CLAIMS

What is Claimed:

1. A wireless transmit/receive unit (WTRU) configured to perform a 2-step random access channel (RACH) procedure, the WTRU comprising:

a transceiver; and

a processor, wherein:

the processor is configured to select a random access preamble having a preamble index;

the processor is further configured to determine a scrambling sequence for a physical uplink shared channel (PUSCH) transmission, wherein the scrambling sequence is based on a random access – radio network temporary identifier (RA-RNTI) and the preamble index; and

the transceiver is configured to send a message to a network node, wherein the message comprises the selected random access preamble and the PUSCH transmission, wherein the PUSCH transmission is scrambled with the determined scrambling sequence that is based on the RA-RNTI and the preamble index.

2. The WTRU of claim 1, wherein the RA-RNTI is based on at least one parameter of a preamble transmission opportunity, wherein the at least one parameter comprises at least one of: a symbol, a slot, a frequency, or a carrier identifier (ID).

3. The WTRU of claim 1, wherein the processor is further configured to multiplex a demodulation reference signal (DMRS) sequence with the PUSCH transmission, wherein the DMRS sequence is based on the preamble index.

4. The WTRU of claim 1, wherein the RA-RNTI is common to a plurality of random access preambles configured to a same physical random access channel (PRACH) transmission opportunity.

5. The WTRU of claim 1, wherein a cyclic redundancy check (CRC) associated with the PUSCH transmission is scrambled.

6. The WTRU of claim 1, wherein the random access preamble is selected randomly.

7. The WTRU of claim 1, wherein the RA-RNTI is configured for a subset of WTRUs.

8. The WTRU of claim 1, wherein the transceiver is further configured to receive configuration information, wherein the configuration information indicates an association between random access preambles and synchronization signal blocks (SSBs), wherein the configuration information indicates an association between random access preambles, reference signal (RS) sets, and physical uplink shared channel (PUSCH) resources.

9. The WTRU of claim 1, wherein the message is sent using a first beam.

10. The WTRU of claim 9, wherein:

the transceiver is further configured to receive a plurality of sets of reference signals (RSs) based on the sent message;

the processor is further configured to determine a measurement of the received sets of RSs;

the processor is further configured to select a RS based on the determined measurement of the received sets of RSs; and

the transceiver is further configured to send uplink data on a PUSCH using a second beam.

11. A method implemented by a wireless transmit/receive unit (WTRU) configured to perform a 2-step random access channel (RACH) procedure, the method comprising:

selecting a random access preamble having a preamble index;

determining a scrambling sequence for a physical uplink shared channel (PUSCH) transmission, wherein the scrambling sequence is based on a random access – radio network temporary identifier (RA-RNTI) and the preamble index; and

sending a message to a network node, wherein the message comprises the selected random access preamble and the PUSCH transmission, wherein the PUSCH transmission is scrambled with the determined scrambling sequence that is based on the RA-RNTI and the preamble index.

12. The method of claim 11, wherein the RA-RNTI is based on at least one parameter of a preamble transmission opportunity, wherein the at least one parameter comprises at least one of: a symbol, a slot, a frequency, or a carrier identifier (ID).

13. The method of claim 11, further comprising multiplexing a demodulation reference signal (DMRS) sequence with the PUSCH transmission, wherein the DMRS sequence is based on the preamble index.

14. The method of claim 11, wherein the RA-RNTI is common to a plurality of random access preambles configured to a same physical random access channel (PRACH) transmission opportunity.

15. The method of claim 11, wherein a cyclic redundancy check (CRC) associated with the PUSCH transmission is scrambled.

16. The method of claim 11, wherein the random access preamble is selected randomly.

17. The method of claim 11, wherein the RA-RNTI is configured for a subset of WTRUs.

18. The method of claim 11, further comprising receiving configuration information, wherein the configuration information indicates an association between random access preambles and synchronization signal blocks (SSBs), wherein the configuration information indicates an association between random access preambles, reference signal (RS) sets, and physical uplink shared channel (PUSCH) resources.

19. The method of claim 11, wherein the message is sent using a first beam.

20. The method of claim 19, further comprising:

receiving a plurality of sets of reference signals (RSs) based on the sent message;

determining a measurement of the received sets of RSs;

selecting a RS based on the determined measurement of the received sets of RSs; and

sending uplink data on a PUSCH using a second beam.