resource elements REs, resource elements REs comprised in each PRB pair are divided according to the specified number to obtain multiple groups, and each group is corresponding to an eREG.~~

~~13. The device according to claim 11 or 12, wherein:~~

25 ~~the eREG attribute information comprises resource location information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource location information; or~~

30 ~~the eREG attribute information comprises resource port number information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource port number information; or~~

~~the eREG attribute information comprises resource location information and resource port number information, and that the selected eREGs have different eREG attribute information refers to that the selected eREGs have different resource location information, or that the selected eREGs have different resource port number information, or that the selected eREGs have different resource~~

location information and resource port number information.

14. The device according to claim 13, wherein the eREG attribute information further comprises the number of punches of an RE; and

that the selected eREGs have different eREG attribute information further comprises that the selected eREGs have different numbers of punches.

15. The device according to any one of claims 11 to 14, wherein:

the processor is further configured to select at least two eCCEs from the generated eCCEs, wherein among eREGs of the at least two eCCEs, eREGs belonging to a same PRB pair have different resource port number information; and

the transmitter is specifically configured to transmit the control channel through the at least two eCCEs selected by the processor.