METHOD OF UPLINK POWER CONTROL, TERMINAL DEVICE AND NETWORK DEVICE

TECHNICAL FIELD

[0001] The present application relates to the field of information processing technologies, and in particular, to a method of uplink power control, a terminal device, a network device and a computer storage medium.

BACKGROUND

[0002] The current transmission power of PUSCH can be calculated by the following formula:

$$P_{\mathrm{PUSCH},f,c}(i,j,q_d,l)=\min\left\{\begin{matrix}P_{\mathrm{CMAX},f,c}(i),\\ P_{\mathrm{O_PUSCH},f,c}(j)+10\log_{10}(2^{\mu}\cdot M^{\mathrm{PUSCH}}_{\mathrm{RB},f,c}(i))+\alpha_{f,c}(j)\cdot PL_{f,c}(q_d)+\Delta_{\mathrm{TF},f,c}(i)+f_{f,c}(i,l)\end{matrix}\right\};$$

wherein i represents an index of the primary PUSCH transmission, j is an index of an open-loop power control parameter, wherein $P_{\mathrm{O_PUSCH},f,c}(j)$ and $\alpha_{f,c}(j)$ are open-loop power control parameters, $PL_{f,c}(q_d)$ is an estimated path loss value measured based on a downlink reference signal, and $f_{f,c}(i,l)$ is a closed-loop power adjustment factor, and l is an index of a closed-loop power control process. The values of j and l, and the downlink reference signal which is used to measure the estimated path loss value $PL_{f,c}(q_d)$ can be obtained based on SRI (SRS Resource Indicator) information included in DCI. The network side pre-configures a correspondence between different SRI states and {j, qd, l}, and then indicates the {j, qd, l} used by a current transmission through SRI.

[0003] For PUCCH, the network side pre-configures a correspondence between different PUCCH-Spatial relation Info and {j, qd, l}, and then determines the {j, qd, l} used by a current PUCCH transmission thorough a currently used PUCCH-Spatial relation Info. The network side indicates all available PUCCH-Spatial relation Info through a RRC signaling, and then indicates a currently used PUCCH-Spatial relation Info through MAC CE.

[0004] For PUSCH and PUCCH, a Transmission Power Control (TPC) command can be obtained by dedicated Downlink Control Information (DCI) which is dedicated to carrying a TPC command, so as to determine the closed-loop power adjustment factor. The DCI adopts DCI format 2-2 and performs scrambling by using PUSCH-TPC-RNTI or PUCCH-TPC-RNTI, and may include TPC commands of multiple terminals. In NR, PUSCH

corresponding to the TPC command, or the last two bits are a TPC command and the preceding log2 (N) bits indicate the BWP or closed-loop power control process corresponding to the TPC command.

[00188] This embodiment may further include:

the first communication unit, configured to transmit the uplink signal based on the determined transmission power.

the first processing unit, configured to determine a transmission power of the uplink signal based on a closed-loop power adjustment factor of a BWP currently transmitting the uplink signal or a closed-loop power adjustment factor of a closed-loop power control process currently used by the uplink signal.

[00189] It can be seen that, by adopting the foregoing solution, the corresponding TPC command can be determined based on the number of BWPs of the uplink signal or the number of the closed-loop power control processes, and the power adjustment factor corresponding to the uplink signal is determined based on the TPC command, thereby reducing DCI overhead of the TPC command of one terminal as much as possible, saving unnecessary DCI overhead, and performing closed-loop power control of more terminals and more BWPs through one DCI.

[00190] Embodiment 4

[00191] An embodiment of the present application provides a network device, as shown in FIG. 4, comprising:

a second processing unit 41, configured to determine number of bits of a Transmission Power Control TPC command field of a terminal device in Downlink Control Information DCI based on number of Bandwidth Parts BWPs transmitting an uplink signal or number of closed-loop power control processes associated with an uplink signal;

a second communication unit 42, configured to transmit the TPC command field to the terminal device through the DCI. The terminal device in this embodiment can be understood as a terminal with a communication function in a communication system, such as a mobile phone or the like.

[00192] The above second processing unit 41 performs at least one of the following:

determining the number of the closed-loop power control processes associated with the uplink signal based on a current transmission type of the uplink signal; that is, determining based on a transmission type of the current uplink signal;

determining the number of the closed-loop power control processes associated with the uplink signal based on configuration of a high-layer signaling;

the second communication unit 42, configured to receive the uplink signal transmitted by the terminal device based on the determined transmission power.

[00244] It can be seen that, by adopting the foregoing solution, the corresponding TPC command can be determined based on the number of BWPs of the uplink signal or the number of the closed-loop power control processes, and the power adjustment factor corresponding to the uplink signal is determined based on the TPC command, thereby reducing DCI overhead of the TPC command of one terminal as much as possible, saving unnecessary DCI overhead, and performing closed-loop power control of more terminals and more BWPs through one DCI.

