

CLAIMS

What is claimed is:

1. A method for allocating uplink transmission power of a wireless transmit/receive unit (WTRU) during a time interval, the method comprising:

configuring the WTRU with a first minimum guaranteed power for first uplink transmissions from the WTRU using uplink resources of at least one cell of a first cell group (CG);

configuring the WTRU with a second minimum guaranteed power for second uplink transmissions from the WTRU using uplink resources of at least one cell of a second CG;

wherein the first minimum guaranteed power and the second minimum guaranteed power are each a ratio of a total power (P_{max}) available to the WTRU for uplink transmissions during the time interval; and

wherein a remaining power equals P_{max} minus the total of the first minimum guaranteed power and the second minimum guaranteed power;

reserving up to the first minimum guaranteed power for the first uplink transmissions;

reserving up to the second minimum guaranteed power for the second uplink transmissions;

making the remaining power available for the first uplink transmissions on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG; and

making the remaining power available for the second uplink transmissions on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG.

2. The method of claim 1, further comprising:

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allocating, by the WTRU, up to the first minimum guaranteed power for the first uplink transmissions;

allocating, by the WTRU, up to the second minimum guaranteed power for the second uplink transmissions; and

allocating, by the WTRU, the remaining power for the first uplink transmissions, for the second uplink transmissions, or for both the first uplink transmissions and the second uplink transmissions.

3. The method of claim 2, wherein the remaining power is allocated on a per-transmission basis.

4. The method of claim 3, wherein each of the first uplink transmissions and second uplink transmissions has an associated priority and the remaining power is allocated to the first uplink transmissions and second uplink transmissions according to a priority order of the first uplink transmissions and second uplink transmissions.

5. The method of claim 4, wherein the priority is based on an uplink control information (UCI) type.

6. (Cancelled)

7. The method of claim 1, further comprising:

reserving up to the first minimum guaranteed power for the first uplink transmissions;

reserving up to the second minimum guaranteed power for the second uplink transmissions; and

on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG,

making the remaining power available for the first uplink transmissions,

allocating the remaining power to the first uplink transmissions up to the total power required for the first uplink transmissions, and

making a remainder of the remaining power, which was not allocated to the first uplink transmissions, available for the second uplink transmissions; and

on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG,

making the remaining power available for the second uplink transmissions,

allocating the remaining power to the second uplink transmissions up to the total power required for the second uplink transmissions, and

making a remainder of the remaining power, which was not allocated to the second uplink transmissions, available for the first uplink transmissions.

8. The method of claim 1, further comprising

on a condition that a subframe of the first CG asynchronously overlaps in time a subframe of the second CG and the subframe of the first CG leads in time the subframe of the second CG:

calculating a first power range based on the subframe of the first CG and the subframe of the second CG;

calculating a second power range based on the subframe of the first CG and a preceding subframe of the second CG which overlaps in time the subframe of the first CG;

determining a minimum value for P_{max} as a lesser of a lowest value of the first power range and a lowest value of the second power range; and

determining a maximum value for P_{max} as a greater of a highest value of the first power range and a highest value of the second power range.

9. The method of claim 4, further comprising

on a condition that one of the first uplink transmissions and one of the second uplink transmissions have a same priority order, determining whether the first CG or the second CG comprises a master CG (MCG);

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on a condition that the first CG comprises an MCG, prioritizing the one of the first uplink transmissions for allocation of the remaining power; and

on a condition that the second CG comprises an MCG, prioritizing the one of the second uplink transmissions for allocation of the remaining power.

10. The method of claim 1, further comprising calculating, by the WTRU, a required power for each of the first uplink transmissions and second uplink transmissions prior to allocating power for the first uplink transmissions and second uplink transmissions.

11. The method of claim 10, further comprising allocating, by the WTRU, a portion of the remaining power to each of the first uplink transmissions and second uplink transmissions in a decreasing priority order.

12. The method of claim 1, further comprising, on a condition that the WTRU is power limited, configuring the WTRU with a first power control mode (PCM1) or a second power control mode (PCM2) based on a capability of the WTRU; and allocating power for the first uplink transmissions and second uplink transmissions according to PCM1 on a condition that PCM1 is configured, and according to PCM2 on a condition that PCM2 is configured.

