

CLAIMS

What is claimed is:

1. A communication method, comprising:

determining, by a terminal device, a first downlink signal from a plurality of downlink signals;

5 determining, by the terminal device, at least one signature based on the first downlink signal;
and

sending, by the terminal device, data by using the at least one signature.

2. The method according to claim 1, wherein the determining, by the terminal device, at least one signature based on the first downlink signal comprises:

10 determining, by the terminal device based on the first downlink signal, a first resource from a plurality of resources that have a mapping relationship with the plurality of downlink signals;
and

determining, by the terminal device based on the first resource, the at least one signature from a plurality of signatures that have a mapping relationship with the plurality of resources.

15 3. The method according to claim 2, wherein the resources are a preamble and a physical random access channel PRACH time-frequency resource for sending the preamble; and the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between N preambles on the PRACH time-frequency resource and M
20 combinations of a physical uplink shared channel PUSCH time-frequency resource, a pilot resource, and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M
25 combinations of a pilot resource and a signature; or

a mapping relationship between N preambles on the PRACH time-frequency resource and M signatures, wherein

M and N are positive integers.

4. The method according to claim 3, wherein the mapping relationship between N preambles
30 on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature comprises:

the N preambles are first selected in increasing order of preamble indexes on the PRACH time-frequency resource, then in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PRACH time-frequency resources, and thirdly in increasing

order of time-domain resource indexes of a plurality of time multiplexed PRACH time-frequency resources; and

the M combinations of a PUSCH time-frequency resource and a signature that are mapped to the N preambles are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein

the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

5. The method according to claim 2, wherein the resources are a pilot resource and a PUSCH time-frequency resource; and

the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures, wherein

P and Q are positive integers.

6. The method according to claim 5, wherein the mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures comprises:

the P pilot resources are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of pilot port indexes on the PUSCH time-frequency resource, thirdly in increasing order of pilot sequence indexes on the PUSCH time-frequency resource, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources; and

the Q signatures mapped to the P pilot resources are first selected in increasing order of signature group indexes, and then in increasing order of indexes in a signature group, wherein

the signature is a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

7. The method according to any one of claims 2 to 6, wherein the method further comprises: receiving, by the terminal device, configuration information from a network device, wherein the configuration information is used to configure the mapping relationship between a plurality of resources and a plurality of signatures.

8. The method according to claim 1, wherein there is a mapping relationship between a

plurality of downlink signals and a plurality of signatures, and the at least one signature is a signature that is in the plurality of signatures and that is mapped to the first downlink signal; and the mapping relationship between a plurality of downlink signals and a plurality of signatures comprises:

- 5 a mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource, a pilot resource, and a signature;
a mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource and a signature;
a mapping relationship between R downlink signals in the plurality of downlink signals and
10 S combinations of a pilot resource and a signature; or
a mapping relationship between R downlink signals in the plurality of downlink signals and S signatures, wherein
R and S are positive integers.

9. The method according to claim 8, wherein the mapping relationship between R downlink
15 signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource and a signature comprises:

the R downlink signals are selected from the plurality of downlink reference signals in increasing order of indexes; and

the S combinations of a PUSCH time-frequency resource and a signature that correspond to
20 the R downlink signals are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein

25 the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

10. The method according to claim 1, wherein the determining, by the terminal device, at least one signature based on the first downlink signal comprises:

30 determining, by the terminal device, the at least one signature in a signature set associated with the first downlink signal, wherein each of the plurality of downlink signals has an associated signature set.

11. The method according to claim 10, wherein the determining, by the terminal device, the at least one signature in a signature set associated with the first downlink signal comprises:

35 when the terminal device is determined to locate in a coverage edge area of the first downlink

signal, determining, by the terminal device, the at least one signature in a first signature subset, wherein

the first signature subset and a signature set associated with a second downlink signal are orthogonal to each other;

5 a correlation between the first signature subset and the signature set associated with the second downlink signal is lower than a correlation threshold; and

the first signature subset is a subset of the signature set associated with the first downlink signal, and the second downlink signal is one of the plurality of downlink signals.

