

CLAIMS

1. An uplink pre-coding method, comprising:

5 transmitting, by a terminal device, a sounding reference signal (SRS) on at least one SRS resource;

 receiving, by the terminal device, downlink control information (DCI) for scheduling uplink data transmission from a network side, wherein the DCI comprises at least one of a rank indication (RI) and an SRS resource indication (SRI);

10 determining, by the terminal device, a pre-coding scheme for uplink data according to at least one SRS resource and at least one of the RI and the SRI; and

 pre-coding, by the terminal device, the uplink data according to the pre-coding scheme; and

 sending, by the terminal device, the pre-coded uplink data.

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2. The method of claim 1, wherein

 the pre-coding scheme comprises at least one of: a beam for analogue domain beamforming, and a pre-coding matrix for digital domain pre-coding.

20 3. The method of claim 1, wherein

 the DCI does not comprise information for indicating the pre-coding matrix for the uplink data.

4. The method of claim 1, wherein

25 a single antenna port is adopted for each of the at least one SRS resource;

 or, N antenna ports are adopted for each of the at least one SRS resource;

 or, the at least one SRS resource comprises K SRS resources, and k antenna ports are adopted for a k^{th} SRS resource of the K SRS resources,

 where N is a number of ports for uplink data transmission, $1 \leq k \leq K$, $K \leq N$.

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5. The method of claim 1, wherein

 the terminal device determines a beam for transmitting the SRS according to downlink channel information obtained from a downlink signal.

6. The method of claim 1, wherein

determining, by the terminal device, the pre-coding scheme for the uplink data according to at least one SRS resource and at least one of the RI and the SRI comprises:

5 determining a transmission layer number according to the RI, and determining the pre-coding matrix for the uplink data according to the transmission layer number and uplink channel information;

determining one or more target SRS resources from the at least one SRS resource according to the SRI, and determining a beam for the uplink data according to a beam for the target SRS resources; and

10 obtaining the pre-coding scheme for the uplink data according to the determined pre-coding matrix and beam.

7. The method of claim 1, wherein

15 determining, by the terminal device, the pre-coding scheme for the uplink data according to at least one SRS resource and at least one of the RI and the SRI comprises:

determining one or more target SRS resources from the at least one SRS resource according to the SRI; and

determining the pre-coding scheme for the uplink data according to the pre-coding scheme for the target SRS resources.

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8. The method of claim 7, wherein

the DCI with the SRI does not comprise indication information of a transmission layer number, and

25 the terminal device determines a transmission layer number according to a number of ports for the target SRS resources or a number of the target SRS resources.

9. The method of claim 1,

further comprising:

30 determining, by the terminal device, a manner for determining the pre-coding scheme for the uplink data according to indication information of the pre-coding scheme acquired from the network side or a number of ports adopted for the at least one SRS resource.

10. The method of claim 1,

further comprising:

determining the pre-coding scheme based on downlink channel information obtained from a downlink signal.

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11. A terminal device, comprising an information processing unit, a pre-coding scheme determination unit and an uplink data processing unit, wherein

the information processing unit is configured to transmit a sounding reference signal (SRS) on at least one SRS resource and receive downlink control information (DCI) for scheduling uplink data transmission from a network side, wherein the DCI comprises at least one of a rank indication (RI) and an SRS resource indication (SRI);

the pre-coding scheme determination unit is configured to determine a pre-coding scheme for uplink data according to at least one SRS resource and at least one of the RI and the SRI; and

15 the uplink data processing unit is configured to pre-code the uplink data according to the pre-coding scheme and send the pre-coded uplink data.

12. The terminal device of claim 11, wherein

20 the pre-coding scheme comprises at least one of: a beam for analogue domain beamforming, and a pre-coding matrix for digital domain pre-coding.

13. The terminal device of claim 11, wherein

the DCI does not comprise information for indicating the pre-coding matrix for the uplink data.

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14. The terminal device of claim 11, wherein

a single antenna port is adopted for each of the at least one SRS resource;

or, N antenna ports are adopted for each of the at least one SRS resource;

or, the at least one SRS resource comprises K SRS resources, and k antenna

30 ports are adopted for the k^{th} SRS resource of the K SRS resources,

where N is a number of ports for uplink data transmission, $1 \leq k \leq K$, $K \leq N$.

15. The terminal device of claim 11, wherein

the information processing unit determines a beam for transmitting the SRS according to downlink channel information obtained from a downlink signal.

16. The terminal device of claim 11, wherein

5 the pre-coding scheme determination unit is configured to determine a transmission layer number according to the RI, determine the pre-coding matrix for the uplink data according to the transmission layer number and uplink channel information, determine one or more target SRS resources from the at least one SRS resource according to the SRI, determine a beam for the uplink data according to a beam for the target SRS resource, and obtain the pre-coding scheme for the uplink data according to the determined pre-coding matrix and beam.

17. The terminal device of claim 11, wherein

15 the pre-coding scheme determination unit is configured to determine one or more target SRS resources from the at least one SRS resource according to the RI and the SRI, and determine the pre-coding scheme for the uplink data according to the pre-coding scheme for the target SRS resources.

18. The terminal device of claim 17, wherein

20 the DCI with the SRI does not comprise indication information of a transmission layer number, and

 the pre-coding scheme determination unit is configured to determine the transmission layer number according to a number of ports for the target SRS resources or a number of the target SRS resources.

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19. The terminal device of claim 11, wherein

 the pre-coding scheme determination unit is configured to determine a manner for determining the pre-coding scheme for the uplink data according to indication information of the pre-coding scheme acquired from the network side or a number of ports for the at least one SRS resource.

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20. The terminal device of claim 11, wherein

 the pre-coding scheme is determined based on the downlink channel

information obtained from the downlink signal.