

CLAIMS

What is claimed is:

1. A method for generating a radio link control (RLC) protocol data unit (PDU) for multi-carrier operation, the method comprising:

selecting a logical channel;

determining whether there is data available for the logical channel;

calculating a maximum amount of data allowed to be transmitted for a current transmission time interval (TTI) for each of a plurality of carriers;

selecting an RLC PDU data field size for the logical channel such that each RLC PDU to be multiplexed to a medium access control (MAC) PDU matches a minimum of the maximum amount of data calculated for the carriers; and

generating at least one RLC PDU for a later TTI based on the selected RLC PDU data field size.

2. The method of claim 1 performed by a wireless transmit/receive unit (WTRU) wherein the maximum amount of data that can be transmitted on each carrier is calculated based on an applicable current grant for each carrier for the current TTI.

3. The method of claim 2 wherein the RLC PDU is generated for the later TTI on a condition that an amount of data in outstanding pre-generated RLC PDUs for the logical channel is less than or equal to $4N$ times the minimum of the maximum amount of data allowed to be transmitted by the applicable current grant for the carriers for the current TTI, where N is a number of activated carriers.

4. The method of claim 2 wherein the applicable current grant for a first carrier of the current TTI is a non-scheduled grant on a condition that the logical channel belongs to a non-scheduled medium access control (MAC) flow, and the applicable current grant for a second carrier of the current TTI is a

serving grant on a condition that the logical channel belongs to a scheduled MAC flow.

5. The method of claim 4 wherein the first carrier is a primary carrier and the second carrier is a secondary carrier, and the non-scheduled MAC flow is allowed on the primary carrier and the scheduled MAC flow is allowed on both the primary carrier and the secondary carrier, and the RLC PDU data field size for the logical channel is selected so that each RLC PDU to be multiplexed to the MAC PDU matches a minimum of:

a maximum amount of data allowed to be transmitted by an applicable current scheduled or non-scheduled grant on the primary carrier for the current TTI and

a maximum amount of data allowed to be transmitted by an applicable current scheduled grant on the secondary carrier for the current TTI.

6. The method of claim 1 wherein the maximum amount of data is calculated based on both an applicable current grant and a maximum remaining power allowed for enhanced dedicated channel (E-DCH) transmission on each carrier.

7. The method of claim 6 wherein the maximum remaining power allowed for E-DCH transmission for a primary carrier is a sum of a power pre-allocated for non-scheduled transmissions and a power allocated based on a serving grant ratio of the carriers, and the maximum remaining power allowed for E-DCH transmission for a secondary carrier is a power allocated based on the serving grant ratio of the carriers.

8. A wireless transmit/receive unit (WTRU) for generating a radio link control (RLC) protocol data unit (PDU) in a flexible size for multi-carrier transmission, the WTRU comprising:

a transceiver configured for wireless communication using logical channels via a plurality of carriers;

a processor configured to select a logical channel and to determine whether there is data available for the logical channel;

the processor configured to calculate a maximum amount of data allowed to be transmitted for a current transmission time interval (TTI) for each of a plurality of carriers;

the processor configured to select an RLC PDU data field size for the logical channel such that each RLC PDU to be multiplexed to a medium access control (MAC) PDU matches a minimum of the maximum amount of data calculated for the carriers; and

the processor configured to generate at least one RLC PDU for a later TTI based on the selected RLC PDU data field size.

9. The WTRU of claim 8 wherein the processor is configured to calculate the maximum amount of data that can be transmitted on each carrier based on an applicable current grant for each carrier for the current TTI.

10. The WTRU of claim 9 wherein the processor is configured to generate the RLC PDU for the later TTI on a condition that an amount of data in outstanding pre-generated RLC PDUs for a particular logical channel is less than or equal to $4N$ times the minimum of the maximum amount of data allowed to be transmitted by the applicable current grant for the carriers for the current TTI, where N is a number of activated carriers.

11. The WTRU of claim 9 wherein the processor is configured to calculate the maximum amount of data that can be transmitted on first and second carriers for the current TTI where the applicable current grant for the first carrier is a non-scheduled grant on a condition that the logical channel belongs to a non-scheduled medium access control (MAC) flow, and the applicable

current grant for the second carrier is a serving grant on a condition that the logical channel belongs to a scheduled MAC flow.

12. The WTRU of claim 11 where the first carrier is a primary carrier and the second carrier is a secondary carrier, and the non-scheduled MAC flow is allowed on the primary carrier and the scheduled MAC flow is allowed on both the primary carrier and the secondary carrier, wherein the processor is configured to select the RLC PDU data field size for the logical channel so that each RLC PDU to be multiplexed to the MAC PDU matches a minimum of:

a maximum amount of data allowed to be transmitted by an applicable current scheduled or non-scheduled grant on the primary carrier for the current TTI and

a maximum amount of data allowed to be transmitted by an applicable current scheduled grant on the secondary carrier for the current TTI.

13. The WTRU of claim 8 wherein the processor is configured to calculate the maximum amount of data based on both an applicable current grant and a maximum remaining power allowed for enhanced dedicated channel (E-DCH) transmission on each carrier.

14. The WTRU of claim 13 wherein the processor is configured to calculate the maximum amount of data where the maximum remaining power allowed for E-DCH transmission for a primary carrier is a sum of a power pre-allocated for non-scheduled transmissions and a power allocated based on a serving grant ratio of the carriers, and the maximum remaining power allowed for E-DCH transmission for a secondary carrier is a power allocated based on the serving grant ratio of the carriers.

