

CLAIMS

What is claimed is:

- 1 1. A method for wireless communication at a user equipment (UE),
2 comprising:
3 identifying a first set of control channel resources in a first transmission time
4 interval (TTI) of a plurality of TTIs in which repetitions of a downlink shared channel
5 transmission to the UE are transmitted;
6 rate-matching each repetition of the downlink shared channel transmission in
7 each of the plurality of TTIs based at least in part on the first set of control channel resources
8 to identify shared channel resources in each of the plurality of TTIs; and
9 receiving the downlink shared channel transmission via the shared channel
10 resources in each of the plurality of TTIs.
- 1 2. The method of claim 1, wherein the first set of control channel
2 resources comprises a subset of a set of resources configurable for control channel
3 transmissions, and wherein the shared channel resources in each of the plurality of TTIs
4 comprise at least a portion of the set of resources configurable for control channel
5 transmissions.
- 1 3. The method of claim 2, wherein the first set of control channel
2 resources are configured semi-statically or dynamically.
- 1 4. The method of claim 2, wherein the first set of control channel
2 resources are configured dynamically, and wherein the rate-matching comprises:
3 determining a rate-matching mode for the first set of control channel resources
4 based at least on a dynamic indication field in first control information;
5 rate-matching the downlink shared channel transmission of the first TTI based
6 at least in part on the determined rate-matching mode; and
7 rate-matching each remaining TTI of the plurality of TTIs based at least in
8 part on the rate-matching mode for the first set of control channel resources.
- 1 5. The method of claim 4, wherein the dynamic indication field indicates
2 rate-matching around only the first control information or rate-matching around an entire

3 resource block (RB) set and whether such rate-matching is performed in the presence or
4 absence of control information within the first TTI, and wherein the rate-matching each
5 remaining TTI is performed according to the dynamic indication field and assuming that none
6 of the remaining TTIs include control information.

1 6. The method of claim 4, wherein the rate-matching each remaining TTI
2 is performed according to a semi-static configuration to rate-match around an entire resource
3 block (RB) set.

1 7. The method of claim 6, wherein the semi-static configuration is
2 provided via radio resource control (RRC) signaling.

1 8. The method of claim 1, wherein repetition information for the plurality
2 of TTIs in first control information of the first TTI comprises a trigger to activate the
3 repetitions of the downlink shared channel transmission.

1 9. The method of claim 1, further comprising:
2 receiving two or more instances of first control information in two or more
3 TTIs of the plurality of TTIs, wherein each of the two or more instances of first control
4 information are received via same control channel resources as the first set of control channel
5 resources.

1 10. The method of claim 1, further comprising:
2 identifying a second set of resources for transmission of one or more of a
3 physical broadcast channel (PBCH), a primary synchronization signal (PSS), and a secondary
4 synchronization signal (SSS), and wherein the rate-matching further comprises rate-matching
5 one or more repetitions of the downlink shared channel transmission around the second set of
6 resources.

1 11. The method of claim 10, wherein the rate-matching around the second
2 set of resources is performed for each TTI of the plurality of TTIs irrespective of whether one
3 or more of the PBCH, PSS, or SSS is scheduled in the TTI.

1 12. The method of claim 10, further comprising:

2 determining that one or more resource blocks (RBs) of the downlink shared
3 channel transmission of a second TTI is to be demodulated based at least in part on a
4 demodulation reference signal (DMRS) scheduled in the first TTI;
5 identifying that a DMRS occasion of at least a first RB collides with the
6 second set of resources in the first TTI; and
7 rate-matching the downlink shared channel transmission of the second TTI
8 around the first RB in the second TTI.

1 13. The method of claim 1, wherein first control information in the first set
2 of control channel resources indicates a number of repetitions of the downlink shared channel
3 transmission.

1 14. A method for wireless communication at a base station, comprising:
2 identifying a first set of control channel resources in a first transmission time
3 interval (TTI) of a plurality of TTIs in which repetitions of a downlink shared channel
4 transmission to a user equipment (UE) are transmitted;
5 rate-matching each repetition of the downlink shared channel transmission in
6 each of the plurality of TTIs based at least in part on the first set of control channel resources;
7 and
8 transmitting the repetitions of the downlink shared channel transmission in
9 each of the plurality of TTIs.

1 15. The method of claim 14, wherein the first set of control channel
2 resources comprises a subset of a set of resources configurable for control channel
3 transmissions, and wherein shared channel resources in each of the plurality of TTIs for the
4 downlink shared channel transmissions comprise at least a portion of the set of resources
5 configurable for control channel transmissions.

1 16. The method of claim 15, wherein the first set of control channel
2 resources are configured semi-statically or dynamically.

