

CLAIMS

What is claimed is:

- 1 1. A method for wireless communication at a user equipment (UE),
2 comprising:
3 transmitting a capability message to a base station indicating a multi-
4 connectivity capability of the UE to support more than two concurrent active cell group
5 connections;
6 transmitting, to the base station, one or more measurement reports that provide
7 measurement information for cells in proximity to the UE;
8 receiving, responsive to the capability message and the one or more
9 measurement reports, a multi-connectivity configuration, the multi-connectivity configuration
10 comprising a cell group set that includes a plurality of cell groups with which the UE is
11 configured for multi-connectivity communications, the cell group set including more than
12 two active cell groups to which the UE is connected for concurrent connected mode
13 operations between the UE and the base station; and
14 communicating with the base station via the more than two active cell groups
15 in accordance with the multi-connectivity configuration.
- 1 2. The method of claim 1, further comprising:
2 receiving an indication of which cell groups of the more than two active cell
3 groups are to be configured for packet data convergence protocol (PDCP) aggregation such
4 that data associated with a data radio bearer (DRB) having a throughput requirement above at
5 least one threshold is distributed across the indicated cell groups having an aggregate
6 throughput that satisfies the throughput requirement of the DRB.
- 1 3. The method of claim 2, wherein the at least one threshold is a plurality
2 of predetermined thresholds, with each of the plurality of predetermined thresholds
3 corresponding to one of the indicated cell groups, and wherein the data associated with the
4 DRB is distributed across the indicated cell groups in accordance with the plurality of
5 predetermined thresholds.
- 1 4. The method of claim 2, wherein the at least one threshold is one or
2 more conditional thresholds, with each of the one or more conditional thresholds

3 corresponding to a predetermined quality of a link connection associated with the indicated
4 cell groups.

1 5. The method of claim 1, further comprising:
2 receiving an indication of which cell groups of the more than two active cell
3 groups are to be configured for packet data convergence protocol (PDCP) replication such
4 that data associated with a data radio bearer (DRB) having a latency or reliability requirement
5 above a threshold is replicated across the indicated cell groups.

1 6. The method of claim 5, wherein the indication includes one or more
2 replication flags corresponding to each of the indicated cell groups.

1 7. The method of claim 1, further comprising:
2 receiving a conditional indication of which cell groups of the more than two
3 active cell groups are to be configured for data radio bearer (DRB) packet data convergence
4 protocol (PDCP) aggregation and of which cell groups of the more than two active cell
5 groups are to be configured for DRB PDCP replication; and
6 updating the multi-connectivity configuration for DRB PDCP aggregation or
7 DRB PDCP replication based on a trigger of the conditional indication and without prior
8 receipt of an updated multi-connectivity configuration.

1 8. The method of claim 1, wherein a number of the plurality of cell
2 groups included in the cell group set for which the UE is configured is based at least in part
3 on the multi-connectivity capability of the UE, service requirements of data radio bearers
4 (DRBs) configured for the UE, throughput or reliability requirements of DRBs configured for
5 the UE, a location of the UE, channel conditions affecting communications with the UE,
6 battery resources of the UE, other device resource conditions having an effect on capabilities
7 of the UE, or combinations thereof.

1 9. The method of claim 1, wherein the plurality of cell groups included in
2 the cell group set include cell groups for both New Radio (NR) and Long Term Evolution
3 (LTE) radio access technologies (RATs).

1 10. The method of claim 1, wherein the plurality of cell groups included in
2 the cell group set include cell groups for a same type of radio access technology (RAT).

1 11. The method of claim 1, wherein each of the plurality of cell groups of
2 the cell group set includes a set of cells configured for a same distributed unit (DU) of the
3 base station and managed by a single medium access control (MAC) entity, and wherein all
4 of the plurality of cell groups of the cell group set are associated with a same central unit
5 (CU) of the base station.

6 12. The method of claim 1, further comprising:
7 identifying that two or more of the more than two of active cell groups are
8 controlling cell groups.