CLAIM

What is claimed is:

1. A method for generating a radio link control (RLC) protocol data unit (PDU) for multi-carrier operation, the method comprising:
 - selecting a logical channel;
 - determining whether there is data available for the logical channel;
 - calculating a maximum amount of data allowed to be transmitted for a current transmission time interval (TTI) for each of a plurality of carriers;
 - selecting an RLC PDU data field size for the logical channel such that each RLC PDU to be multiplexed to a medium access control (MAC) PDU matches a minimum, wherein the minimum is the lowest of the maximum amount of data calculated for each of the plurality of carriers; and
 - generating at least one RLC PDU for a later TTI based on the selected RLC PDU data field size.
2. The method of claim 1 performed by a wireless transmit/receive unit (WTRU) wherein the maximum amount of data allowed to be transmitted for the current TTI on each carrier is calculated based on an applicable current grant for each carrier for the current TTI.
3. The method of claim 2 wherein the RLC PDU is generated for the later TTI on a condition that an amount of data in outstanding pre-generated RLC PDUs for the logical channel is less than or equal to $4N$ times the minimum of the maximum amount of data allowed to be transmitted for the current TTI by the applicable current grant for the plurality of carriers for the current TTI, where N is a number of activated carriers.
4. The method of claim 2 wherein the applicable current grant for a first carrier of the current TTI is a non-scheduled grant on a condition that the logical channel belongs to a non-scheduled medium access control (MAC) flow, and the applicable current grant for a second carrier of the current TTI is a serving grant on a condition that the logical channel belongs to a scheduled MAC flow.
5. The method of claim 4 wherein the first carrier is a primary carrier and the second carrier is a secondary carrier, and the non-scheduled MAC flow is allowed on the

primary carrier and the scheduled MAC flow is allowed on both the primary carrier and the secondary carrier, and the RLC PDU data field size for the logical channel is selected so that each RLC PDU to be multiplexed to the MAC PDU matches a minimum of:

- a maximum amount of data allowed to be transmitted by an applicable current scheduled or non-scheduled grant on the primary carrier for the current TTI and

- a maximum amount of data allowed to be transmitted by an applicable current scheduled grant on the secondary carrier for the current TTI.

6. The method of claim 1 wherein the maximum amount of data is calculated based on both an applicable current grant and a maximum remaining power allowed for enhanced dedicated channel (E-DCH) transmission on each carrier.

7. The method of claim 6 wherein the maximum remaining power allowed for E-DCH transmission for a primary carrier is a sum of a power pre-allocated for non-scheduled transmissions and a power allocated based on a serving grant ratio of the plurality of carriers, and the maximum remaining power allowed for E-DCH transmission for a secondary carrier is a power allocated based on the serving grant ratio of the plurality of carriers.

8. A wireless transmit/receive unit (WTRU) for generating a radio link control (RLC) protocol data unit (PDU) in a flexible size for multi-carrier transmission, the WTRU comprising:

- a transceiver configured for wireless communication using logical channels via a plurality of carriers;

- a processor configured to:

- select a logical channel;

- determine whether there is data available for the logical channel;

- calculate a maximum amount of data allowed to be transmitted for a current transmission time interval (TTI) for each of the plurality of carriers;

- select an RLC PDU data field size for the logical channel such that each RLC PDU to be multiplexed to a medium access control (MAC) PDU matches a minimum, wherein the minimum is the lowest of the maximum amount of data calculated for each of the plurality of carriers; and

generate at least one RLC PDU for a later TTI based on the selected RLC PDU data field size.

9. The WTRU of claim 8 wherein the processor is configured to calculate the maximum amount of data that can be transmitted for the current TTI on each carrier based on an applicable current grant for each carrier for the current TTI.

10. The WTRU of claim 9 wherein the processor is configured to generate the RLC PDUs for the later TTI on a condition that an amount of data in outstanding pre-generated RLC PDUs for a particular logical channel is less than or equal to $4N$ times the minimum of the maximum amount of data allowed to be transmitted for the current TTI by the applicable current grant for the plurality of carriers for the current TTI, where N is a number of activated carriers.

11. The WTRU of claim 9 wherein the applicable current grant for a first carrier of the current TTI is a non-scheduled grant on a condition that the logical channel belongs to a non-scheduled medium access control (MAC) flow, and the applicable current grant for a second carrier of the current TTI is a serving grant on a condition that the logical channel belongs to a scheduled MAC flow.

12. The WTRU of claim 11 where the first carrier is a primary carrier and the second carrier is a secondary carrier, and the non-scheduled MAC flow is allowed on the primary carrier and the scheduled MAC flow is allowed on both the primary carrier and the secondary carrier, wherein the processor is configured to select the RLC PDU data field size for the logical channel so that each RLC PDU to be multiplexed to the MAC PDU matches a minimum of:

a maximum amount of data allowed to be transmitted by an applicable current scheduled or non-scheduled grant on the primary carrier for the current TTI and

a maximum amount of data allowed to be transmitted by an applicable current scheduled grant on the secondary carrier for the current TTI.

13. The WTRU of claim 8 wherein the processor is configured to calculate the maximum amount of data based on both an applicable current grant and a maximum remaining power allowed for enhanced dedicated channel (E-DCH) transmission on each carrier.

14. The WTRU of claim 13 wherein the maximum remaining power allowed for E-DCH transmission for a primary carrier is a sum of a power pre-allocated for non-scheduled transmissions and a power allocated based on a serving grant ratio of the plurality of carriers, and the maximum remaining power allowed for E-DCH transmission for a secondary carrier is a power allocated based on the serving grant ratio of the plurality of carriers.