13. The method of claim 1, wherein the first CG comprises a master cell group (MCG) and wherein the second CG comprises a secondary cell group (SCG).

14. A transmit/receive unit (WTRU) configured for allocating uplink transmission power of a wireless during a time interval, the WTRU comprising:
circuitry adapted to configure the WTRU with a first minimum guaranteed power for first uplink transmissions from the WTRU using uplink resources of at least one cell of a first cell group (CG); and

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circuitry adapted to configure the WTRU with a second minimum guaranteed power for second uplink transmissions from the WTRU using uplink resources of at least one cell of a second CG;

wherein the first minimum guaranteed power and the second minimum guaranteed power are each a ratio of a total power (P_{max}) available to the WTRU for uplink transmissions during the time interval; and

wherein a remaining power equals P_{max} minus the total of the first minimum guaranteed power and the second minimum guaranteed power;

circuitry configured to reserve up to the first minimum guaranteed power for the first uplink transmissions;

circuitry configured to reserve up to the second minimum guaranteed power for the second uplink transmissions;

circuitry configured to make the remaining power available for the first uplink transmissions on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG; and

circuitry configured to make the remaining power available for the second uplink transmissions on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG.

15. The WTRU of claim 14, further comprising:

circuitry configured to allocate, by the WTRU, up to the first minimum guaranteed power for the first uplink transmissions;

circuitry configured to allocate, by the WTRU, up to the second minimum guaranteed power for the second uplink transmissions; and

circuitry configured to allocate, by the WTRU, the remaining power for the first uplink transmissions, for the second uplink transmissions, or for both the first uplink transmissions and the second uplink transmissions.

16. The WTRU of claim 15, wherein the remaining power is allocated on a per-transmission basis.

17. The WTRU of claim 16, wherein each of the first uplink transmissions and second uplink transmissions has an associated priority and the remaining power is allocated to the first uplink transmissions and second uplink transmissions according to a priority order of the first uplink transmissions and second uplink transmissions.

18. The WTRU of claim 17, wherein the priority is based on an uplink control information (UCI) type.

19. (Cancelled)

20. The WTRU of claim 14, further comprising:

circuitry configured to reserve up to the first minimum guaranteed power for the first uplink transmissions;

circuitry configured to reserve up to the second minimum guaranteed power for the second uplink transmissions; and

circuitry configured to, on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG,

make the remaining power available for the first uplink transmissions,

allocate the remaining power to the first uplink transmissions up to the total power required for the first uplink transmissions, and

make a remainder of the remaining power, which was not allocated to the first uplink transmissions, available for the second uplink transmissions; and

circuitry configured to, on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG,

make the remaining power available for the second uplink transmissions,

allocate the remaining power to the second uplink transmissions up to the total power required for the second uplink transmissions, and

make a remainder of the remaining power, which was not allocated to the second uplink transmissions, available for the first uplink transmissions.

21. The WTRU of claim 14, further comprising:

circuitry configured to, on a condition that a subframe of the first CG asynchronously overlaps in time a subframe of the second CG and the subframe of the first CG leads in time the subframe of the second CG:

calculate a first power range based on the subframe of the first CG and the subframe of the second CG;

calculate a second power range based on the subframe of the first CG and a preceding subframe of the second CG which overlaps in time the subframe of the first CG;

determine a minimum value for P_{cmx} as a lesser of a lowest value of the first power range and a lowest value of the second power range; and

determine a maximum value for P_{cmx} as a greater of a highest value of the first power range and a highest value of the second power range.

22. The WTRU of claim 14, further comprising:

circuitry configured to, on a condition that one of the first uplink transmissions and one of the second uplink transmissions have a same priority order, determine whether the first CG or the second CG comprises a master CG (MCG);

circuitry configured to, on a condition that the first CG comprises an MCG, prioritize the one of the first uplink transmissions for allocation of the remaining power; and

circuitry configured to, on a condition that the second CG comprises an MCG, prioritize the one of the second uplink transmissions for allocation of the remaining power.

