

CLAIMS

WHAT IS CLAIMED IS:

1. ~~— A method of wireless communication at a user equipment (UE), comprising:
— receiving, from a base station, random access configuration information;
determining a preamble for a random access message from a preamble group for a random access occasion (RO);
determining one or more physical uplink shared channel resource unit (PRU) resource sets for the random access message based on the preamble and a mapping based on the random access configuration information, wherein the random access configuration information maps the preamble to the one or more PRU resource sets;
and
transmitting, to the base station, the random access message including the preamble and a payload, wherein the payload is transmitted using one or more PRU groups of the one or more PRU resource sets based on the mapping.~~
2. ~~— The method of claim 1, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set.~~
3. ~~— The method of claim 2, wherein the random access message comprises uplink control information (UCI) transmitted using a first PRU group in the first PRU resource set, and the UCI allocates a second PRU group in the second PRU resource set for the payload of the random access message.~~
4. ~~— The method of claim 3, wherein the UCI includes at least one of a modulation control scheme (MCS), a transport block size (TBS), a waveform, resource allocation information for the payload, a frequency hopping pattern for the payload, or multi-slot repetition information for the payload.~~
5. ~~— The method of claim 2, wherein the random access message is transmitted according to a frequency hopping pattern using the first PRU resource set and the second PRU resource set, wherein the random access message is transmitted using a first PRU group in the first PRU resource set in a first frequency of the frequency~~

hopping pattern and using a second PRU group in the second PRU resource set in a second frequency of the frequency hopping pattern.

6. — The method of claim 1, wherein each PRU group of the one or more PRU groups comprises a time-frequency resource associated with a physical uplink shared channel (PUSCH) transmission and an antenna port and sequence scrambling identification associated with a demodulation reference signal (DMRS) transmission.

7. — The method of claim 1, wherein the one or more PRU resource sets comprise a plurality of PRU resource sets associated with the preamble group configured for the RO, and wherein the plurality of PRU resource sets are orthogonal in at least one of a time domain, a frequency domain or a code domain.

8. — The method of claim 1, wherein the one or more PRU resource sets comprise a plurality of PRUs associated with the preamble group configured for the RO, and wherein the preamble determined by the UE is associated with multiple PRU groups in a single PRU resource set.

9. — The method of claim 1, wherein the one or more PRU resource sets comprise a plurality of PRUs associated with the preamble group configured for the RO, and wherein the preamble determined by the UE is associated with at least one PRU group in different PRU resource sets.

10. — The method of claim 9, wherein the preamble group comprises a first set of preambles and a second set of preambles, each preamble of the first set of preambles being associated with multiple PRU groups in the one or more PRU resource sets, and at least one preamble of the second set of preambles being associated with a single PRU group in one of the one or more PRU resource sets.

11. — The method of claim 1, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set, wherein the random access message is transmitted according to a multi-slot repetition pattern across the first PRU resource set and the second PRU resource set, wherein a first transmission of the

random access message is using a first PRU group in the first PRU resource set, and a second transmission of the random access message is using a second PRU group in the second PRU resource set.

12. — The method of claim 1, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set, wherein uplink control information (UCI) is transmitted in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is transmitted in the second PRU group of the second PRU resource set, and wherein the payload is transmitted using frequency hopping or slot repetition across the second PRU group and a third PRU group in the second PRU resource set.

13. — The method of claim 12, wherein the payload is transmitted in the second PRU group and the third PRU group based on frequency hopping information in the UCI, wherein the UCI includes one of intra-slot or inter-slot physical resource block (PRB) hopping information.

14. — The method of claim 12, wherein the payload is transmitted in the second PRU group and the third PRU group based on multi-slot repetition information in the UCI, wherein the payload spans one of multiple consecutive slots or non-consecutive slots in a time domain.

