CLAIMS

1. A method for wireless communication performed by a user equipment (UE), comprising:

receiving a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user- specific search spaces;

receiving a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

determining, based on the cross-carrier configuration, whether control information for the UE is present in a control information format carried on a second component carrier by decoding the plurality of search spaces according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

2. The method of claim **1**, wherein the first component carrier and the second component carrier are different component carriers.

3. The method of claim **1**, wherein the control information format is configured to control downlink grants.

4. The method of claim **3**, wherein the second set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 1, 1A, 1B, 1C, 1D, 2, 2A and 2B transmitted via a physical downlink control channel (PDCCH).

5. The method of claim **1**, wherein the control information format is configured to control uplink grants.

6. The method of claim **5**, wherein the first set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 0 and 1A transmitted via a physical downlink control channel (PDCCH).

7. The method of claim **1**, wherein each DCI format in the first set of control information formats comprises a DCI format without a carrier indicator.

8. The method of claim **1**, wherein the carrier indicator is located in control information formats in each of the plurality of user-specific search spaces.

9. The method of claim **1**, wherein the carrier indicator is used for unicast traffic and not used for broadcast traffic.

10. The method of claim **1**, wherein the carrier indicator comprises a carrier indicator field (CIF) consisting of three bits.

11. The method of claim **10**, wherein the CIF is located at a beginning of the control information.

12. The method of claim **10**, wherein the CIF is user specific and comprises a distinct value for each component carrier.

13. The method of claim **10**, wherein the CIF is component carrier specific and values of the CIF for two or more component carriers comprise a same value if the control information for the two or more component carriers are located on different component carriers.

14. The method of claim **1**, wherein the first set of control information formats includes DCI formats of two different sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein cross-carrier control is enabled for unicast traffic and cross-carrier control is not enabled for broadcast traffic via carrier indicators.

15. The method of claim **1**, wherein the first set of control information formats includes a second DCI format with a carrier indicator.

16. The method of claim **1**, wherein the first set of control information formats includes the first DCI format with a carrier indicator.

17. The method of claim **1**, wherein each control information format of the second set of control information formats comprises a DCI format with a carrier indicator.

18. The method of claim **1**, wherein the first set of control information formats includes DCI formats of three sizes, comprising DCI formats of two sizes with carrier indicators and a DCI format of a third size without a carrier indicator, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

19. The method of claim **1**, wherein the first set of control information formats includes DCI formats of four sizes, comprising DCI format of a first two sizes with carrier indicators and DCI formats of a second two sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with

carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

20. An apparatus for wireless communication, comprising:

means for receiving a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user- specific search spaces;

means for receiving a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

means for determining, based on the cross-carrier configuration, whether control information for the apparatus is present in a control information format carried on a second component carrier by decoding the plurality of search spaces according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

21. An apparatus for wireless communication by a user equipment (UE), comprising:

a processor; and

a memory comprising processor executable code that, when executed by the processor, configures the apparatus to:

receive a plurality of component carriers configured for a wireless communication device, the plurality of

component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces;

receive a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

determine, based on the cross-carrier configuration, whether control information for the UE is present in a control information format carried on a second component carrier by decoding the plurality of search spaces according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

22. The apparatus of claim **21**, wherein the first component carrier and the second component carrier are different component carriers.

23. The apparatus of claim **21**, wherein the control information format is configured to control downlink grants.

24. The apparatus of claim **21**, wherein the second set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 1,1A, 1B, 1C, 1D, 2, 2A and 2B transmitted via a physical downlink control channel (PDCCH).

25. The apparatus of claim **21**, wherein the control information format is configured to control uplink grants.

26. The apparatus of claim **21**, wherein the first set of control information formats comprises at least LTE Rel-8 and

Rel-9 DCI formats 0 and 1A transmitted via a physical downlink control channel (PDCCH).

27. The apparatus of claim **21**, wherein each DCI format in the first set of control information formats comprises a DCI format without a carrier indicator.

28. The apparatus of claim **21**, wherein the carrier indicator is located in control information formats in each of the plurality of user-specific search spaces.