12. The method according to claim 11, wherein the sending, by the terminal device, data by
10 using the at least one signature comprises:

when the terminal device is located in the coverage edge area of the first downlink signal, sending, by the terminal device, the data by using a first transmission parameter and the at least one signature; or

15 when the terminal device is located in a non-coverage edge area of the first downlink signal, sending, by the terminal device, the data by using a second transmission parameter and the at least one signature.

13. The method according to claim 11 or 12, wherein a condition for determining that the terminal device is located in the coverage edge area of the first downlink signal comprises one or more of the following:

20 signal quality of the first downlink signal is less than or equal to a first threshold;

signal quality of a third downlink signal is greater than or equal to a second threshold;

an absolute value of a difference between signal quality of a third downlink signal and signal quality of the first downlink signal is less than or equal to a third threshold; or

25 a ratio of signal quality of a third downlink signal to signal quality of the first downlink signal is greater than or equal to a fourth threshold; and

the third downlink signal is a downlink signal with highest signal quality in the plurality of downlink signals other than the first downlink signal.

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

30 determining, by the terminal device, an interference and/or multiplexing level of a time-frequency resource for sending the data; and

determining, by the terminal device, a third transmission parameter based on the interference and/or multiplexing level of the time-frequency resource, wherein the third parameter meets the following characteristic: a higher interference and/or multiplexing level of the time-frequency resource indicates a lower power corresponding to the third transmission parameter; and

35 the sending, by the terminal device, data by using the at least one signature comprises:

sending, by the terminal device, the data by using the third transmission parameter and the at least one signature.

15. The method according to any one of claims 10 to 14, wherein any two signatures in the signature set associated with the first downlink signal are orthogonal to each other; and

5 at least one signature in the signature set associated with the first downlink signal is not orthogonal to at least one signature in a signature set associated with a fourth downlink signal, and the fourth downlink signal is one of the plurality of downlink signals.

16. The method according to any one of claims 10 to 15, wherein the signature is at least one of a code-domain resource, a pilot resource, a power resource, a space-domain resource, and a resource hopping pattern.

17. The method according to any one of claims 1 to 16, wherein the downlink signal is a synchronization signal block SSB.

18. A communication method, comprising:

15 determining, by a network device, configuration information, wherein the configuration information is used to configure a mapping relationship between a plurality of resources and a plurality of signatures; and

sending, by the network device, the configuration information to a terminal device.

19. The method according to claim 18, wherein the resources are a preamble and a physical random access channel PRACH time-frequency resource for sending the preamble; and

20 the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a physical uplink shared channel PUSCH time-frequency resource, a pilot resource, and a signature;

25 a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a pilot resource and a signature; or

30 a mapping relationship between N preambles on the PRACH time-frequency resource and M signatures, wherein

M and N are positive integers.

20. The method according to claim 19, wherein the mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature comprises:

35 the N preambles are first selected in increasing order of preamble indexes on the PRACH

time-frequency resource, then in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PRACH time-frequency resources, and thirdly in increasing order of time-domain resource indexes of a plurality of time multiplexed PRACH time-frequency resources; and

the M combinations of a PUSCH time-frequency resource and a signature that are mapped to the N preambles are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein

the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

21. The method according to claim 18, wherein the resources are a pilot resource and a PUSCH time-frequency resource; and

the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures, wherein

P and Q are positive integers.

22. The method according to claim 21, wherein the mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures comprises:

the P pilot resources are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of pilot port indexes on the PUSCH time-frequency resource, thirdly in increasing order of pilot sequence indexes on the PUSCH time-frequency resource, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources; and

the Q signatures mapped to the P pilot resources are first selected in increasing order of signature group indexes, and then in increasing order of indexes in a signature group, wherein

the signature is a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

23. A communication apparatus, comprising an interface unit and a processing unit, wherein the processing unit is configured to: determine a first downlink signal from a plurality of downlink signals, and determine at least one signature based on the first downlink signal; and

the interface unit is configured to send data by using the at least one signature.

24. The apparatus according to claim 23, wherein when determining the at least one signature based on the first downlink signal, the processing unit is specifically configured to: determine, based on the first downlink signal, a first resource from a plurality of resources that have a mapping relationship with the plurality of downlink signals; and determine, based on the first resource, the at least one signature from a plurality of signatures that have a mapping relationship with the plurality of resources.