23. The WTRU of claim 14, further comprising circuitry configured to calculate a required power for each of the first uplink transmissions and second

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uplink transmissions prior to allocating power for the first uplink transmissions and second uplink transmissions.

24. The WTRU of claim 23, further comprising circuitry configured to allocate a portion of the remaining power to each of the first uplink transmissions and second uplink transmissions in a decreasing priority order.

25. The WTRU of claim 14, further comprising, circuitry configured to, on a condition that the WTRU is power limited, configure the WTRU with a first power control mode (PCM1) or a second power control mode (PCM2) based on a capability of the WTRU; and circuitry configured to allocate power for the first uplink transmissions and second uplink transmissions according to PCM1 on a condition that PCM1 is configured, and according to PCM2 on a condition that PCM2 is configured.

26. The WTRU of claim 14, wherein the first CG comprises a master cell group (MCG) and wherein the second CG comprises a secondary cell group (SCG).

27. A method for reporting power headroom information from a wireless transmit/receive unit (WTRU) which is in communication with a first cell group (CG1) and in communication with a second cell group (CG2), each of CG1 and CG2 including at least one cell, the method comprising:

determining, by the WTRU, whether a trigger condition exists; and

on a condition that the trigger condition exists, transmitting the power headroom information;

wherein the trigger condition comprises a scheduling condition and/or power allocation condition.

28. The method of claim 27, wherein the power headroom information is transmitted as a power headroom report (PHR).

29. The method of claim 27 wherein the trigger condition comprises a power limitation for uplink transmissions from the WTRU using uplink resources of CG1, on a condition that the power limitation is induced by a scheduling of uplink transmissions from the WTRU using uplink resources of CG2.

30. The method of claim 27, wherein the trigger condition comprises a change in a relative power allocation priority between CG1 and CG2.

31. The method of claim 27, wherein the trigger condition comprises a change in a level of scaling applied to uplink transmissions from the WTRU using uplink resources of CG1 or CG2.

32. The method of claim 27, wherein the trigger condition comprises a quality of service (QoS) metric for uplink transmissions from the WTRU using uplink resources of CG1 falling below a threshold.

33. The method of claim 27, wherein the trigger condition comprises an increase in a required power for uplink transmissions from the WTRU using uplink resources of CG1 or CG2.

34. A wireless transmit/receive unit (WTRU) configured for reporting power headroom information when in communication with a first cell group (CG1) and in communication with a second cell group (CG2), each of CG1 and CG2 including at least one cell, the WTRU comprising:

circuitry configured to determine whether a trigger condition exists; and
circuitry configured to, on a condition that the trigger condition exists, transmit the power headroom information;

wherein the trigger condition comprises a scheduling condition and/or power allocation condition.

35. The WTRU of claim 34, wherein the power headroom information is transmitted as a power headroom report (PHR).

36. The WTRU of claim 34, wherein the trigger condition comprises a power limitation for uplink transmissions from the WTRU using uplink resources of CG1, on a condition that the power limitation is induced by a scheduling of uplink transmissions from the WTRU using uplink resources of CG2.

37. The WTRU of claim 34, wherein the trigger condition comprises a change in a relative power allocation priority between CG1 and CG2.

38. The WTRU of claim 34, wherein the trigger condition comprises a change in a level of scaling applied to uplink transmissions from the WTRU using uplink resources of CG1 or CG2.

39. The WTRU of claim 34, wherein the trigger condition comprises a quality of service QoS metric for uplink transmissions from the WTRU using uplink resources of CG1 falling below a threshold.

40. The WTRU of claim 34, wherein the trigger condition comprises an increase in a required power for uplink transmissions from the WTRU using uplink resources of CG1 or CG2.

41. A method for reporting information regarding data available in a buffer of a wireless transmit/receive unit (WTRU) which is in communication with a first cell group (CG1) served by a first eNodeB (eNB1), and in communication with a second cell group (CG2) served by a second eNodeB (eNB2), each of CG1 and CG2 including at least one cell, the method comprising:
determining, by the WTRU, whether a trigger condition exists; and
on a condition that the trigger condition exists, reporting the information;
wherein the information comprises an amount of data available in the

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buffer; and

wherein the trigger condition comprises a determination by the WTRU that new data is available for a split data radio bearer (DRB) and should be sent to one of eNB1 or eNB2.

