

BEAM FAILURE DETERMINATION METHOD AND APPARATUS, DEVICE, AND STORAGE MEDIUM

TECHNICAL FIELD

5 **[0001]** The present disclosure relates to the technical field of mobile communication, and in particular, to a method for determining beam failure, an apparatus for determining beam failure, a terminal, and a medium.

BACKGROUND

10 **[0002]** In a new radio (NR) system, particularly when a communication band is in band range 2, due to the fast attenuation of high frequency channel, beam-based transmission and reception is required to ensure the coverage.

15 **[0003]** In the NR system, a control channel also needs to use beam-based transmission and reception. When a user equipment (UE) moves or an antenna direction rotates, a problem may occur in a receiving beam or a sending beam currently configured to the UE for sending and receiving a physical downlink control channel (PDCCH), namely, a problem of beam failure occurs. A current communication protocol defines a reference signal resource set q0 for detecting beam failure. A beam failure occurs when the UE detects that the radio link quality of all reference signals in the reference signal resource set is lower than a threshold #1. At this
20 time, the UE will, according to a reference signal resource set q1 for determining candidate beam configured by a base station, detect whether there is a reference signal in the reference signal resource set, whose reference signal received power (RSRP) meets a threshold #2. If yes, the UE may also notify the base station of a new candidate beam while notifying a beam failure, for the base station to configure a new beam for the terminal.

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SUMMARY

30 **[0004]** Embodiments of the present disclosure provide a method for determining beam failure, an apparatus for determining beam failure, a terminal, and a medium, based on which, in a scenario of multiple TRPs, a network device can recover from a beam failure on a single TRP. The technical solutions are as follows.

What is claimed is:

1. A method for determining beam failure, ~~applied to~~performed by a terminal, comprising:
determining N reference signal resource sets for beam failure detection, and
transmission/reception point (TRP) identifiers corresponding to respective reference signal
5 resource sets, wherein at least two different reference signal resource sets are included in the
N reference signal resource sets, TRP identifiers corresponding to the at least two different
reference signal resource sets are different, and physical cell identifiers corresponding to the at
least two different reference signal resource sets are the same.

2. The method of claim 1, wherein,

10 a TRP identifier comprises a CORESET pool index, ~~and the CORESET pool index is in
one-to-one correspondence~~ corresponding to a TRP;

or,

a TRP identifier comprises a reference signal resource set index or at least one reference
signal resource index, ~~and the reference signal resource set index is in one-to-one
15 correspondence to a TRP, or the reference signal resource index is in one-to-one
correspondence~~ corresponding to a TRP;

or,

a TRP identifier comprises a TRP number.

3. ~~The method of claim 2~~especially, wherein a physical cell identifier comprises: a
20 physical cell identifier of a serving cell and/or a neighboring cell of the terminal.

4. The method of any one of claims 1 to 3, wherein determining the N reference signal
resource sets for the beam failure detection comprises:

receiving first configuration information from a network device, wherein the first
configuration information is configured to configure the N reference signal resource sets;

25 or,

determining default N reference signal resource sets;

or,

receiving second configuration information from a network device, wherein the second
configuration information is configured to configure a first part of reference signal resource

sets in the N reference signal resource sets; and determining a default second part of reference signal resource sets, wherein the second part of reference signal resource sets are remaining sets of the N reference signal resource sets other than the first part of reference signal resource sets;

5 ~~5.~~ The method of claim ~~4~~especially, wherein,

for each TRP of the N TRPs, the default reference signal resource set is a reference signal resource set corresponding to a target transmission configuration indication (TCI) state, and the target TCI state is a TCI state configured for the terminal to monitor a physical downlink control channel (PDCCH) on a control resource set corresponding to the TRP.

10 ~~6~~4. The method of any one of claims 1 to ~~3~~2, further comprising:

determining that a beam failure occurs on a first TRP corresponding to a first reference signal resource set, in response to that at least one reference signal in the first reference signal resource set in the at least two different reference signal resource sets satisfies a beam failure condition.