1 13. The method of claim 12, wherein identifying that two or more of the
2 more than two active cell groups are controlling cell groups comprises:
3 receiving, via a radio resource control (RRC) message, an indicator that the
4 two or more of the more than two active cell groups are controlling cell groups.

1 14. The method of claim 12, wherein identifying that two or more of the
2 more than two active cell groups are controlling cell groups comprises:
3 receiving an allocation of signaling radio bearer (SRB) resources for each of
4 the controlling cell groups; and
5 identifying the controlling cell groups based at least in part on receipt of the
6 allocation of SRB resources for the controlling cell groups.

1 15. The method of claim 12, further comprising:
2 measuring one or more attributes of the controlling cell groups;
3 identifying, based at least in part on the measuring, one or more of the
4 controlling cell groups as one or more selected controlling cell groups;
5 reporting the one or more selected controlling cell groups to the base station;
6 and
7 receiving at least one of system information (SI) notifications, public warning
8 system (PWS) notifications, core network (CN) registration area notifications, or radio area
9 network (RAN) notifications via the one or more selected controlling cell groups.

1 16. The method of claim 12, further comprising:

2 declaring radio link failure (RLF) only if RLF is identified on each of the
3 controlling cell groups.

1 17. The method of claim 1, further comprising:
2 identifying, from the multi-connectivity configuration, that the cell group set
3 includes one or more inactive cell groups to which the UE is connected but for which the UE
4 lacks an allocation of uplink and downlink physical resources.

1 18. The method of claim 1, further comprising:
2 receiving an update to the multi-connectivity configuration indicating that an
3 additional cell group is to be added to the cell group set.

1 19. The method of claim 1, further comprising:
2 receiving an update to the multi-connectivity configuration indicating that at
3 least one of an active cell group or an inactive cell group has been released and is no longer a
4 part of the cell group set.

1 20. A method for wireless communication at a base station, comprising:
2 receiving a capability message from a user equipment (UE) indicating a multi-
3 connectivity capability of the UE to support more than two concurrent active cell group
4 connections;
5 receiving, from the UE, one or more measurement reports that provide
6 measurement information for cells in proximity to the UE;
7 determining, based at least in part on the one or more measurement reports, a
8 cell group set that includes a plurality of cell groups with which the UE is to be configured
9 for multi-connectivity communications, the cell group set including of more than two active
10 cell groups to which the UE is to be connected for concurrent connected mode operations
11 between the UE and the base station;
12 transmitting to the UE, responsive to the capability message and the one or
13 more measurement reports, a multi-connectivity configuration that includes the cell group set;
14 and
15 communicating with the UE via the more than two active cell groups in
16 accordance with the multi-connectivity configuration.

1 21. The method of claim 20, further comprising:

2 transmitting an indication of which cell groups of the more than two active
3 cell groups are to be configured for packet data convergence protocol (PDCP) aggregation
4 such that data associated with a data radio bearer (DRB) having a throughput requirement
5 above at least one threshold is distributed across the indicated cell groups having an
6 aggregate throughput that satisfies the throughput requirement of the DRB.

1 22. The method of claim 21, wherein the at least one threshold is a
2 plurality of predetermined thresholds, with each of the plurality of predetermined thresholds
3 corresponding to one of the indicated cell groups, and wherein the data associated with the
4 DRB is distributed across the indicated cell groups in accordance with the plurality of
5 predetermined thresholds.

1 23. The method of claim 21, wherein the at least one threshold is one or
2 more conditional thresholds, with each of the one or more conditional thresholds
3 corresponding to a predetermined quality of a link connection associated with the indicated
4 cell groups.

1 24. The method of claim 20, further comprising:
2 transmitting an indication of which cell groups of the more than two active
3 cell groups are to be configured for packet data convergence protocol (PDCP) replication
4 such that data associated with a data radio bearer (DRB) having a latency or reliability
5 requirement above a threshold is replicated across the indicated cell groups.

