

CLAIMS

1. A communication apparatus, comprising:
 - a receiver, which in operation, receives a physical downlink control channel (PDCCH) on a control resource set zero (CORESET#0) of which time and frequency resources are defined based on a bandwidth configuration of reduced capacity user equipments (RedCap UEs), and receives a system information block type 1 (SIB1) physical downlink shared channel (PDSCH) which is scheduled based on the CORESET#0; and
 - 10 circuitry, which in operation, determines control information and parameters from the PDCCH on CORESET#0 to read SIB1 for initial access, handover, or beam failure recovery.
2. The communication apparatus according to claim 1, wherein the circuitry is
15 configured to discard or ignore control information on the CORESET#0 if the CORESET#0 has a larger bandwidth than that of the communication apparatus.
3. The communication apparatus according to claim 1, wherein CORESET#0 for the RedCap UEs can be a subset of entries of Tables 13.1-13.10 in TS 38.213 or a subset of
20 physical resources such as control channel elements (CCEs) or physical resource blocks (PRBs) of Rel-15 CORESET#0.
4. The communication apparatus according to claim 1, wherein the CORESET#0 is a
25 subset of a Rel-15 CORESET#0, such that only the subset is available to configure for all types of UEs including normal (non-RedCap) UEs and RedCap UEs in an associated network.
- 30 5. The communication apparatus according to claim 1, wherein the CORESET#0 is a Rel-15 CORESET#0 that is partitioned into m equal or unequal subsets such that $m \geq 1$, each subset having a bandwidth that is lesser than that of the RedCap UE.

6. The communication apparatus according to claim 5, wherein each subset corresponds to a subset of entries of Tables 13.1-13.10 in TS 38.213 or a subset of physical resources such as control channel elements (CCEs) or physical resource blocks (PRBs) of Rel-15 CORESET#0.

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7. The communication apparatus according to claim 5, wherein each subset is mapped to each of m consecutive slots.

8. The communication apparatus of claim 5, wherein the subsets are mapped to m consecutive slots such that an i th subset of the subsets is mapped in a corresponding slot $n - i$, where $0 \leq i < m$, wherein slot n can be a PDCCH monitoring occasion (slot or symbol) for Rel-15 CORESET#0 or a PDCCH monitoring occasion configured for RedCap UE.

9. The communication apparatus according to claim 1, wherein the CORESET#0 is a Rel-15 CORESET#0 that is partitioned into m equal or unequal subsets such that $m \geq 1$, each subset having a bandwidth that is lesser than that of the RedCap UE;

wherein the Rel-15 CORESET#0 is mapped in a first slot;

wherein each subset is mapped to each slot of $m-1$ consecutive slots different from the first slot.

10. The communication apparatus according to claim 1, wherein the CORESET#0 is a Rel-15 CORESET#0 that is partitioned into m equal or unequal subsets such that $m \geq 1$, each subset having a bandwidth that is lesser than that of the RedCap UE;

wherein the Rel-15 CORESET#0 is mapped in a slot n ;

wherein an i th subset is mapped to a corresponding slot $k - i$ such that k is a predefined value and $0 \leq i < m$.

11. The communication apparatus according to any one of claims 5, 9, and 10, wherein an upper limit for m is dependent on UE capability, consideration of channel delay/estimation, or periodicity of SSB.

12. The communication apparatus according to claim 1, wherein the CORESET#0 is a Rel-15 CORESET#0, wherein part of the Rel-15 CORESET#0 that is outside of the

RedCap UE bandwidth is partitioned into q equal or unequal subset(s) such that $q \geq 1$, each subset having a bandwidth that is lesser than that of the RedCap UE;

wherein the Rel-15 CORESET#0 is mapped in a first slot;

5 wherein each subset of the q equal or unequal subset(s) is copied and mapped within the RedCap UE bandwidth in each slot of q consecutive slots different from the first slot.

13. The communication apparatus according to claim 1, wherein the CORESET#0 is a Rel-15 CORESET#0, wherein part of the Rel-15 CORESET#0 that is outside of the RedCap UE bandwidth is partitioned into q equal or unequal subset(s) such that $q \geq 1$, each subset having a bandwidth that is lesser than that of the RedCap UE;

wherein the Rel-15 CORESET#0 is mapped in a first slot;

10 wherein at each slot of q consecutive slots different from the first slot, only the part of CORESET#0 mapping inside of the BW, where the RedCap UE can monitor, is replaced by an subset of the q equal or unequal subset(s) of the CORESET#0 .

14. The communication apparatus according to any one of claims 12 and 13, wherein an upper limit for q is dependent on UE capability, consideration of channel delay/estimation, or periodicity of SSB.

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15. The communication apparatus according to any one of claims 1-13, wherein information indicating Rel-15 CORESET#0 and PDCCH monitoring occasions for normal UEs is used to present the CORESET#0 for RedCap UEs, the information comprising existing entries in *ControlResourceSetZero* and *SearchSpaceZero* IEs in MIB,.

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16. The communication apparatus according to any one of claims 1-13, wherein information indicating Rel-15 CORESET#0 and PDCCH monitoring occasions for normal (non-RedCap) UEs, and information indicating CORESET#0 and PDCCH monitoring occasions for RedCap UEs, are configured to be independent from each other, wherein the receiver is configured to receive both information, and wherein the circuitry is configured to determine control information and parameters to read the SIB1 based on the indicated information for normal UEs if the communication apparatus is the normal UE, or based on the indicated information for RedcapUEs if the communication apparatus is the RedCap UE.