15 ~~7~~5. The method of claim ~~6~~4, further comprising:

sending a beam failure recovery request to a network device in response to that the beam failure occurs on the first TRP.

~~8~~6. The method of claim ~~7~~5, wherein sending the beam failure recovery request to the network device in response to that the beam failure occurs on the first TRP comprises:

20 sending a first random access preamble on a first random access time-frequency resource, in response to that the beam failure occurs on the first TRP, wherein the first random access preamble is configured to indicate the beam failure recovery request.

~~9~~7. The method of claim ~~8~~6, wherein sending the first random access preamble on the first random access time-frequency resource, in response to that the beam failure occurs on the first TRP, comprises:

25 sending the first random access preamble on the first random access time-frequency resource, in response to that the beam failure occurs on the first TRP and the first TRP is a TRP on a primary cell (PCell);

or,

sending the first random access preamble on the first random access time-frequency resource, in response to that the beam failure occurs on the first TRP and the first TRP is a TRP on a primary secondary cell (PScell).

810. The method of claim 86, wherein sending the first random access preamble on the first random access time-frequency resource in response to that the beam failure occurs on the first TRP comprises:

sending the first random access preamble on the first random access time-frequency resource, in response to that the beam failure occurs on the first TRP and the first TRP is a TRP configured with CORESET#0 of the terminal in a primary cell (PCell);

or,

sending the first random access preamble on the first random access time-frequency resource, in response to that the beam failure occurs on the first TRP and the first TRP is a TRP configured with CORESET#0 of the terminal in a primary secondary cell (PScell).

119. The method of claim 9-7 or 108, wherein the first random access time-frequency resource is a random access time-frequency resource corresponding to a first synchronization signal block (SSB) sent by the first TRP;

~~12. The method of claim 11, wherein,~~

the first SSB is a reference signal resource corresponding to a TCI state of at least one CORESET corresponding to a CORESET pool index corresponding to the first TRP;

or,

the first SSB corresponds to a first channel state information reference signal (CSI-RS), and the first CSI-RS is a reference signal resource corresponding to a transmission configuration indication (TCI) state of at least one control resource set CORESET corresponding to a CORESET pool index corresponding to the first TRP.

1310. The method of claim 97, wherein the first random access time-frequency resource is a random access time-frequency resource corresponding to a second SSB, and the second SSB is an SSB sent by a TRP configured with the CORESET#0 of the terminal.

1411. The method of claim 9-7 or 108, wherein the first random access time-frequency resource is a random access time-frequency resource corresponding to a SSB corresponding to

a target candidate beam; and

a radio link quality of a reference signal corresponding to the target candidate beam is greater than a threshold, and the reference signal is a reference signal in a second reference signal resource set configured to discover candidate beams;

5 ~~15. The method of claim 14~~especially, wherein the SSB corresponding to the target candidate beam is a SSB sent by the first TRP or the second TRP.

~~16~~12. The method of claim ~~10~~3, further comprising:

sending identification information in a physical uplink shared channel (PUSCH) of message A in a two-step random access procedure, wherein the identification information is
10 configured to indicate the first TRP;

or,

sending identification information in a PUSCH of message 3 in a four-step random access procedure.

~~17~~13. The method of claim ~~7~~5, wherein sending the beam failure recovery request to the
15 network device in response to that the beam failure occurs on the first TRP comprises:

sending SR-BFR to the network device in a physical uplink control channel (PUCCH), in response to that the beam failure occurs on the first TRP, wherein the SR-BFR is a scheduling request (SR) for requesting beam failure recovery.