42. The method of claim 41, wherein the reporting comprises transmitting a buffer status report (BSR).

43. The method of claim 41, wherein the trigger condition comprises a logical channel priority (LCP).

44. The method of claim 41, wherein the trigger condition comprises a quality of service (QoS).

45. The method of claim 41, wherein the trigger condition comprises an emptying rate of the buffer.

46. The method of claim 41, wherein the reporting comprises transmitting a medium access control (MAC) protocol data unit (PDU).

47. The method of claim 46, wherein the MAC PDU comprises at least one happy bit.

48. The method of claim 41, wherein the reporting comprises an indication that an amount of data in the buffer is increasing or decreasing.

49. The method of claim 41, wherein the reporting comprises a depletion rate of the buffer.

50. The method of claim 41, wherein the reporting comprises a fill rate of the buffer.

51. The method of claim 41, wherein the reporting comprises a head-of-queue delay of the buffer.

52. The method of claim 41, wherein the reporting comprises an average time-of-stay of data in the buffer.

53. The method of claim 41, wherein the reporting comprises an indication based on logical channel prioritization (LCP) or quality of service (QoS).

54. The method of claim 41, wherein the reporting comprises an indication of whether data in the buffer should be transmitted using uplink resources of CG1 or should be transmitted using uplink resources of CG2.

55. The method of claim 41, wherein the trigger condition comprises a determination by the WTRU that data in the buffer should be transmitted using uplink resources of CG1.

56. The method of claim 47, wherein the at least one happy bit comprises an indication relating to packet data convergence protocol (PDCP) data.

57. A wireless transmit/receive unit (WTRU) configured for reporting information regarding data available in a buffer when in communication with a first cell group (CG1) served by a first eNodeB (eNB1), and in communication with a second cell group (CG2) served by a second eNodeB (eNB2), each of CG1 and CG2 including at least one cell, the WTRU comprising:

circuitry configured to determine whether new data is available for a split data radio bearer (DRB) and should be sent to one of eNB1 or eNB2;

circuitry configured to determine whether a trigger condition exists; and

circuitry configured to, on a trigger condition, report the information;

wherein the information comprises an amount of data available in the

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buffer; and

wherein the trigger condition comprises a determination by the WTRU that new data is available for a split data radio bearer (DRB) and should be sent to one of eNB1 or eNB2.

58. The WTRU of claim 57, wherein the reporting comprises transmitting a buffer status report (BSR).

59. The WTRU of claim 57, wherein the trigger condition comprises a logical channel priority (LCP).

60. The WTRU of claim 57, wherein the trigger condition comprises a quality of service (QoS).

61. The WTRU of claim 57, wherein the trigger condition comprises an emptying rate of the buffer.

62. The WTRU of claim 57, wherein the reporting comprises transmitting a medium access control (MAC) protocol data unit (PDU).

63. The WTRU of claim 62, wherein the MAC PDU comprises at least one happy bit.

64. The WTRU of claim 57, wherein the reporting comprises an indication that an amount of data in the buffer is increasing or decreasing.

65. The WTRU of claim 57, wherein the reporting comprises a depletion rate of the buffer.

66. The WTRU of claim 57, wherein the reporting comprises a fill rate of the buffer.

67. The WTRU of claim 57, wherein the reporting comprises a head-of-queue delay of the buffer.

68. The WTRU of claim 57, wherein the reporting comprises an average time-of-stay of data in the buffer.

69. The WTRU of claim 57, wherein the reporting comprises an indication based on logical channel prioritization (LCP) or quality of service (QoS).

70. The WTRU of claim 57, wherein the reporting comprises an indication of whether data in the buffer should be transmitted using uplink resources of CG1 or should be transmitted using uplink resources of CG2.

71. The WTRU of claim 57, wherein the trigger condition comprises a determination by the WTRU that data in the buffer should be transmitted using uplink resources of CG1.

72. The WTRU of claim 63, wherein the at least one happy bit comprises an indication relating to packet data convergence protocol (PDCP) data.

