

CLAIMS

What is claimed is:

1. A method implemented in a wireless transmit/receive unit (WTRU), the method comprising:
 - determining first and second sets of reference signals (RS sets) from among a plurality of reference signals associated with a plurality of control resource set (CORESET) groups, wherein the first and second RS sets are associated with first and second sets of beams, respectively;
 - receiving information for first and second beam failure recovery (BFR) sets corresponding to the first and second RS sets, respectively, wherein the information indicates a set of reference signals associated with one or more candidate beams (CB-RS set) and a set of uplink resources (UL resource set) for each of the first and second BFR sets;
 - determining first and second beam failures for the first set of beams and the second set of beams based on the first RS set and the second RS set, respectively;
 - selecting the CB-RS set and the UL resource set from one of the first and second BFR sets;
 - determining a reference signal (CB RS) of the selected CB-RS set; and
 - transmitting information indicating the beam failures using one or more UL resources of the selected UL resource set.
2. The method of the preceding claim, wherein the one or more UL resources comprises an UL resource associated with the determined reference signal.
3. The method of at least one of the preceding claims, wherein the selected CB-RS set comprises a plurality of CB RSs, and wherein determining a reference signal of the selected CB-RS set comprises:
 - determining, from among the plurality of CB RSs, a CB RS having a best quality; and
 - using the CB RS having the best quality as the CB RS.
4. The method of at least one of the preceding claims, wherein the information also indicates a downlink (DL) resource set for each of the first and second BFR sets, the method comprising
 - selecting the DL resource set from one of the first and second BFR sets; and
 - monitoring one or more DL resources of the DL resource set for information indicating (i) any of a confirmation, an acknowledgement and a non-acknowledgement of the beam

failure, and (ii) any of a confirmation, an acknowledgement and a non-acknowledgement of receipt of the information indicating the beam failure.

5. The method of the preceding claim, wherein the DL resource set comprises any of a CORESET and a set of search spaces.

6. The method of at least one of the preceding claims, wherein determining first and second beam failures comprises:

measuring beam qualities of each RS of the first RS set and each RS of the second RS set;

determining that all of the beam qualities of all RSs of the first RS set fail to satisfy a first threshold; and

determining that all of the beam qualities of all RSs of the second RS set fail to satisfy a second threshold, wherein the first and second thresholds are the same or different thresholds.

7. The method of at least one of the preceding claims, wherein determining first and second sets of reference signals (RS sets) comprises:

determining the first and second RS sets, from among a plurality of reference signals associated with a plurality of CORESET groups, based on first and second identifiers (CORESET group IDs) of first and second CORESET groups of the plurality of CORESET groups.

8. The method of at least one of the claims 1-7, further comprising:

receiving first CORESET configuration information and second CORESET configuration information, wherein the first CORESET configuration information indicates a first identifier (CORESET group ID) of the first CORESET group and a first set of transmission configuration indicator (TCI) states, wherein the second CORESET configuration information indicates a second CORESET group ID of the second CORESET group and a second set of TCI states, and

wherein determining first and second sets of reference signals (RS sets) comprises determining the first and second RS sets based on first and second CORESET group IDs and the first and second sets of TCI states.

9. The method of at least one of the preceding claims, wherein selecting the CB-RS set and the UL resource set from one of the first and second BFR sets comprises:

selecting the CB-RS set and the UL resource set from one of the first and second BFR sets based on one or more rules

10. The method of at least one of the preceding 4-8, wherein selecting the DL resource set from one of the first and second BFR sets comprises: selecting the DL resource set from one of the first and second BFR sets based on the one or more rules.

11. The method of at least one of the preceding claims, wherein transmitting information indicating the beam failure using one or more UL resources of the selected UL resource set comprises:

transmitting the information indicating the beam failure via a PRACH transmission using one or more PRACH resource associated with the selected CB-RS set.

12. The method of at least one of the preceding claims, wherein transmitting information indicating the beam failure using one or more UL resources of the selected UL resource set comprises:

transmitting the information indicating the beam failure via a PUCCH transmission using one or more PUCCH resources associated with the selected CB-RS set.

13. A method implemented in a wireless transmit/receive unit (WTRU), the method comprising:

receiving information indicating (i) a first set of one or more reference signals (RS set) associated with a first cell and (ii) a second RS set associated with a second cell;

using the first RS set for performing beam failure detection;

using the second RS set for performing beam failure detection after a determination of beam failure based on the first RS set;

determining a second beam failure based on the second RS set;

determining a reference signal of a CB-RS set; and

transmitting information indicating the beam failure using one or more UL resources of an UL resource set.

14. A method implemented in a wireless transmit/receive unit (WTRU), the method comprising:

receiving information indicating a plurality of BFD RS resources, wherein each BFD RS resource comprises a plurality of RSs

determining beam failures of the plurality of BFD RS resources based on individual beam failures of the plurality of BFD RS resources, and wherein each of the individual beam failures is determined based on the plurality of RSs of the corresponding BFD RS resource;

determining a CB-RS resource of a plurality of CB-RS resources, wherein each CB-RS resource comprises a plurality of RSs; and

transmitting information indicating the beam failure using a plurality of UL resources of an UL resource set, wherein each UL resource is associated with each of the plurality of RSs of the determined CB-RS resource.

15. An apparatus comprising circuitry, including any of a transmitter, receiver, processor and memory, configured to carry out a method as in any of claims 1-14.
16. An apparatus comprising circuitry, including any of a transmitter, receiver, processor and memory, configured to carry out a method comprising complementary functions to the functions forth in any of claims 1-14.