~~18~~14. The method of claim ~~17~~13, wherein,

20 the PUCCH is a PUCCH on a cell of a primary cell group;

or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

the PUCCH is a PUCCH on a neighboring cell;

25 or,

the PUCCH is a PUCCH sent on a third TRP, which has no beam failure and belongs to a same cell as the first TRP;

or,

the PUCCH is a PUCCH on a serving cell to which a non-first TRP without beam failure

belongs₂

or,

~~19. The method of claim 17, wherein the first TRP is a TRP on a secondary cell (Scell);~~

the PUCCH is a PUCCH on a cell of a primary cell group;

5 or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

the PUCCH is a PUCCH sent on a fourth TRP, which has no beam failure and is on a Scell to which the first TRP belongs;

10 or,

the PUCCH is a PUCCH on another serving cell other than the Scell to which the first TRP belongs₂

or,

~~20. The method of claim 17, wherein the first TRP is a TRP on a primary cell (PCell) or a~~
15 primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

20 the PUCCH is a PUCCH sent on a fifth TRP, which is on the PCell or the PScell to which the first TRP belongs and has no beam failure;

or,

the PUCCH is a PUCCH on another serving cell other than the PScell or the PCell to which the first TRP belongs₁

25 or,-

~~21. The method of claim 17, wherein the first TRP is a TRP not configured with~~
CORESET#0 of the terminal on a primary cell (PCell) or a primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

the PUCCH is a PUCCH sent on a sixth TRP, in which the sixth TRP is on the PCell or PScell to which the first TRP belongs and has no beam failure, and the sixth TRP comprises a TRP configured with the CORESET #0 of the terminal or a TRP not configured with the CORESET#0 of the terminal;

or,

~~22. The method of claim 17,~~ wherein the first TRP is a TRP configured with CORESET#0 of the terminal on a primary cell (PCell) or a primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

the PUCCH is a PUCCH sent on a seventh TRP, in which the seventh TRP is on the PCell or PScell to which the first TRP belongs and has no beam failure, and the seventh TRP comprises a TRP not configured with the CORESET#0 of the terminal;

or,

~~23. The method of claim 17,~~ wherein the first TRP is a TRP on a neighboring cell;

the PUCCH is a PUCCH on a cell of a primary cell group;

or,

the PUCCH is a PUCCH on a cell of a secondary cell group;

or,

the PUCCH is a PUCCH on a neighboring cell.

~~24~~15. The method of claim ~~17~~14, further comprising:

receiving resource configuration information from the network device, wherein the resource configuration information is configured to allocate a physical uplink shared channel (PUSCH) resource;

sending identification information on the PUSCH resource, wherein the identification information is configured to indicate the first TRP;

25. ~~The method of claim 24,~~ wherein the resource configuration information is included in an uplink (UL) grant, and the UL grant is responded by the network device based on the SR-BFR.

26. ~~The method of claim 24,~~ wherein sending the identification information on the PUSCH resources, wherein the identification information is configured to indicate the first TRP, comprises:

sending a media access control control element (MAC CE) on the PUSCH resource, wherein the MAC CE includes identification information, and the identification information is configured to indicate the first TRP.

27. ~~The method of claim 17, or 24, or 26~~ 14 or 15, wherein the identification information comprises at least one of:

a CORESET pool index corresponding to the first TRP;

a reference signal resource set index or at least one reference signal resource index corresponding to the first TRP;

an identifier of the first TRP; or

a cell identifier of the first TRP.

28. ~~The method of claim 17~~ 14, further comprising:

sending a reference signal identifier of a target candidate beam on the PUSCH resource, wherein a radio link quality of a reference signal corresponding to the target candidate beam is greater than a threshold, and the reference signal is a reference signal in the second reference signal resource set configured to discover candidate beams.

29. ~~A method for determining beam failure, applied to~~ performed by a network device, comprising:

sending configuration information, wherein the configuration information configures a terminal with at least one reference signal resource set in N reference signal resource sets for beam failure detection, and a transmission/reception point (TRP) identifier corresponding to each reference signal resource set in the at least one reference resource set;

wherein at least two different reference signal resource sets are included in the N reference signal resource sets, TRP identifiers corresponding to the at least two different reference signal

resource sets are different, and physical cell identifiers corresponding to the at least two different reference signal resource sets are the same.