73. A method for managing uplink transmissions from a wireless transmit/receive unit (WTRU), the method comprising:

receiving, by the WTRU, a grant from an eNodeB (eNB) for at least one uplink transmission;

determining, by the WTRU, whether an alternative grant should be applied in place of the grant; and,

on a condition that the WTRU determines that the alternative grant should be applied in place of the grant, autonomously applying, by the WTRU, the alternative grant in place of the grant.

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74. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied on a condition that a power required for the at least one uplink transmission exceeds an amount of power available to the WTRU for transmitting the at least one uplink transmission.

75. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied on a condition that the WTRU scales a power allocated for the at least one uplink transmission.

76. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied on a condition that an amount of resources allocated by the grant for uplink exceeds an amount of data of the at least one uplink transmission.

77. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied on a condition that an amount of resources allocated by the grant for uplink exceeds an amount of data of the at least one uplink transmission by a threshold amount.

78. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied on a condition that the WTRU has access to contention-based uplink resources for the at least one uplink transmission.

79. The method of claim 73, the WTRU determines that the alternative grant should be applied on a condition that the WTRU has access to uplink resources through a second WTRU for the at least one uplink transmissions.

80. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied based upon a type of a received downlink control information (DCI), a format of a received DCI, or a number of received DCIs.

81. The method of claim 73, wherein the WTRU determines that the alternative grant should be applied based upon whether the at least one uplink transmission includes a hybrid automatic repeat request (HARQ) retransmission.

82. The method of claim 73, further comprising determining, by the WTRU, parameters of the alternative grant based upon at least one of a characteristic of the grant, a content of a received downlink control information (DCI), or a configured parameter.

83. The method of claim 73, further comprising selecting, by the WTRU, the alternative grant from a group of alternative grants based upon at least one of a characteristic of the grant, a content of a received downlink control information (DCI), or a configured parameter.

84. A wireless transmit/receive unit (WTRU) comprising:
circuitry configured to receive a grant from an eNodeB (eNB) for at least one uplink transmission;
circuitry configured to determine whether an alternative grant should be applied in place of the grant; and
circuitry configured to, on a condition that the WTRU determines that the alternative grant should be applied in place of the grant, autonomously apply the alternative grant in place of the grant.

85. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that a power required for the at least one uplink transmission exceeds an amount of power available to the WTRU for transmitting the at least one uplink transmission.

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86. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that the WTRU scales a power allocated for the at least one uplink transmission.

87. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that an amount of resources allocated by the grant for uplink exceeds an amount of data of the at least one uplink transmission.

88. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that an amount of resources allocated by the grant for uplink exceeds an amount of data of the at least one uplink transmission by a threshold amount.

89. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that the WTRU has access to contention-based uplink resources for the at least one uplink transmission.

90. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied on a condition that the WTRU has access to uplink resources through a second WTRU for the at least one uplink transmissions.

91. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied based upon a type of a received downlink control information (DCI), a format of a received DCI, or a number of received DCIs.

92. The WTRU of claim 84, further comprising circuitry configured to determine that the alternative grant should be applied based upon whether the at least one uplink transmission includes a hybrid automatic repeat request (HARQ) retransmission.

93. The WTRU of claim 84, further comprising circuitry configured to determine parameters of the alternative grant based upon at least one of a characteristic of the grant, a content of a received downlink control information (DCI), or a configured parameter.

94. The WTRU of claim 84, further comprising circuitry configured to select the alternative grant from a group of alternative grants based upon at least one of a characteristic of the grant, a content of a received downlink control information (DCI), or a configured parameter.