25. The apparatus according to claim 24, wherein the resources are a preamble and a physical random access channel PRACH time-frequency resource for sending the preamble; and the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a physical uplink shared channel PUSCH time-frequency resource, a pilot resource, and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a pilot resource and a signature; or

a mapping relationship between N preambles on the PRACH time-frequency resource and M signatures, wherein

M and N are positive integers.

26. The apparatus according to claim 25, wherein the mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature comprises: the N preambles are first selected in increasing order of preamble indexes on the PRACH time-frequency resource, then in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PRACH time-frequency resources, and thirdly in increasing order of time-domain resource indexes of a plurality of time multiplexed PRACH time-frequency resources; and the M combinations of a PUSCH time-frequency resource and a signature that are mapped to the N preambles are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource

hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

27. The apparatus according to claim 24, wherein the resources are a pilot resource and a PUSCH time-frequency resource; and the mapping relationship between a plurality of resources and a plurality of signatures comprises: a mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures, wherein P and Q are positive integers.

28. The apparatus according to claim 27, wherein the mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures comprises: the P pilot resources are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of pilot port indexes on the PUSCH time-frequency resource, thirdly in increasing order of pilot sequence indexes on the PUSCH time-frequency resource, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources; and the Q signatures mapped to the P pilot resources are first selected in increasing order of signature group indexes, and then in increasing order of indexes in a signature group, wherein the signature is a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

29. The apparatus according to any one of claims 24 to 28, wherein the interface unit is further configured to receive configuration information from a network device, wherein the configuration information is used to configure the mapping relationship between a plurality of resources and a plurality of signatures.

30. The apparatus according to claim 23, wherein there is a mapping relationship between a plurality of downlink signals and a plurality of signatures, and the at least one signature is a signature that is in the plurality of signatures and that is mapped to the first downlink signal; and

the mapping relationship between a plurality of downlink signals and a plurality of signatures comprises: a mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource, a pilot resource, and a signature; a mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource and a signature; a mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a pilot resource and a signature; or a mapping relationship between R downlink signals in the plurality of downlink signals and S signatures, wherein R and S are positive integers.

31. The apparatus according to claim 30, wherein the mapping relationship between R downlink signals in the plurality of downlink signals and S combinations of a PUSCH time-frequency resource and a signature comprises: the R downlink signals are selected from the plurality of downlink reference signals in increasing order of indexes; and the S combinations of

a PUSCH time-frequency resource and a signature that correspond to the R downlink signals are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

32. The apparatus according to claim 23, wherein when determining the at least one signature based on the first downlink signal, the processing unit is specifically configured to determine the at least one signature in a signature set associated with the first downlink signal, wherein each of the plurality of downlink signals has an associated signature set.

33. The apparatus according to claim 32, wherein when determining the at least one signature in the signature set associated with the first downlink signal, the processing unit is specifically configured to: when the processing unit determines that the communication apparatus is located in a coverage edge area of the first downlink signal, determine the at least one signature in a first signature subset, wherein the first signature subset and a signature set associated with a second downlink signal are orthogonal to each other; a correlation between the first signature subset and the signature set associated with the second downlink signal is lower than a correlation threshold; and the first signature subset is a subset of a signature set associated with the first downlink signal, and the second downlink signal is one of the plurality of downlink signals.

34. The apparatus according to claim 33, wherein when sending the data by using the at least one signature, the interface unit is specifically configured to: when the processing unit determines that the communication apparatus is located in the coverage edge area of the first downlink signal, send the data by using a first transmission parameter and the at least one signature; or when the processing unit determines that the communication apparatus is located in a non-coverage edge area of the first downlink signal, send the data by using a second transmission parameter and the at least one signature.

