

CLAIMS

What is Claimed:

1. A method for transmitting uplink control information (UCI) comprising:
 - a wireless transmit receive unit (WTRU) ~~determining that a transmission of UCI overlaps with a grant free (GF) transmission on a physical uplink shared channel (PUSCH);~~
 - ~~the WTRU determining to not transmit the GF transmission on the PUSCH;~~
 - ~~the WTRU determining to transmit the UCI on a physical uplink control channel (PUCCH); and~~
 - the WTRU transmitting the UCI on the PUCCH, receiving a radio resource control (RRC) message, wherein the RRC message comprises information indicating physical uplink shared channel (PUSCH) resources for the WTRU, and the RRC message indicates whether or not uplink control information (UCI) can be multiplexed with data on the PUSCH resources;
 - the WTRU determining to transmit first UCI during a time period that overlaps with a transmission opportunity associated with the PUSCH resources; and
 - the WTRU transmitting the first UCI, wherein the WTRU multiplexes the first UCI on the PUSCH resources associated with the transmission opportunity if the RRC message indicates that UCI can be multiplexed with data on the PUSCH resources, and the WTRU transmits the first UCI on one or more physical uplink control channel (PUCCH) resources if the RRC message indicates that UCI cannot be multiplexed with data on the PUSCH resources.
2. The method of claim 1,
 - wherein the first UCI comprises HARQ/ACK information.
3. The method of claim 1,
 - wherein ~~determining the transmission of UCI overlaps with the GF transmission on the PUSCH comprises determining the transmission of the UCI overlaps with the GF transmission in a slot;~~ the WTRU does not transmit the first UCI using the PUSCH resources during the transmission opportunity if the RRC message indicates that UCI cannot be multiplexed with data on the PUSCH resources.
4. The method of claim 1, further comprising:
 - ~~transmitting the GF transmission on the PUSCH,~~

~~wherein the UCI is transmitted on the PUCCH before transmitting the GF transmission on the PUSCH; the WTRU transmitting a transport block (TB) that was to be transmitted on the PUSCH resources during the transmission opportunity using PUSCH resources associated with a subsequent transmission opportunity associated with the RRC configured PUSCH resources if the RRC message indicates that UCI cannot be multiplexed with data on the PUSCH resources.~~

5. The method of claim 4,
wherein transmitting the ~~UCI comprises transmitting the UCI in a first slot; and~~
~~wherein transmitting the GF transmission comprises transmitting the GF transmission in a second slot, the second slot immediately following the first slot. TB using PUSCH resources associated with the subsequent transmission opportunity comprises transmitting the TB a number of times, the number of times being based on a configured value.~~

6. The method of claim ~~14~~, further comprising:
~~the WTRU receiving configuration information;~~
~~wherein determining to not transmit the GF transmission comprises determining to not transmit the GF transmission based on the configuration information. wherein the first UCI is transmitted on the PUCCH resources before transmitting the TB using PUSCH resources.~~

7. The method of claim ~~64~~, wherein ~~receiving configuration information comprises receiving radio resource control (RRC) configuration information. the first UCI is transmitted in a first slot; and~~
~~wherein the TB is transmitted in at least a second slot.~~

8. ~~The method of claim 1, wherein determining to not transmit the GF transmission comprises determining to not transmit the GF transmission based on an absence of configuration information.~~

9. ~~The method of claim 1, further comprising:~~
~~the WTRU determining a transmission of a second UCI overlaps with a second grant free (GF) transmission on a physical uplink shared channel (PUSCH);~~
~~the WTRU determining to multiplex the second UCI and the second GF transmission on the PUSCH;~~

~~the WTRU multiplexing the second UCI and the second GF transmission on the PUSCH; and
the WTRU transmitting the second UCI and second GF transmission on the PUSCH.~~

~~10. The method of claim 9, further comprising:~~

~~the WTRU receiving configuration information;~~

~~wherein determining to multiplex the second UCI and the second GF transmission on the PUSCH
comprises determining to multiplex the second UCI and the second GF transmission on the PUSCH based
on the configuration information.~~