1 17. The method of claim 15, wherein the first set of control channel
2 resources are configured dynamically, and wherein the rate-matching comprises:
3 dynamically determining a rate-matching mode for the first set of control
4 channel resources;

5 setting a dynamic indication field in first control information to indicate the
6 rate-matching mode to the UE;
7 rate-matching the downlink shared channel transmission of the first TTI based
8 at least in part on the determined rate-matching mode; and
9 rate-matching each remaining TTI of the plurality of TTIs based at least in
10 part on the rate-matching mode for the first set of control channel resources.

1 18. The method of claim 17, wherein the dynamic indication field
2 indicates rate-matching around only the first control information or rate-matching around an
3 entire resource block (RB) set and whether such rate-matching is performed in the presence
4 or absence of control information within a TTI, and wherein the rate-matching each
5 remaining TTI is performed according to the dynamic indication field and assuming that none
6 of the remaining TTIs include control information.

1 19. The method of claim 17, further comprising:
2 providing a semi-static configuration to the UE to rate-match around an entire
3 resource block (RB) set.

1 20. The method of claim 19, wherein the semi-static configuration is
2 provided via radio resource control (RRC) signaling.

1 21. The method of claim 14, further comprising:
2 transmitting two or more instances of first control information in two or more
3 TTIs of the plurality of TTIs, wherein each of the two or more instances of first control
4 information are transmitted via same control channel resources as the first set of control
5 channel resources.

1 22. The method of claim 14, further comprising:
2 identifying a second set of resources for transmission of one or more of a
3 physical broadcast channel (PBCH), a primary synchronization signal (PSS), and a secondary
4 synchronization signal (SSS), and wherein the rate-matching further comprises rate-matching
5 one or more repetitions of the downlink shared channel transmission around the second set of
6 resources.

1 23. The method of claim 22, wherein the rate-matching around the second
2 set of resources is performed for each TTI of the plurality of TTIs irrespective of whether one
3 or more of the PBCH, PSS, or SSS is scheduled in the TTI.

1 24. A method for wireless communication at a user equipment (UE),
2 comprising:
3 receiving a plurality of repetitions of downlink control information (DCI) in a
4 plurality of transmission time intervals (TTIs);
5 decoding at least a first instance of the DCI received in at least a first TTI of
6 the plurality of TTIs; and
7 identifying uplink resources for acknowledging receipt of transmissions in all
8 of the plurality of TTIs based at least in part on the first instance of the DCI.

1 25. The method of claim 24, wherein the DCI indicates a number of
2 repetitions of downlink shared channel transmission.

1 26. The method of claim 24, wherein each repetition of the DCI includes
2 an index indicating a location of the uplink resources relative to a TTI of the plurality of TTIs
3 containing the DCI, and wherein the index of each subsequent repetition of the DCI is
4 adjusted to indicate a same location of the uplink resources.

1 27. The method of claim 24, wherein a location of the uplink resources is
2 determined based at least in part on a first decoded instance of the DCI, and wherein one or
3 more subsequent instances of the DCI are ignored.

1 28. The method of claim 24, wherein the decoding further comprises:
2 combining multiple instances of the DCI, and wherein the uplink resources are
3 further identified based at least in part on the combined DCI.

1 29. The method of claim 28, wherein the DCI includes an explicit
2 indication of the uplink resources or an implicit indication of uplink resources based on an
3 index of a starting control channel element (CCE) of the DCI.

1 30. The method of claim 29, wherein the starting CCE of the DCI is a
2 same CCE for each of the plurality of repetitions of the DCI.

1 31. The method of claim 29, wherein the starting CCE of the DCI is a
2 different CCE for at least one of the plurality of repetitions of the DCI, and wherein the
3 implicit indication of the uplink resources is based on an index of the starting CCE of a first
4 instance of the DCI.

1 32. A method for wireless communication at a base station, comprising:
2 identifying a plurality of transmission time intervals (TTIs) for transmission of
3 a plurality of repetitions of downlink control information (DCI) to a user equipment (UE);
4 formatting at least a first instance of the DCI to indicate uplink resources
5 allocated for the UE to acknowledge receipt of transmissions in all of the plurality of TTIs;
6 and
7 transmitting the plurality of repetitions of DCI to the UE in at least a subset of
8 the plurality of transmission time intervals (TTIs).

1 33. The method of claim 32, wherein the DCI indicates a number of TTIs
2 of the plurality of TTIs.

1 34. The method of claim 32, wherein each repetition of the DCI includes
2 an index indicating a location of the uplink resources relative to a TTI of the plurality of TTIs
3 containing the DCI, and wherein the index of each subsequent repetition of the DCI is
4 adjusted to indicate a same location of the uplink resources.

1 35. The method of claim 32, wherein a location of the uplink resources is
2 determined based at least in part on a first decoded instance of the DCI, and wherein one or
3 more subsequent instances of the DCI are ignored.

1 36. The method of claim 32, wherein:
2 multiple instances of the DCI are combined at the UE, and wherein the
3 multiple instances of the DCI include identical information.

