

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 a first cell group (CG);
 configuring the WTRU with a second minimum guaranteed power for a second CG;
 on a condition that, during the time interval, an earliest transmission is scheduled to occur for the first CG, determining a first remaining power based on P_{max} , a power level for the earliest transmission for the first CG and the first minimum guaranteed power, wherein an uplink transmission power level for the second CG is based on the first remaining power;
 on a condition that, during the time interval, the earliest transmission is scheduled to occur for the second CG, determining a second remaining power based on P_{max} , a power level for the earliest transmission for the second CG and the second minimum guaranteed power, wherein an uplink transmission power level for the first CG is based on the second remaining power; and
 transmitting uplink transmissions for the first and second CG in the time interval.~~
- ~~2. The method of claim 1, further comprising:
 allocating, by the WTRU, up to the first minimum guaranteed power for the first CG;
 allocating, by the WTRU, up to the second minimum guaranteed power for the second CG; and
 allocating, by the WTRU, a remaining power for the first CG, for the second CG, or for both the first CG and the second CG, wherein the remaining power comprises any difference between P_{max} and a sum of the first minimum guaranteed power for the first CG and the second minimum guaranteed power for the second CG.~~

~~3. The method of claim 2, wherein the remaining power is allocated on a per-transmission basis, wherein first uplink transmissions are transmitted on the first CG, and second uplink transmissions are transmitted on the second CG.~~

~~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:~~

~~transmitting first uplink transmissions on the first CG, and second uplink transmissions on the second CG;~~

~~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 first CG,~~

~~making a remaining power available for the first uplink transmissions,~~

~~allocating the remaining power to the first uplink transmissions up to a 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 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_{max} and a 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_{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.~~

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 CG and second CG prior to allocating power for the first CG and second CG.~~

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

~~11. A transmit/receive unit (WTRU) configured for allocating uplink transmission power of a wireless during a time interval, the WTRU comprising:
configuration circuitry adapted to configure the WTRU with a first minimum guaranteed power for a first cell group (CG); and~~

~~configuration circuitry adapted to configure the WTRU with a second minimum guaranteed power for a second CG;~~

~~wherein a total power (P_{max}) is available to the WTRU for uplink transmissions during the time interval; and~~

~~determination circuitry adapted to, on a condition that, during the time interval, an earliest transmission is scheduled to occur for the first CG, determine a first remaining power based on P_{max} , a power level for the earliest transmission for the first CG and the first minimum guaranteed power, wherein an uplink transmission power level for the second CG is based on the first remaining power;~~

~~the determination circuitry further adapted to, on a condition that, during the time interval, the earliest transmission is scheduled to occur for the second CG, determine a second remaining power based on P_{max} , a power level for the earliest transmission for the second CG and the second minimum guaranteed power, wherein an uplink transmission power level for the first CG is based on the second remaining power; and~~

~~transmitter circuitry adapted to transmit uplink transmissions for the~~

~~first and second CG in the time interval.~~

~~12.—The WTRU of claim 11, further comprising:~~

~~allocation circuitry adapted to allocate, by the WTRU, up to the first minimum guaranteed power for the first CG;~~

~~the allocation circuitry further adapted to allocate, by the WTRU, up to the second minimum guaranteed power for the second CG; and~~

~~circuitry adapted to allocate, by the WTRU, a remaining power for the first CG, for the second CG, or for both the first CG and the second CG, wherein the remaining power comprises any difference between P_{max} a sum of the first minimum guaranteed power for the first CG and the second minimum guaranteed power for the second CG.~~

~~13.—The WTRU of claim 12, wherein the remaining power is allocated on a per transmission basis, wherein first uplink transmissions are transmitted on the first CG, and second uplink transmissions are transmitted on the second CG.~~

~~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:~~

~~transmitter circuitry adapted to transmit first uplink transmissions on the first CG, and second uplink transmissions are on the second CG;~~

~~power reserving circuitry adapted to reserve up to the first minimum guaranteed power for the first uplink transmissions;~~

~~the power-reserving circuitry further adapted to reserve up to the second minimum guaranteed power for the second uplink transmissions; and~~
~~power allocation circuitry adapted to, on a condition that, during the time interval, an earliest transmission is scheduled to occur using 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~~
~~the power allocation circuitry further adapted to, on a condition that, during the time interval, the earliest transmission is scheduled to occur using 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_{max} and a 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:~~

~~power calculation circuitry adapted 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_{max} 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_{max} 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:~~

~~CG determination circuitry adapted 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);~~

~~prioritization circuitry adapted 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~~

~~the prioritization circuitry further adapted 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 power calculation circuitry adapted to calculate a required power for each of the first CG and second CG prior to allocating power for the first CG and second CG.~~