[00245] The embodiment of the present application further provides a terminal device, or a hardware component architecture of a network device, as shown in FIG. 5, comprising: at least one processor 51, a memory 52, and at least one network interface 53. The various components are coupled together via a bus system 54. It can be understood that the bus system 54 is used to implement connection communication between these components. The bus system 54 includes, in addition to a data bus, a power bus, a control bus, and a status signal bus. However, for clarity of description, various buses are all labeled as the bus system 54 in FIG. 5.

[00246] It can be understood that the memory 52 in the embodiments of the present application may be a volatile memory or a non-volatile memory, or may include both volatile and non-volatile memory.

[00247] In some embodiments, the memory 52 stores the following elements, executable modules or data structures, or a subset thereof, or an extension set thereof:

an operating system 521 and an application program 522.

[00248] The processor 51 is configured to: be able to process the steps of the methods of the first embodiment or the second embodiment, and details are not described herein.

[00249] The above apparatus of the embodiments of the application, if implemented in the form of the software functional unit and sold or used as a standalone product, may be stored in a computer-readable storage medium. Based on such an understanding, the technical solutions of the embodiments of the application in essence or the part that contributes to the prior art may be embodied in the form of a software product. The computer software product is stored in a storage medium and includes a plurality of instructions for a computer device (which may be a personal computer, a server, a network device or the like) to execute all or part of the methods described in the embodiments of the present application. The foregoing storage medium includes various media that may store program code, such as a USB flash

CLAIMS

1. A method of uplink power control, which is applied to a terminal device, comprising:
determining number of bits of a Transmission Power Control TPC command field of the terminal device in Downlink Control Information DCI based on number of Bandwidth Parts BWPs transmitting an uplink signal or number of closed-loop power control processes associated with an uplink signal;
determining a closed-loop power adjustment factor of at least one BWP transmitting the uplink signal or a closed-loop power adjustment factor of at least one closed-loop power control process associated with the uplink signal based on a TPC command in the TPC command field.
2. The method according to claim 1, wherein the method further comprises at least one of the following:
determining the number of the closed-loop power control processes associated with the uplink signal based on a current transmission type of the uplink signal;
determining the number of the closed-loop power control processes associated with the uplink signal based on configuration of a high-layer signaling;
determining the number of the closed-loop power control processes associated with the uplink signal based on the number of BWPs which transmit the uplink signal and the number of the closed-loop power control processes on each BWP which transmits the uplink signal;
determining the number of the closed-loop power control processes associated with the uplink signal based on a first correspondence configured by a high-layer signaling when the uplink signal is PUSCH, wherein the first correspondence is a correspondence between an SRI state and a closed-loop power control process;
determining the number of the closed-loop power control processes associated with the uplink signal based on a second correspondence configured by a high-layer signaling when the uplink signal is PUCCH, wherein the second correspondence is a correspondence between PUCCH-spatial correlation info and a closed-loop power control process;
determining the number of the closed-loop power control processes associated with the uplink signal based on a third correspondence configured by a high-layer signaling when the uplink signal is SRS, wherein the third correspondence is a correspondence between an SRS-spatial correlation info and a closed-loop power control process.

3. The method according to claim 1, before determining the number of BWPs transmitting the uplink signal or the number of the closed-loop power control processes associated with the uplink signal, wherein further comprising:

determining that the number of bits of the TPC command field in the DCI is 2.

4. The method according to any one of claims 1 to 2, wherein the method further comprises:

determining that the number of bits in the TPC command field is 2*N or 2+log2(N) if the number of BWPs transmitting the uplink signal is N or the number of the closed-loop power control processes associated with the uplink signal is N.

5. The method according to any one of claims 1 to 4, wherein the DCI is at least one of the following:

DCI carrying a TPC command of PUSCH;

DCI carrying a TPC command of PUCCH;

DCI carrying a TPC command of SRS.

6. The method according to any one of claims 1 to 5, wherein the uplink signal is one of the following: PUSCH, PUCCH, SRS.

7. The method according to any one of claims 1 to 6, wherein the method further comprises:

determining the TPC command field of the terminal device from the DCI based on a position index of TPC command indicated by a network side and a number of bits of the TPC command field.

8. The method according to claim 7, wherein the position index of TPC command comprises a position index of at least one TPC command; wherein each TPC command corresponds to a BWP or a closed-loop power control process of a BWP.

9. The method according to any one of claims 1 to 8, wherein the TPC command field occupies continuous bits in the DCI.

10. The method according to claim 1, wherein the method further comprises::

determining a transmission power of the uplink signal based on a closed-loop power adjustment factor of a BWP currently transmitting the uplink signal or a closed-loop power adjustment factor of a closed-loop power control process currently used by the uplink signal;

transmitting the uplink signal based on the determined transmission power.