30. ~~The method of claim 29, wherein sending the configuration information comprises:
sending first configuration information, wherein the first configuration information is
configured to configure the N reference signal resource sets;~~

~~or,~~

~~sending second configuration information, wherein the second configuration information
is configured to configure a first part of reference signal resource sets in the N reference signal
resource sets.~~

31. ~~The method of claim 29, further comprising:
receiving a beam failure recovery request sent by the terminal, wherein the beam failure
recovery request is sent by the terminal in response to that beam failure occurs on the first TRP.~~

32. ~~The method of claim 31, wherein receiving the beam failure recovery request sent by
the terminal comprises:~~

~~receiving a first random access preamble on a first random access time-frequency resource,
wherein the first random access preamble is configured to indicate the beam failure recovery
request.~~

33. ~~The method of claim 32, further comprising:
determining that the beam failure occurs on the first TRP according to a first
synchronization signal block (SSB) corresponding to the first random access time-frequency
resource;~~

~~wherein the first SSB is a reference signal resource corresponding to a transmission
configuration indication (TCI) state of at least one control resource set (CORESET)
corresponding to a CORESET pool index corresponding to the first TRP; or, the first SSB
corresponds to a first channel state information reference signal (CSI-RS), and the first CSI-
RS is a reference signal resource corresponding to a TCI state of at least one CORESET
corresponding to a CORESET pool index corresponding to the first TRP.~~

34. ~~The method of claim 32, further comprising:
receiving identification information in a physical uplink shared channel (PUSCH) of~~

message A in a two-step random access procedure, and determining that the beam failure occurs on the first TRP according to the identification information;

or;

receiving the identification information in a PUSCH of message 3 in a four-step random access procedure, and determining that the beam failure occurs on the first TRP according to the identification information.

35. The method of claim 34, wherein receiving the beam failure recovery request sent by the terminal comprises:

receiving SR-BFR sent on a physical uplink control channel (PUCCH), wherein the SR-BFR is an SR for requesting beam failure recovery.

36. The method of claim 35, wherein;

the PUCCH is a PUCCH on a cell of a primary cell group;

or;

the PUCCH is a PUCCH on a cell of a secondary cell group;

or;

the PUCCH is a PUCCH on a cell of a neighboring cell;

or;

the PUCCH is a PUCCH sent on a third TRP, which belongs to a same cell as the first TRP and has no beam failure;

or;

the PUCCH is a PUCCH on a serving cell to which a non-first TRP without beam failure belongs.

37. The method of claim 35, wherein the first TRP is a TRP on a secondary cell (Scell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or;

the PUCCH is a PUCCH on a cell of a secondary cell group;

or;

the PUCCH is a PUCCH sent on a fourth TRP, which is on the Scell to which the first TRP belongs and has no beam failure;

or;

the PUCCH is a PUCCH on another serving cell other than the SCell to which the first TRP belongs.

38. The method of claim 35, wherein the first TRP is a TRP on a primary cell (PCell) or a primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or;

the PUCCH is a PUCCH on a cell of a secondary cell group;

or;

the PUCCH is a PUCCH sent on a fifth TRP, which is on the PCell or the PScell to which the first TRP belongs and has no beam failure;

or;

the PUCCH is a PUCCH on another serving cell other than the PScell or the PCell to which the first TRP belongs.

39. The method of claim 17, wherein the first TRP is a TRP not configured with CORESET#0 of the terminal on a primary cell (PCell) or a primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or;

the PUCCH is a PUCCH on a cell of a secondary cell group;

or;

the PUCCH is a PUCCH sent on a sixth TRP, in which the sixth TRP is on the PCell or PScell to which the first TRP belongs and has no beam failure, and the sixth TRP comprises a TRP configured with the CORESET #0 of the terminal or a TRP not configured with the CORESET#0 of the terminal.