1 25. The method of claim 20, further comprising:
2 determining a number of the plurality of cell groups to be included in the cell
3 group set based at least in part on the multi-connectivity capability of the UE, service
4 requirements of data radio bearers (DRBs) configured for the UE, throughput or reliability
5 requirements of DRBs configured for the UE, a location of the UE, channel conditions
6 affecting communications with the UE, battery resources of the UE, other device resource
7 conditions having an effect on capabilities of the UE, or combinations thereof.

1 26. The method of claim 20, wherein the plurality of cell groups included
2 in the cell group set include cell groups for both New Radio (NR) and Long Term Evolution
3 (LTE) radio access technologies (RATs).

1 27. The method of claim 20, wherein the plurality of cell groups included
2 in the cell group set include cell groups for a same type of radio access technology (RAT).

1 28. The method of claim 20, wherein each of the plurality of cell groups of
2 the cell group set includes a set of cells configured for a same distributed unit (DU) of the
3 base station and managed by a single medium access control (MAC) entity, and wherein all
4 of the plurality of cell groups of the cell group set are associated with a same central unit
5 (CU) of the base station.

1 29. The method of claim 20, further comprising:
2 determining that two or more of the more than two active cell groups are
3 controlling cell groups.

1 30. The method of claim 29, further comprising:
2 transmitting, via a radio resource control (RRC) message, an indicator that the
3 two or more of the more than two active cell groups are controlling cell groups.

1 31. The method of claim 29, further comprising:
2 transmitting an allocation of signaling radio bearer (SRB) resources for each
3 of the controlling cell groups without also transmitting an indicator that the two or more of
4 the more than two active cell groups are controlling cell groups.

1 32. The method of claim 29, further comprising:
2 receiving a report from the UE indicating one or more selected controlling cell
3 groups from controlling cell groups; and
4 transmitting at least one of system information (SI) notifications, public
5 warning system (PWS) notifications, core network (CN) registration area notifications, or
6 radio area network (RAN) notifications via the one or more selected controlling cell groups.

1 33. The method of claim 20, further comprising:
2 determining, based at least in part on the one or more measurement reports,
3 that the cell group set is to further include one or more inactive cell groups to which the UE is
4 connected but for which the UE lacks an allocation of uplink or downlink physical resources;
5 and

6 including an identification of the one or more inactive cell groups in the multi-
7 connectivity configuration.

1 34. The method of claim 33, further comprising:
2 receiving from the UE one or more additional measurement reports identifying
3 channel conditions associated with at least the more than two active cell groups and the one
4 or more inactive cell groups; and
5 transmitting an update to the multi-connectivity configuration based at least in
6 part on the one or more additional measurement reports.

1 35. The method of claim 34, further comprising:
2 determining that the update to the multi-connectivity configuration is
3 associated with adding an additional cell group to the cell group set;
4 configuring a distributed unit (DU) of the base station and associated with the
5 additional cell group with a UE context of the UE; and
6 wherein transmitting the update to the multi-connectivity configuration
7 comprises transmitting a radio resource control (RRC) signal indicating that the additional
8 cell group is to be added to the cell group set.

1 36. The method of claim 34, further comprising:
2 determining that the update to the multi-connectivity configuration is
3 associated with activating an inactive cell group to an active cell group;
4 indicating the activating to a distributed unit (DU) of the base station and
5 associated with the cell group to be activated via an flag; and
6 wherein transmitting the update to the multi-connectivity configuration
7 comprises transmitting a medium access control (MAC) control element (CE) or radio
8 resource control (RRC) signal indicating that the inactive cell group has been changed to be
9 an active cell group.

1 37. The method of claim 34, further comprising:
2 determining that the update to the multi-connectivity configuration is
3 associated with deactivating an active cell group to an inactive cell group;
4 indicating the deactivating to a distributed unit (DU) of the base station and
5 associated with the cell group to be deactivated via a flag; and

6 wherein transmitting the update to the multi-connectivity configuration
7 comprises transmitting a medium access control (MAC) control element (CE) or radio
8 resource control (RRC) signal indicating that the active cell group has been changed to be an
9 inactive cell group.