~~118.~~ A wireless transmit receive unit (WTRU) comprising:

a processor configured at least to:

~~determine that a transmission of UCI overlaps with a grant free (GF) transmission on a physical
uplink shared channel (PUSCH);~~

~~determine to not transmit the GF transmission on the PUSCH;~~

~~determine to transmit the UCI on a physical uplink control channel (PUCCH); and~~

~~transmit the UCI on the PUCCH; receive a radio resource control (RRC) message, wherein the
RRC message comprises information indicating physical uplink shared channel (PUSCH) resources for the
WTRU, and the RRC message indicates whether or not uplink control information (UCI) can be multiplexed
with data on the PUSCH resources;~~

~~determine to transmit first UCI during a time period that overlaps with a transmission opportunity
associated with the PUSCH resources; and~~

~~transmit the first UCI, wherein the WTRU multiplexes the first UCI on the PUSCH resources
associated with the transmission opportunity if the RRC message indicates that UCI can be multiplexed
with data on the PUSCH resources, and the WTRU transmits the first UCI on one or more physical uplink
control channel (PUCCH) resources if the RRC message indicates that UCI cannot be multiplexed with
data on the PUSCH resources.~~

~~129.~~ The WTRU of claim ~~118~~,

wherein the first UCI comprises HARQ/ACK information.

~~1310.~~ The WTRU of claim ~~118~~, wherein the processor is further configured to:

~~determine the transmission of the UCI overlaps with the GF transmission in a slot. not transmit the first UCI using the PUSCH resources during the transmission opportunity if the RRC message indicates that UCI cannot be multiplexed with data on the PUSCH resources.~~

~~1411.~~ The WTRU of claim ~~148~~, wherein the processor is further configured to:

~~transmit the GF transmission on the PUSCH,~~

~~wherein the UCI is transmitted on the PUCCH before transmitting the GF transmission on the PUSCH. a transport block (TB) that was to be transmitted on the PUSCH resources during the transmission opportunity using PUSCH resources associated with a subsequent transmission opportunity associated with the RRC configured PUSCH resources if the RRC message indicates that UCI cannot be multiplexed with data on the PUSCH resources.~~

~~1512.~~ The WTRU of claim ~~1411~~,

~~wherein the UCI is transmitted in a first slot; and~~

~~wherein the processor is further configured to transmit the GF transmission in a second slot, the second slot immediately following the first slot. TB using PUSCH resources associated with the subsequent transmission opportunity a number of times, the number of times being based on a configured value.~~

~~1613.~~ The WTRU of claim 11, ~~wherein the processor is further configured to:~~

~~— receive configuration information; and~~

~~— determine to not transmit the GF transmission based on the configuration information. the first UCI is transmitted using PUSCH resources.~~

~~1714.~~ The WTRU of claim ~~1611~~, wherein the ~~configuration information comprises radio resource control (RRC) configuration information. first UCI is transmitted in a first slot; and~~

~~— wherein the TB is transmitted in at least a second slot.~~

~~1815.~~ The WTRU of claim ~~1414~~, wherein the ~~processor is further configured to:~~

~~determine to not transmit the GF transmission based on having not received configuration information. RRC message further includes the configured value.~~

~~19~~16. The WTRU of claim ~~14~~15, wherein the processor is further configured to:
~~determine a transmission of a second UCI overlaps with a second grant free (GF) transmission on a physical uplink shared channel (PUSCH);~~
~~determine to multiplex the second UCI and the second GF transmission on the PUSCH;~~
~~multiplex the second UCI and the second GF transmission on the PUSCH; and~~
~~transmit the second UCI and second GF transmission on the PUSCH.~~second slot is an immediately subsequent slot to the first slot.

~~20.~~ The WTRU of claim 19, wherein the processor is further configured to:
~~receive configuration information; and~~
~~determine to multiplex the second UCI and the second GF transmission on the PUSCH based on the configuration information.~~

17. The method of claim 7, wherein the RRC message further includes the configured value.

18. The WTRU of claim 14, wherein the second slot is an immediately subsequent slot to the first slot.