40. The method of claim 17, wherein the first TRP is a TRP configured with CORESET#0 of the terminal on a primary cell (PCell) or a primary secondary cell (PScell);

the PUCCH is a PUCCH on a cell of a primary cell group;

or;

the PUCCH is a PUCCH on a cell of a secondary cell group;

~~or;~~

~~the PUCCH is a PUCCH sent on a seventh TRP, in which the seventh TRP is on the PCell or PScell to which the first TRP belongs and has no beam failure, and the seventh TRP comprises a TRP not configured with the CORESET#0 of the terminal.~~

5 41. The method of claim 35, wherein the first TRP is a TRP on a neighboring cell;
the PUCCH is a PUCCH on a cell of a primary cell group;

~~or;~~

~~the PUCCH is a PUCCH on a cell of a secondary cell group;~~

~~or;~~

10 ~~the PUCCH is a PUCCH on a cell of a neighboring cell.~~

~~42. The method of claim 35, further comprising:~~

~~sending resource configuration information to the terminal, wherein the resource configuration information is configured to allocate a physical uplink shared channel (PUSCH) resource;~~

15 ~~receiving identification information on the PUSCH resource; and~~

~~determining that the beam failure occurs on the first TRP according to the identification information.~~

~~43. The method of claim 42, wherein the resource configuration information is included in an uplink (UL) grant, and the UL grant is responded by the network device based on the SR-BFR.~~

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~~44. The method of claim 43, wherein receiving the identification information on the PUSCH resource, wherein the identification information is configured to indicate the first TRP, comprises:~~

~~receiving a media access control control element (MAC CE) on the PUSCH resource;~~

25 ~~wherein the MAC CE includes the identification information.~~

~~45. The method of claim 34, or 42, or 44, wherein the identification information comprises at least one of:~~

~~a CORESET pool index corresponding to the first TRP;~~

~~a reference signal resource set index or at least one reference signal resource index~~

corresponding to the first TRP;

an identifier of the first TRP; or

a cell identifier of the first TRP.

46. An apparatus for determining beam failure, comprising:

5 a determining module, configured to determine N reference signal resource sets for beam failure detection, and transmission/reception point (TRP) identifiers corresponding to respective reference signal resource sets, wherein at least two different reference signal resource sets are included in the N reference signal resource sets, TRP identifiers corresponding to the at least two different reference signal resource sets are different, and physical cell
10 identifiers corresponding to the at least two different reference signal resource sets are the same.

47. An apparatus for determining beam failure, comprising:

a configuration module, configured to send configuration information, wherein the configuration information configures a terminal with at least one reference signal resource set in N reference signal resource sets for beam failure detection, and a transmission/reception
15 point (TRP) identifier corresponding to each reference signal resource set in the at least one reference resource set;

wherein at least two different reference signal resource sets are included in the N reference signal resource sets, TRP identifiers corresponding to the at least two different reference signal resource sets are different, and physical cell identifiers corresponding to the at least two
20 different reference signal resource sets are the same.

4819. A terminal, comprising:

a processor;

a transceiver connected to the processor; and

a memory for storing executable instructions of the processor;

25 wherein the processor is configured to load and execute the executable instructions to implement the method for determining beam failure of any one of claims 1 to 2817.

2049. A network device, comprising:

a processor;

a transceiver connected to the processor; and

a memory for storing executable instructions of the processor;

wherein the processor is configured to load and execute the executable instructions to implement the method for determining beam failure of ~~any one of claims 29 to 45~~claim 18.

5 ~~50~~21. A computer-readable storage medium having stored therein executable programs that, when loaded and executed by a processor, cause the method for determining beam failure of any one of claims 1 to ~~17~~28, or the method for determining beam failure of ~~any one of claims 29 to 45~~claim 18 to be implemented.