CLAIMS

What is claimed is:

1. A method for allocating uplink transmission power of a wireless transmit/receive unit (WTRU) during a time interval, the method comprising:

configuring the WTRU with a first minimum guaranteed power for first uplink transmissions that use uplink resources of at least one cell of a first cell group (CG);

configuring the WTRU with a second minimum guaranteed power for second uplink transmissions that use uplink resources of at least one cell of a second CG;

wherein the first minimum guaranteed power and the second minimum guaranteed power are each a ratio of a total power (P_{cmx}) available to the WTRU for uplink transmissions during the time interval; and

on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG, allocating the second minimum guaranteed power for the second uplink transmissions, and allocating the first minimum guaranteed power plus any difference between P_{cmx} and a sum of the first minimum guaranteed power and the second minimum guaranteed power for the first uplink transmissions; and

on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG, allocating the first minimum guaranteed power for the first uplink transmissions, and allocating the second minimum guaranteed power plus any difference between P_{cmx} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

2. The method of claim 1, further comprising:
allocating, by the WTRU, up to the first minimum guaranteed power for the first uplink transmissions;
allocating, by the WTRU, up to the second minimum guaranteed power for the second uplink transmissions; and
allocating, by the WTRU, a remaining power for the first uplink transmissions, for the second uplink transmissions, or for both the first uplink transmissions and the second uplink transmissions, wherein the remaining power comprises any difference between P_{cmx} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

3. The method of claim 2, wherein the remaining power is allocated on a per-transmission basis.

4. The method of claim 3, wherein each of the first uplink transmissions and second uplink transmissions has an associated priority and the remaining power is allocated to the first uplink transmissions and second uplink transmissions according to a priority order of the first uplink transmissions and second uplink transmissions.

5. The method of claim 4, wherein the priority is based on an uplink control information (UCI) type.

6. The method of claim 1, further comprising:
reserving up to the first minimum guaranteed power for the first uplink transmissions;
reserving up to the second minimum guaranteed power for the second uplink transmissions; and
on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG,

making a remaining power available for the first uplink transmissions,
allocating the remaining power to the first uplink transmissions up to
the total power required for the first uplink transmissions, and

making a remainder of the remaining power, which was not allocated to
the first uplink transmissions, available for the second uplink transmissions;
and

on a condition that, during the time interval, the earliest transmission
is scheduled to occur using the uplink resources of the at least one cell of the
second CG,

making the remaining power available for the second uplink
transmissions,

allocating the remaining power to the second uplink transmissions up
to the total power required for the second uplink transmissions, and

making a remainder of the remaining power, which was not allocated to
the second uplink transmissions, available for the first uplink transmissions;

wherein the remaining power comprises any difference between P_{cmax}
and the sum of the first minimum guaranteed power and the second minimum
guaranteed power for the second uplink transmissions.

7. The method of claim 1, further comprising

on a condition that a subframe of the first CG asynchronously overlaps
in time a subframe of the second CG and the subframe of the first CG leads in
time the subframe of the second CG:

calculating a first power range based on the subframe of the first CG
and the subframe of the second CG;

calculating a second power range based on the subframe of the first CG
and a preceding subframe of the second CG which overlaps in time the
subframe of the first CG;

determining a minimum value for P_{cmax} as a lesser of a lowest value of
the first power range and a lowest value of the second power range; and

determining a maximum value for P_{cmax} as a greater of a highest
value of the first power range and a highest value of the second power range.

8. The method of claim 4, further comprising
on a condition that one of the first uplink transmissions and one of the second uplink transmissions have a same priority order, determining whether the first CG or the second CG comprises a master CG (MCG);
on a condition that the first CG comprises an MCG, prioritizing the one of the first uplink transmissions for allocation of the remaining power; and
on a condition that the second CG comprises an MCG, prioritizing the one of the second uplink transmissions for allocation of the remaining power.

9. The method of claim 1, further comprising calculating, by the WTRU, a required power for each of the first uplink transmissions and second uplink transmissions prior to allocating power for the first uplink transmissions and second uplink transmissions.

10. The method of claim 9, further comprising allocating, by the WTRU, a portion of a remaining power to each of the first uplink transmissions and second uplink transmissions in a decreasing priority order; wherein the remaining power comprises any difference between P_{max} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