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17. The communication apparatus according to any one of claims 1-13, wherein information indicating Rel-15 CORESET#0 for normal (non-RedCap) UEs is configured to be interpreted differently for RedCap UEs, such that the information indicates the physical resources of CORESET#0 for RedCap UEs that can be the same or different from that of normal UEs, wherein the receiver is configured to receive the information; and wherein, based on the information, the circuitry is configured to obtain control information and parameters to read the SIB1 from the Rel-15 CORESET#0 for normal UEs if the communication apparatus is the normal UE or from the CORESET#0 for RedCap UEs if the communication apparatus is the RedCap UE.

18. The communication apparatus according to claim 1-13, wherein information indicating Rel-15 CORESET#0 for normal (non-RedCap) UEs is configured to be interpreted differently for RedCap UEs, such that the information indicates the physical resources of CORESET#0 for RedCap UEs that can be different from that of normal UEs and indicates monitoring occasions for RedCap UEs that are different from that of normal UEs, wherein the receiver is configured to receive the information; and wherein, based on the information, the circuitry is configured to obtain control information and parameters to read the SIB1 from the Rel-15 CORESET#0 for normal UEs if the communication apparatus is the normal UE or from the CORESET#0 for RedCap UEs the communication apparatus is the RedCap UE in the corresponding monitoring occasions.

19. The communication apparatus according to claim 1-13, wherein information indicative of Rel-15 CORESET#0 for normal (non-RedCap) UEs are configured to be interpreted differently for RedCap UEs, such that the information indicates physical resources of RedCap UE CORESET#0 that can be different from that of normal UEs and indicates one or more repetitions of for CORESET#0, wherein the one or more repetitions can be signalled implicitly via (pre-)configured rules or explicitly via higher layer signalling to the RedCap UEs, wherein the receiver is configured to receive the information, and wherein, based on the information, the circuitry is configured to obtain control information and parameters to read the SIB1 from the Rel-15 CORESET#0 for normal UEs if the communication apparatus is the normal UE or from the CORESET#0 for RedCap UEs the communication apparatus is the RedCap UE.

20. The communication apparatus according to claim 19, wherein within a same beam, an associated gNB is configured to transmit the Rel-15 CORESET#0 for normal UEs specified in SSBx and CORESET#0 for RedCap UEs specified in SSB with index x and
5 SSB with index y, wherein the CORESET#0 specified in SSB with index y being a repetition of the CORESET#0 in SSB with index x, such that normal UEs detect SSBx to obtain the Rel-CORESET#0 and RedCap UEs detect SSB with index x and SSB with index y to obtain the CORESET#0 for RedCap UEs, wherein the one or more repetitions is signalled implicitly via (pre-)configured rules or explicitly via higher layer signalling.
- 10 21. The communication apparatus according to claims 1-20, wherein CORESET#0 for RedCap UEs is pre-configured by an application layer.
- 15 22. The communication apparatus according to claims 1-20, wherein cell(s) (Pcell/PSCell/Scell) with only Rel-15/16 capability cannot support RedCap UEs, a message such as "this cell does not support RedCap UE" requires to be signalled in MIB/SIB1, or a new physical-layer cell identity (PCID) range is used for the RedCap UEs, such that the communication apparatus can discard or ignore these cells if the communication apparatus is the RedCap UE.
- 20 23. The communication apparatus according to claim 1, wherein the RedCap UEs support a bandwidth that is at least equal to a maximum bandwidth of CORESET#0 defined in Rel-15/16, wherein Rel-15 CORESET#0 is used to configure for all type of non-RedCap and RedCap UEs.
- 25 24. The communication apparatus according to claim 1, wherein physical resources of CORESET#0 are defined based on a minimum bandwidth configuration associated with one or more UEs in a set of normal (non-RedCap) UEs and RedCap UEs in a serving cell, wherein the UEs are configured to perform blind decoding on PDCCH candidates
30 in a search space carried by the CORESET#0 to achieve all control information over one or more consecutive slots depending on the CORESET#0 bandwidth, physical resource mapping schemes, or monitoring occasions.
25. A base station, comprising:

- circuitry, which in operation, configures a control resource set zero (CORESET#0) of which time and frequency resources are defined based on a minimum bandwidth configuration associated with one or more UEs in a set of normal (non-RedCap) UEs and the RedCap UEs, generates a physical downlink control channel (PDCCH) on the CORESET#0, and schedules a system information block type 1 (SIB1) physical downlink shared channel (PDSCH) based on the CORESET#0; and
- 5 a transmitter, which in operation, transmits the PDCCH on CORESET#0 and the SIB1 PDSCH to a communication apparatus.
- 10 26. A communication method, comprising:
- receiving a CORESET#0 of which time and frequency resources are defined based on a minimum bandwidth configuration associated with one or more UEs in a set of normal (non-RedCap) UEs and RedCap UE,
- receiving a system information block type 1 (SIB1) physical downlink shared
- 15 channel (PDSCH) which is scheduled based on the CORESET#0; and
- determining control information and parameters from the PDCCH on CORESET#0 to read the SIB1 for initial access, handover, or beam failure recovery.