29. The apparatus of claim **21**, wherein the carrier indicator is used for unicast traffic and not used for broadcast traffic.

30. The apparatus of claim **21**, wherein the carrier indicator comprises a carrier indicator field (CIF) consisting of three bits.

31. The apparatus of claim **30**, wherein the CIF is located at a beginning of the control information.

32. The apparatus of claim **30**, wherein the CIF is user specific and comprises a distinct value for each component carrier.

33. The apparatus of claim **30**, wherein the CIF is component carrier specific and values of the CIF for two or more component carriers comprise a same value if the control information for the two or more component carriers are located on different component carriers.

34. The apparatus of claim **21**, wherein the first set of control information formats includes DCI formats of two different sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein cross-carrier control is enabled for unicast traffic and cross- carrier control is not enabled for broadcast traffic via carrier indicators.

35. The apparatus of claim **21**, wherein the first set of control information formats includes a second DCI format with a carrier indicator.

36. The apparatus of claim **21**, wherein the first set of control information formats includes the first DCI format with a carrier indicator.

37. The apparatus of claim **21**, wherein each control information format of the second set of control information formats comprises a DCI format with a carrier indicator.

38. The apparatus of claim **21**, wherein the first set of control information formats includes DCI formats of three sizes, comprising DCI formats of two sizes with carrier indicators and a DCI format of a third size without a carrier indicator, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

39. The apparatus of claim **21**, wherein the first set of control information formats includes DCI formats of four sizes, comprising DCI format of a first two sizes with carrier indicators and DCI formats of a second two sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

40. A computer program product for wireless communication by a user equipment (UE), embodied on a non-transitory computer readable storage medium, comprising:

program code for receiving a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces;

program code for receiving a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of a plurality of component carriers; and

program code for determining , based on the cross-carrier configuration, whether control information for the UE is present in a control information format carried on a second component carrier by decoding the plurality of search spaces according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

41. A wireless communication method, comprising:

transmitting a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces; and

transmitting, to a user equipment (UE), a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

transmitting control information for the UE in a control information format carried on a second component carrier, the control information encoded according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control

information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

42. The method of claim **41**, wherein the first component carrier and the second component carrier are different component carriers.

43. The method of claim **41**, wherein the control information format is configured to control downlink grants.

44. The method of claim **43**, wherein the second set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 1, 1A, 1B, 1C, 1D, 2, 2A and 2B transmitted via a physical downlink control channel (PDCCH).

45. The method of claim **41**, wherein the control information format is configured to control uplink grants.

46. The method of claim **45**, wherein the first set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 0 and 1A transmitted via a physical downlink control channel (PDCCH).

47. The method of claim **41**, wherein each DCI format in the first set of control information formats comprises a DCI format without a carrier indicator.

48. The method of claim **41**, wherein the carrier indicator is located in control information formats in each of the plurality of user-specific search spaces.

49. The method of claim **41**, wherein the carrier indicator is used for unicast traffic and not used for broadcast traffic.

50. The method of claim **41**, wherein the carrier indicator comprises a carrier indicator field (CIF) consisting of three bits.

51. The method of claim **50**, wherein the CIF is located at a beginning of the control information.

52. The method of claim **50**, wherein the CIF is user specific and comprises a distinct value for each component carrier.

53. The method of claim **50**, wherein the CIF is component carrier specific and values of the CIF for two or more component carriers comprise a same value if the control information for the two or more component carriers are located on different component carriers.

54. The method of claim **41**, wherein the first set of control information formats includes DCI formats of two different sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein cross-carrier control is enabled for unicast traffic and cross-carrier control is not enabled for broadcast traffic via carrier indicators.

55. The method of claim **41**, wherein the first set of control information formats includes a second DCI format with a carrier indicator.

56. The method of claim **41**, wherein the first set of control information formats includes the first DCI format with a carrier indicator.

57. The method of claim **41**, wherein each control information format of the second set of control information formats comprises a DCI format with a carrier indicator.