~~20.—The WTRU of claim 19, further comprising power allocation circuitry adapted to allocate a portion of a remaining power to each of the first CG and second CG in a decreasing priority order;~~

~~wherein the remaining power comprises any difference between P_{max} and a sum of the first minimum guaranteed power and the second minimum guaranteed power for the second CG.~~

1. A wireless transmit/receive unit (WTRU) comprising:

a transceiver; and

a processor;

the transceiver and the processor configured to receive a first grant for a first uplink transmission;

the transceiver and the processor configured to receive a downlink control

information (DCI) which includes a second grant for a second uplink transmission, the DCI including a priority value associated with the second grant;

the processor configured to determine whether the first uplink transmission and the second uplink transmission would overlap in time and on a condition that the first and second uplink transmission would overlap in time, to determine whether the first grant or the second grant has a higher priority based on at least the priority value; and

the processor and the transceiver configured to transmit one of the first uplink transmission or the second uplink transmission based on which of the first grant or the second grant is determined to have the higher priority.

2. The WTRU of claim 1, wherein the priority value is indicated by one bit.

3. The WTRU of claim 1, wherein the first uplink transmission is a first uplink physical uplink shared channel (PUSCH) transmission and the second uplink transmission is a second PUSCH transmission.

4. The WTRU of claim 1, wherein the first grant is received in a DCI including a priority value associated with the first uplink transmission.

5. The WTRU of claim 1, wherein the DCI includes the priority value in an overloaded field.

6. The WTRU of claim 1, wherein the processor and the transceiver are configured to, on the condition that the first and second uplink transmission would overlap in time, to determine whether the first grant and the second grant are associated with a same priority value.

7. The WTRU of claim 1, wherein the processor and the transceiver are further configured to, on a condition that a priority value associated with

the first grant is equal to the priority value associated with the second grant, to determine whether the first grant or the second grant has a higher priority based on a pre-defined priority rule.

8. The WTRU of claim 1, wherein the processor and the transceiver are further configured to, on a condition that the priority value associated with the first grant is equal to the priority value associated with the second grant, to determine whether the first grant or the second grant has a higher priority as a function of a MAC entity associated with the first grant or the second grant.

9. The WTRU of claim 1, wherein the processor and the transceiver are further configured to, on a condition that the priority value associated with the first grant is equal to the priority value associated with the second grant, to determine whether the first grant or the second grant has a higher priority as a function of a type of the first grant or the second grant.

10. The WTRU of claim 1, wherein the processor and the transceiver are further configured to, on a condition that the priority value associated with the first grant is equal to the priority value associated with the second grant, to determine whether the first grant or the second grant has a higher priority as a function of whether the first grant is a dynamic grant, a semi-persistent grant, or an alternative grant.

11. A method implemented in a wireless transmit/receive unit (WTRU), the method comprising:

receiving a first grant for a first uplink transmission;

receiving a downlink control information (DCI) which includes a second grant for a second uplink transmission, the DCI including a priority value associated with the second grant;

determining whether the first uplink transmission and the second uplink transmission would overlap in time and on a condition that the first and second uplink transmission would overlap in time, to determine whether the first grant

or the second grant has a higher priority based on at least the priority value;
and

transmitting one of the first uplink transmission or the second uplink
transmission based on which of the first grant or the second grant is determined
to have the higher priority.

12. The method of claim 11, wherein the priority value is indicated by
one bit.

13. The method of claim 11, wherein the first uplink transmission is a
first uplink physical uplink shared channel (PUSCH) transmission and the
second uplink transmission is a second PUSCH transmission.

14. The method of claim 11, wherein the first grant is received in a
DCI including a priority value associated with the first uplink transmission.

15. The method of claim 11, wherein the DCI includes the priority
value in an overloaded field.

16. The method of claim 11, further comprising, on the condition that
the first and second uplink transmission would overlap in time, determining
whether the first grant and the second grant are associated with a same priority
value.

17. The method of claim 11, further comprising, on a condition that a
priority value associated with the first grant is equal to the priority value
associated with the second grant, determining whether the first grant or the
second grant has a higher priority based on a pre-defined priority rule.

18. The method of claim 11, further comprising, on a condition that
the a priority value associated with the first grant is equal to the priority value
associated with the second grant, determining whether the first grant or the

second grant has a higher priority as a function of a MAC entity associated with the first grant or the second grant.

19. The method of claim 11, further comprising, on a condition that the priority value associated with the first grant is equal to the priority value associated with the second grant, determining whether the first grant or the second grant has a higher priority as a function of a type of the first grant or the second grant.

20. The method of claim 11, further comprising, on a condition that the priority value associated with the first grant is equal to the priority value associated with the second grant, determining whether the first grant or the second grant has a higher priority as a function of whether the first grant is a dynamic grant, a semi-persistent grant, or an alternative grant.