1 38. The method of claim 34, further comprising:
2 determining that the update to the multi-connectivity configuration is
3 associated with releasing a cell group from the cell group set;
4 releasing a UE context of the UE from a distributed unit (DU) of the base
5 station and associated with the cell group to be released; and
6 wherein transmitting the update to the multi-connectivity configuration
7 comprises transmitting a radio resource control (RRC) signal indicating that either an active
8 cell group or an inactive cell group has been released and is no longer a part of the cell group
9 set.

1 39. The method of claim 20, further comprising:
2 determining, at a central unit (CU) of the base station and based at least in part
3 on information received from the UE and associated distributed units (DUs) of the base
4 station, which data radio bearers (DRBs) are to be enabled for packet data convergence
5 protocol (PDCP) aggregation and which DRBs are to be enabled for PDCP replication.

1 40. The method of claim 20, further comprising:
2 determining, at a distributed unit (DU) of the base station, which data radio
3 bearers (DRBs) are to be enabled for packet data convergence protocol (PDCP) aggregation
4 and which DRBs are to be enabled for PDCP replication; and
5 signaling the determination to a central unit (CU) of the base station.

1 41. The method of claim 20, further comprising:
2 transmitting a conditional indication of which cell groups of the more than two
3 active cell groups are to be configured for data radio bearer (DRB) packet data convergence
4 protocol (PDCP) aggregation and of which cell groups of the more than two active cell
5 groups are to be configured for DRB PDCP replication.

1 42. The method of claim 20, wherein the determining the cell group set is
2 performed by a central unit (CU) of the base station.

1 43. The method of claim 42, wherein the CU of the base station
2 communicates with distributed units (DUs) of the base station corresponding to each cell
3 group of the cell group set via an F1 interface or a W1 interface.

1 44. An apparatus for wireless communication at a user equipment (UE),
2 comprising:
3 means for transmitting a capability message to a base station indicating a
4 multi-connectivity capability of the UE to support more than two concurrent active cell group
5 connections;
6 means for transmitting, to the base station, one or more measurement reports
7 that provide measurement information for cells in proximity to the UE;
8 means for receiving, responsive to the capability message and the one or more
9 measurement reports, a multi-connectivity configuration, the multi-connectivity configuration
10 comprising a cell group set that includes a plurality of cell groups with which the UE is
11 configured for multi-connectivity communications, the cell group set including more than
12 two active cell groups to which the UE is connected for concurrent connected mode
13 operations between the UE and the base station; and
14 means for communicating with the base station via the more than two active
15 cell groups in accordance with the multi-connectivity configuration.

1 45. The apparatus of claim 44, further comprising:
2 means for receiving an indication of which cell groups of the more than two
3 active cell groups are to be configured for packet data convergence protocol (PDCP)
4 aggregation such that data associated with a data radio bearer (DRB) having a throughput
5 requirement above at least one threshold is distributed across the indicated cell groups having
6 an aggregate throughput that satisfies the throughput requirement of the DRB.

1 46. An apparatus for wireless communication at a base station, comprising:
2 means for receiving a capability message from a user equipment (UE)
3 indicating a multi-connectivity capability of the UE to support more than two concurrent
4 active cell group connections;
5 means for receiving, from the UE, one or more measurement reports that
6 provide measurement information for cells in proximity to the UE;

7 means for determining, based at least in part on the one or more measurement
8 reports, a cell group set that includes a plurality of cell groups with which the UE is to be
9 configured for multi-connectivity communications, the cell group set including more than
10 two active cell groups to which the UE is to be connected for concurrent connected mode
11 operations between the UE and the base station;

12 means for transmitting to the UE, responsive to the capability message and the
13 one or more measurement reports, a multi-connectivity configuration that includes the cell
14 group set; and

15 means for communicating with the UE via the more than two active cell
16 groups in accordance with the multi-connectivity configuration.