58. The method of claim **41**, wherein the first set of control information formats includes DCI formats of three sizes, comprising DCI formats of two sizes with carrier indicators and a DCI format of a third size without a carrier indicator, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

59. The method of claim **41**, wherein the first set of control information formats includes DCI formats of four sizes, com-

prising DCI format of a first two sizes with carrier indicators and DCI formats of a second two sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

60. An apparatus for wireless communication, comprising:

means for transmitting a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces;

means for transmitting, to a user equipment (UE), a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

transmitting control information for the UE in a control information format carried on a second component carrier, the control information encoded according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

61. An apparatus for wireless communication, comprising:

a processor; and

a memory comprising processor executable code that, when executed by the processor, configures the apparatus to:

transmit a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces;

transmit, to a user equipment (UE), a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

transmit control information for the UE in a control information format carried on a second component carrier, the control information encoded according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.

62. The apparatus of claim **61**, wherein the first component carrier and the second component carrier are different component carriers.

63. The apparatus of claim **61**, wherein the control information format is configured to control downlink grants.

64. The apparatus of claim **61**, wherein the second set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 1, 1A, 1B, 1C, 1D, 2, 2A and 2B transmitted via a physical downlink control channel (PDCCH).

65. The apparatus of claim **61**, wherein the control information format is configured to control uplink grants.

66. The apparatus of claim **61**, wherein the first set of control information formats comprises at least LTE Rel-8 and Rel-9 DCI formats 0 and 1A transmitted via a physical downlink control channel (PDCCH).

67. The apparatus of claim **61**, wherein each DCI format in the first set of control information formats comprises a DCI format without a carrier indicator.

68. The apparatus of claim **61**, wherein the carrier indicator is located in control information formats in each of the plurality of user-specific search spaces.

69. The apparatus of claim **61**, wherein the carrier indicator is used for unicast traffic and not used for broadcast traffic.

70. The apparatus of claim **61**, wherein the carrier indicator comprises a carrier indicator field (CIF) consisting of three bits.

71. The apparatus of claim **70**, wherein the CIF is located at a beginning of the control information.

72. The apparatus of claim **70**, wherein the CIF is user specific and comprises a distinct value for each component carrier.

73. The apparatus of claim **70**, wherein the CIF is component carrier specific and values of the CIF for two or more component carriers comprise a same value if the control information for the two or more component carriers are located on different component carrier.

74. The apparatus of claim **61**, wherein the first set of control information formats includes DCI formats of two different sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein cross-carrier control is enabled for unicast traffic and cross-carrier control is not enabled for broadcast traffic via carrier indicators.

75. The apparatus of claim **61**, wherein the first set of control information formats includes a second DCI format with a carrier indicator.

76. The apparatus of claim **61**, wherein the first set of control information formats includes the first DCI format with a carrier indicator.

77. The apparatus of claim **61**, wherein each control information format of the second set of control information formats comprises a DCI format with a carrier indicator.

78. The apparatus of claim **61**, wherein the first set of control information formats includes DCI formats of three sizes, comprising DCI formats of two sizes with carrier indicators and a DCI format of a third size without a carrier indicator, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

79. The apparatus of claim **61**, wherein the first set of control information formats includes DCI formats of four sizes, comprising DCI format of a first two sizes with carrier indicators and DCI formats of a second two sizes without carrier indicators, and the second set of control information formats includes DCI formats of at least two different sizes with carrier indicators, wherein the method is backward compatible with LTE Rel-8 broadcast traffic and unicast traffic.

80. A computer program product for wireless communication, embodied on a non-transitory computer readable storage medium, comprising:

program code for transmitting a plurality of component carriers configured for a wireless communication device, the plurality of component carriers comprising a plurality of search spaces comprising one or more common search spaces and a plurality of user-specific search spaces; and

program code for transmitting, to a user equipment (UE), a cross-carrier configuration comprising an indicator of cross-carrier operation for a first component carrier of the plurality of component carriers; and

program code for transmitting control information for the UE in a control information format carried on a second component carrier, the control information encoded according to a first set of control information formats associated with the one or more common search spaces and a second set of control information formats associated with the plurality of user-specific search spaces, the first set of control information formats including at least a first downlink control information (DCI) format without a carrier indicator and the second set of control information formats including at least the first DCI format with a carrier indicator.