11. A method of uplink power control, which is applied to a network device, comprising:

determining number of bits of a Transmission Power Control TPC command field of a

terminal device in Downlink Control Information DCI based on number of Bandwidth Parts BWPs transmitting an uplink signal or number of closed-loop power control processes associated with an uplink signal;

transmitting the TPC command field to the terminal device through the DCI.

12. The method according to claim 11, wherein the method further comprises at least one of the following:

determining the number of the closed-loop power control processes associated with the uplink signal based on a current transmission type of the uplink signal;

determining the number of the closed-loop power control processes associated with the uplink signal based on configuration of a high-layer signaling;

determining the number of the closed-loop power control processes associated with the uplink signal based on the number of BWPs which transmit the uplink signal and the number of the closed-loop power control processes on each BWP which transmits the uplink signal;

determining the number of the closed-loop power control processes associated with the uplink signal based on a first correspondence configured by a high-layer signaling when the uplink signal is PUSCH, wherein the first correspondence is a correspondence between an SRI state and a closed-loop power control process;

determining the number of the closed-loop power control processes associated with the uplink signal based on a second correspondence configured by a high-layer signaling when the uplink signal is PUCCH, wherein the second correspondence is a correspondence between PUCCH-spatial correlation info and a closed-loop power control process;

determining the number of the closed-loop power control processes associated with the uplink signal based on a third correspondence configured by a high-layer signaling when the uplink signal is SRS, wherein the third correspondence is a correspondence between an SRS-spatial correlation info and a closed-loop power control process.

13. A terminal device, comprising:

a first processing unit, configured to determine number of bits of a Transmission Power Control TPC command field of the terminal device in Downlink Control Information DCI based on number of Bandwidth Parts BWPs transmitting an uplink signal or number of closed-loop power control processes associated with an uplink signal; and configured to determine a closed-loop power adjustment factor of at least one BWP transmitting the uplink signal or a closed-loop power adjustment factor of at least one closed-loop power

control process associated with the uplink signal based on a TPC command in the TPC command field.

14. The terminal device according to claim 13, wherein the first processing unit is further configured to perform at least one of the following:

determining the number of the closed-loop power control processes associated with the uplink signal based on a current transmission type of the uplink signal;

determining the number of the closed-loop power control processes associated with the uplink signal based on configuration of a high-layer signaling;

determining the number of the closed-loop power control processes associated with the uplink signal based on the number of BWPs which transmit the uplink signal and the number of the closed-loop power control processes on each BWP which transmits the uplink signal;

determining the number of the closed-loop power control processes associated with the uplink signal based on a first correspondence configured by a high-layer signaling when the uplink signal is PUSCH, wherein the first correspondence is a correspondence between an SRI state and a closed-loop power control process;

determining the number of the closed-loop power control processes associated with the uplink signal based on a second correspondence configured by a high-layer signaling when the uplink signal is PUCCH, wherein the second correspondence is a correspondence between PUCCH-spatial correlation info and a closed-loop power control process;

determining the number of the closed-loop power control processes associated with the uplink signal based on a third correspondence configured by a high-layer signaling when the uplink signal is SRS, wherein the third correspondence is a correspondence between an SRS-spatial correlation info and a closed-loop power control process.

15. The terminal device according to claim 13, wherein the first processing unit is configured to determine that the number of bits of the TPC command field in the DCI is 2.

16. The terminal device according to any one of claims 13 to 15, wherein the first processing unit is further configured to determine that the number of bits in the TPC command field is 2*N or 2+log2(N) if the number of BWPs transmitting the uplink signal is N or the number of the closed-loop power control processes associated with the uplink signal is N.

17. The terminal device according to any one of claims 13 to 16, wherein the DCI is at

least one of the following:

DCI carry a TPC command of PUSCH;

DCI carry a TPC command of PUCCH;

DCI carry a TPC command of SRS.

18. The terminal device according to any one of claims 13 to 17, wherein the uplink signal is one of the following: PUSCH, PUCCH, SRS.

19. The terminal device according to any one of claims 13 to 17, wherein the first processing unit is further configured to determine the TPC command field of the terminal device from the DCI based on a position index of TPC command indicated by a network side and a number of bits of the TPC command field.

20. The terminal device according to claim 19, wherein the position index of TPC command comprises a position index of at least one TPC command; wherein each TPC command corresponds to a BWP or a closed-loop power control process of a BWP.

21. The terminal device according to any one of claims 13 to 20, wherein the TPC command field occupies continuous bits in the DCI.

22. The terminal device according to claim 13, wherein the terminal device further comprises:

a first communication unit, configured to transmit the uplink signal based on the determined transmission power;

the first processing unit, configured to determine a transmission power of the uplink signal based on a closed-loop power adjustment factor of a BWP currently transmitting the uplink signal or a closed-loop power adjustment factor of a closed-loop power control process currently used by the uplink signal.