1 47. The apparatus of claim 46, further comprising:

2 means for transmitting an indication of which cell groups of the more than two
3 active cell groups are to be configured for packet data convergence protocol (PDCP)
4 aggregation such that data associated with a data radio bearer (DRB) having a throughput
5 requirement above at least one threshold is distributed across the indicated cell groups having
6 an aggregate throughput that satisfies the throughput requirement of the DRB.

1 48. An apparatus for wireless communication at a user equipment (UE),
2 comprising:

3 a processor,

4 memory coupled with the processor; and

5 instructions stored in the memory and executable by the processor to cause the
6 apparatus to:

7 transmit a capability message to a base station indicating a multi-
8 connectivity capability of the UE to support more than two concurrent active cell
9 group connections;

10 transmit, to the base station, one or more measurement reports that
11 provide measurement information for cells in proximity to the UE;

12 receive, responsive to the capability message and the one or more
13 measurement reports, a multi-connectivity configuration, the multi-connectivity
14 configuration comprising a cell group set that includes a plurality of cell groups with
15 which the UE is configured for multi-connectivity communications, the cell group set

16 including more than two active cell groups to which the UE is connected for
17 concurrent connected mode operations between the UE and the base station; and
18 communicate with the base station via the more than two active cell
19 groups in accordance with the multi-connectivity configuration.

1 49. An apparatus for wireless communication at a base station, comprising:
2 a processor,
3 memory coupled with the processor; and
4 instructions stored in the memory and executable by the processor to cause the
5 apparatus to:
6 receive a capability message from a user equipment (UE) indicating a
7 multi-connectivity capability of the UE to support more than two concurrent active
8 cell group connections;
9 receive, from the UE, one or more measurement reports that provide
10 measurement information for cells in proximity to the UE;
11 determine, based at least in part on the one or more measurement
12 reports, a cell group set that includes a plurality of cell groups with which the UE is to
13 be configured for multi-connectivity communications, the cell group set including
14 more than two active cell groups to which the UE is to be connected for concurrent
15 connected mode operations between the UE and the base station;
16 transmit to the UE, responsive to the capability message and the one or
17 more measurement reports, a multi-connectivity configuration that includes the cell
18 group set; and
19 communicate with the UE via the more than two active cell groups in
20 accordance with the multi-connectivity configuration.

1 50. A non-transitory computer-readable medium storing code for wireless
2 communication at a user equipment (UE), the code comprising instructions executable by a
3 processor to:
4 transmit a capability message to a base station indicating a multi-connectivity
5 capability of the UE to support more than two concurrent active cell group connections;
6 transmit, to the base station, one or more measurement reports that provide
7 measurement information for cells in proximity to the UE;

8 receive, responsive to the capability message and the one or more
9 measurement reports, a multi-connectivity configuration, the multi-connectivity configuration
10 comprising a cell group set that includes a plurality of cell groups with which the UE is
11 configured for multi-connectivity communications, the cell group set including more than
12 two active cell groups to which the UE is connected for concurrent connected mode
13 operations between the UE and the base station; and
14 communicate with the base station via the more than two active cell groups in
15 accordance with the multi-connectivity configuration.

1 51. A non-transitory computer-readable medium storing code for wireless
2 communication at a base station, the code comprising instructions executable by a processor
3 to:
4 receive a capability message from a user equipment (UE) indicating a multi-
5 connectivity capability of the UE to support more than two concurrent active cell group
6 connections;
7 receive, from the UE, one or more measurement reports that provide
8 measurement information for cells in proximity to the UE;
9 determine, based at least in part on the one or more measurement reports, a
10 cell group set that includes a plurality of cell groups with which the UE is to be configured
11 for multi-connectivity communications, the cell group set including more than two active cell
12 groups to which the UE is to be connected for concurrent connected mode operations
13 between the UE and the base station;
14 transmit to the UE, responsive to the capability message and the one or more
15 measurement reports, a multi-connectivity configuration that includes the cell group set; and
16 communicate with the UE via the more than two active cell groups in
17 accordance with the multi-connectivity configuration.