11. A transmit/receive unit (WTRU) configured for allocating uplink transmission power of a wireless during a time interval, the WTRU comprising:

circuitry adapted to configure the WTRU with a first minimum guaranteed power for first uplink transmissions that use uplink resources of at least one cell of a first cell group (CG); and

circuitry adapted to configure the WTRU with a second minimum guaranteed power for second uplink transmissions that use uplink resources of at least one cell of a second CG;

wherein the first minimum guaranteed power and the second minimum guaranteed power are each a ratio of a total power (P_{cmax}) available to the WTRU for uplink transmissions during the time interval; and

on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG, allocating the second minimum guaranteed power for the second uplink transmissions, and allocating the first minimum guaranteed power plus any difference between P_{cmax} and a sum of the first minimum guaranteed power and the second minimum guaranteed power for the first uplink transmissions; and

on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG, allocating the first minimum guaranteed power for the first uplink transmissions, and allocating the second minimum guaranteed power plus any difference between P_{cmax} and a sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

12. The WTRU of claim 11, further comprising:

circuitry configured to allocate, by the WTRU, up to the first minimum guaranteed power for the first uplink transmissions;

circuitry configured to allocate, by the WTRU, up to the second minimum guaranteed power for the second uplink transmissions; and

circuitry configured to allocate, by the WTRU, a remaining power for the first uplink transmissions, for the second uplink transmissions, or for both the first uplink transmissions and the second uplink transmissions, wherein the remaining power comprises any difference between P_{cmax} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

13. The WTRU of claim 12, wherein the remaining power is allocated on a per-transmission basis.

14. The WTRU of claim 13, wherein each of the first uplink transmissions and second uplink transmissions has an associated priority and the remaining power is allocated to the first uplink transmissions and second uplink transmissions according to a priority order of the first uplink transmissions and second uplink transmissions.

15. The WTRU of claim 14, wherein the priority is based on an uplink control information (UCI) type.

16. The WTRU of claim 11, further comprising:

- circuitry configured to reserve up to the first minimum guaranteed power for the first uplink transmissions;
- circuitry configured to reserve up to the second minimum guaranteed power for the second uplink transmissions; and
- circuitry configured to, on a condition that, during the time interval, an earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the first CG,
 - make a remaining power available for the first uplink transmissions,
 - allocate the remaining power to the first uplink transmissions up to the total power required for the first uplink transmissions, and
 - make a remainder of the remaining power, which was not allocated to the first uplink transmissions, available for the second uplink transmissions; and
- circuitry configured to, on a condition that, during the time interval, the earliest transmission is scheduled to occur using the uplink resources of the at least one cell of the second CG,
 - make the remaining power available for the second uplink transmissions,
 - allocate the remaining power to the second uplink transmissions up to the total power required for the second uplink transmissions, and
 - make a remainder of the remaining power, which was not allocated to the second uplink transmissions, available for the first uplink transmissions;

wherein the remaining power comprises any difference between P_{cmax} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.

17. The WTRU of claim 11, further comprising:

circuitry configured to, on a condition that a subframe of the first CG asynchronously overlaps in time a subframe of the second CG and the subframe of the first CG leads in time the subframe of the second CG:

calculate a first power range based on the subframe of the first CG and the subframe of the second CG;

calculate a second power range based on the subframe of the first CG and a preceding subframe of the second CG which overlaps in time the subframe of the first CG;

determine a minimum value for P_{cmax} as a lesser of a lowest value of the first power range and a lowest value of the second power range; and

determine a maximum value for P_{cmax} as a greater of a highest value of the first power range and a highest value of the second power range.

18. The WTRU of claim 14, further comprising:

circuitry configured to, on a condition that one of the first uplink transmissions and one of the second uplink transmissions have a same priority order, determine whether the first CG or the second CG comprises a master CG (MCG);

circuitry configured to, on a condition that the first CG comprises an MCG, prioritize the one of the first uplink transmissions for allocation of the remaining power; and

circuitry configured to, on a condition that the second CG comprises an MCG, prioritize the one of the second uplink transmissions for allocation of the remaining power.

19. The WTRU of claim 11, further comprising circuitry configured to calculate a required power for each of the first uplink transmissions and

second uplink transmissions prior to allocating power for the first uplink transmissions and second uplink transmissions.

20. The WTRU of claim 19, further comprising circuitry configured to allocate a portion of a remaining power to each of the first uplink transmissions and second uplink transmissions in a decreasing priority order; wherein the remaining power comprises any difference between P_{max} and the sum of the first minimum guaranteed power and the second minimum guaranteed power for the second uplink transmissions.