35. The apparatus according to claim 33 or 34, wherein a condition for determining, by the processing unit, that the communication apparatus is located in the coverage edge area of the first downlink signal comprises one or more of the following: signal quality of the first downlink signal is less than or equal to a first threshold; signal quality of a third downlink signal is greater than or equal to a second threshold; an absolute value of a difference between signal quality of a third downlink signal and signal quality of the first downlink signal is less than or equal to a third threshold; or a ratio of signal quality of a third downlink signal to signal quality of the first

downlink signal is greater than or equal to a fourth threshold; and the third downlink signal is a downlink signal with highest signal quality in the plurality of downlink signals other than the first downlink signal.

36. The apparatus according to claim 32, wherein the processing unit is further configured to:
5 determine an interference and/or multiplexing level of a time-frequency resource for sending the data; and determine a third transmission parameter based on the interference and/or multiplexing level of the time-frequency resource, wherein the third parameter meets the following characteristic: a higher interference and/or multiplexing level of the time-frequency resource indicates a lower power corresponding to the third transmission parameter; and

10 when sending the data by using the at least one signature, the interface unit is specifically configured to send the data by using the third transmission parameter and the at least one signature.

37. The apparatus according to any one of claims 32 to 36, wherein any two signatures in the signature set associated with the first downlink signal are orthogonal to each other; and at least one signature in the signature set associated with the first downlink signal is not orthogonal to at
15 least one signature in a signature set associated with a fourth downlink signal, and the fourth downlink signal is one of the plurality of downlink signals.

38. The apparatus according to any one of claims 32 to 37, wherein the signature is at least one of a code-domain resource, a pilot resource, a power resource, a space-domain resource, and a resource hopping pattern.

20 39. The apparatus according to any one of claims 23 to 38, wherein the downlink signal is a synchronization signal block SSB.

40. A communication apparatus, comprising an interface unit and a processing unit, wherein the processing unit is configured to determine configuration information, wherein the configuration information is used to configure a mapping relationship between a plurality of
25 resources and a plurality of signatures; and

the interface unit is configured to send the configuration information to a terminal device.

41. The apparatus according to claim 40, wherein the resources are a preamble and a physical random access channel PRACH time-frequency resource for sending the preamble; and the mapping relationship between a plurality of resources and a plurality of signatures
30 comprises:

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a physical uplink shared channel PUSCH time-frequency resource, a pilot resource, and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M
35 combinations of a PUSCH time-frequency resource and a signature;

a mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a pilot resource and a signature; or

a mapping relationship between N preambles on the PRACH time-frequency resource and M signatures, wherein

5 M and N are positive integers.

42. The apparatus according to claim 41, wherein the mapping relationship between N preambles on the PRACH time-frequency resource and M combinations of a PUSCH time-frequency resource and a signature comprises:

10 the N preambles are first selected in increasing order of preamble indexes on the PRACH time-frequency resource, then in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PRACH time-frequency resources, and thirdly in increasing order of time-domain resource indexes of a plurality of time multiplexed PRACH time-frequency resources; and

15 the M combinations of a PUSCH time-frequency resource and a signature that are mapped to the N preambles are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of indexes in a signature group, thirdly in increasing order of signature group indexes, and fourthly in increasing order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources, wherein

20 the signature is a frequency-domain resource hopping pattern, a hopping pattern of a resource group comprising a frequency-domain resource, a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.

43. The apparatus according to claim 40, wherein the resources are a pilot resource and a PUSCH time-frequency resource; and

25 the mapping relationship between a plurality of resources and a plurality of signatures comprises:

a mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures, wherein

P and Q are positive integers.

30 44. The apparatus according to claim 43, wherein the mapping relationship between P pilot resources on the PUSCH time-frequency resource and Q signatures comprises:

35 the P pilot resources are first selected in increasing order of frequency-domain resource indexes of a plurality of frequency multiplexed PUSCH time-frequency resources, then in increasing order of pilot port indexes on the PUSCH time-frequency resource, thirdly in increasing order of pilot sequence indexes on the PUSCH time-frequency resource, and fourthly in increasing

order of time-domain resource indexes of a plurality of time multiplexed PUSCH time-frequency resources; and

the Q signatures mapped to the P pilot resources are first selected in increasing order of signature group indexes, and then in increasing order of indexes in a signature group, wherein

- 5 the signature is a code-domain resource, a code-domain resource hopping pattern, a space-domain resource, or a space-domain resource hopping pattern.