1 37. The method of claim 36, wherein the DCI includes an explicit
2 indication of the uplink resources.

1 38. The method of claim 36, wherein the DCI includes an implicit
2 indication of uplink resources based on index of a starting control channel element (CCE) of
3 the DCI.

1 39. An apparatus for wireless communication at a user equipment (UE),
2 comprising:
3 means for identifying a first set of control channel resources in a first
4 transmission time interval (TTI) of a plurality of TTIs in which repetitions of a downlink
5 shared channel transmission to the UE are transmitted;
6 means for rate-matching each repetition of the downlink shared channel
7 transmission in each of the plurality of TTIs based at least in part on the first set of control
8 channel resources to identify shared channel resources in each of the plurality of TTIs; and
9 means for receiving the downlink shared channel transmission via the shared
10 channel resources in each of the plurality of TTIs.

1 40. The apparatus of claim 39, wherein the first set of control channel
2 resources comprises a subset of a set of resources configurable for control channel
3 transmissions, and wherein the shared channel resources in each of the plurality of TTIs
4 comprise at least a portion of the set of resources configurable for control channel
5 transmissions.

1 41. The apparatus of claim 39, wherein the first set of control channel
2 resources are configured dynamically in first control information, and wherein the apparatus
3 further comprises:
4 means for determining a rate-matching mode for the first set of control
5 channel resources based at least on a dynamic indication field in the first control information;
6 means for rate-matching the downlink shared channel transmission of the first
7 TTI based at least in part on the determined rate-matching mode; and
8 means for rate-matching each remaining TTI of the plurality of TTIs based at
9 least in part on the rate-matching mode for the first set of control channel resources.

1 42. The apparatus of claim 41, wherein the dynamic indication field
2 indicates rate-matching around only the first control information or rate-matching around an
3 entire resource block (RB) set and whether such rate-matching is performed in the presence

4 or absence of control information within a TTI, and wherein the rate-matching of each
5 remaining TTI is performed according to the dynamic indication field and assuming that none
6 of the remaining TTIs include control information.

1 43. The apparatus of claim 41, wherein the rate-matching each remaining
2 TTI is performed according to a semi-static configuration to rate-match around an entire
3 resource block (RB) set.

1 44. An apparatus for wireless communication at a base station, comprising:
2 means for identifying a first set of control channel resources in a first
3 transmission time interval (TTI) of a plurality of TTIs in which repetitions of a downlink
4 shared channel transmission to a user equipment (UE) are transmitted;
5 means for rate-matching each repetition of the downlink shared channel
6 transmission in each of the plurality of TTIs based at least in part on the first set of control
7 channel resources; and
8 means for transmitting the repetitions of the downlink shared channel
9 transmission in each of the plurality of TTIs.

1 45. The apparatus of claim 44, wherein the first set of control channel
2 resources are configured dynamically in first control information, and wherein the apparatus
3 further comprises:
4 means for dynamically determining a rate-matching mode for the first set of
5 control channel resources;
6 means for setting a dynamic indication field in the first control information to
7 indicate the rate-matching mode to the UE;
8 means for rate-matching the downlink shared channel transmission of the first
9 TTI based at least in part on the determined rate-matching mode; and
10 means for rate-matching each remaining TTI of the plurality of TTIs based at
11 least in part on the rate-matching mode for the first set of control channel resources.

1 46. The apparatus of claim 45, wherein the dynamic indication field
2 indicates rate-matching around only the first control information or rate-matching around an
3 entire resource block (RB) set and whether such rate-matching is performed in the presence
4 or absence of control information within a TTI, and wherein the rate-matching each

5 remaining TTI is performed according to the dynamic indication field and assuming that none
6 of the remaining TTIs include control information.

1 47. The apparatus of claim 45, further comprising:
2 means for providing a semi-static configuration to the UE to rate-match
3 around an entire resource block (RB) set or to not perform rate-matching in each remaining
4 TTI after the first TTI.

1 48. An apparatus for wireless communication at a user equipment (UE),
2 comprising:
3 means for receiving a plurality of repetitions of downlink control information
4 (DCI) in a plurality of transmission time intervals (TTIs);
5 means for decoding at least a first instance of the DCI received in at least a
6 first TTI of the plurality of TTIs; and
7 means for identifying uplink resources for acknowledging receipt of
8 transmissions in all of the plurality of TTIs based at least in part on the first instance of the
9 DCI.

1 49. An apparatus for wireless communication at a base station, comprising:
2 means for identifying a plurality of transmission time intervals (TTIs) for
3 transmission of a plurality of repetitions of downlink control information (DCI) to a user
4 equipment (UE);
5 means for formatting at least a first instance of the DCI to indicate uplink
6 resources allocated for the UE to acknowledge receipt of transmissions in all of the plurality
7 of TTIs; and
8 means for transmitting the plurality of repetitions of DCI to the UE in at least
9 a subset of the plurality of transmission time intervals (TTIs).