15. — An apparatus for wireless communication, comprising:

means for receiving, from a base station, random access configuration information;

means for determining a preamble for a random access message from a preamble group for a random access occasion (RO);

wherein the means for determining is further configured to determine one or more physical uplink shared channel resource unit (PRU) resource sets for the random access message based on the preamble and a mapping based on the random access configuration information, wherein the random access configuration information maps the preamble to the one or more PRU resource sets; and

means for transmitting, to the base station, the random access message including the preamble and a payload, wherein the means for transmitting is configured to transmit the payload using one or more PRU groups of the one or more PRU resource sets based on the mapping.

16. — The apparatus of claim 15, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set.

17. — The apparatus of claim 16, wherein the random access message comprises uplink control information (UCI) transmitted using a first PRU group in the first PRU resource set, and the UCI allocates a second PRU group in the second PRU resource set for the payload of the random access message.

18. — The apparatus of claim 16, wherein the random access message is transmitted according to a frequency hopping pattern using the first PRU resource set and the second PRU resource set, wherein the random access message is transmitted using a first PRU group in the first PRU resource set in a first frequency of the frequency hopping pattern and using a second PRU group in the second PRU resource set in a second frequency of the frequency hopping pattern.

19. — The apparatus of claim 16, wherein the random access message is transmitted according to a multi-slot repetition pattern across the first PRU resource set and the second PRU resource set, wherein a first transmission of the random access message is using a first PRU group in the first PRU resource set, and a second transmission of the random access message is using a second PRU group in the second PRU resource set.

20. — The apparatus of claim 16, wherein uplink control information (UCI) is transmitted in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is transmitted in the second PRU group of the second PRU resource set, and wherein the payload is transmitted using frequency hopping or slot repetition across the second PRU group and a third PRU group in the second PRU resource set.

21. — ~~An apparatus for wireless communication, comprising:~~
a memory; and
at least one processor coupled to the memory and configured to:
receive, from a base station, random access configuration information;
determine a preamble for a random access message from a preamble
group for a random access occasion (RO);
determine one or more physical uplink shared channel resource unit
(PRU) resource sets for the random access message based on the preamble and a
mapping based on the random access configuration information, wherein the
random access configuration information maps the preamble to the one or more
PRU resource sets; and
transmit, to the base station, the random access message including the
preamble and a payload, wherein the at least one processor is configured to
transmit the payload using one or more PRU groups of the one or more PRU
resource sets based on the mapping.
22. — ~~The apparatus of claim 21, wherein the one or more PRU resource sets comprise
a first PRU resource set and a second PRU resource set.~~
23. — ~~The apparatus of claim 22, wherein the random access message comprises
uplink control information (UCI) transmitted using a first PRU group in the first PRU
resource set, and the UCI allocates a second PRU group in the second PRU resource set
for the payload of the random access message.~~
24. — ~~The apparatus of claim 22, wherein the random access message is transmitted
according to a frequency hopping pattern using the first PRU resource set and the
second PRU resource set, wherein the random access message is transmitted using a
first PRU group in the first PRU resource set in a first frequency of the frequency
hopping pattern and using a second PRU group in the second PRU resource set in a
second frequency of the frequency hopping pattern.~~
25. — ~~The apparatus of claim 22, wherein the random access message is transmitted
according to a multi-slot repetition pattern across the first PRU resource set and the~~

second PRU resource set, wherein a first transmission of the random access message is using a first PRU group in the first PRU resource set, and a second transmission of the random access message is using a second PRU group in the second PRU resource set.

26. — The apparatus of claim 22, wherein uplink control information (UCI) is transmitted in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is transmitted in the second PRU group of the second PRU resource set, and wherein the payload is transmitted using frequency hopping or slot repetition across the second PRU group and a third PRU group in the second PRU resource set.

27. — A computer-readable medium storing computer-executable code, the code when executed by a processor cause the processor to:

- receive, from a base station, random access configuration information;

- determine a preamble for a random access message from a preamble group for a random access occasion (RO);

- determine one or more physical uplink shared channel resource unit (PRU) resource sets for the random access message based on the preamble and a mapping based on the random access configuration information, wherein the random access configuration information maps the preamble to the one or more PRU resource sets; and

- transmit, to the base station, the random access message including the preamble and a payload, wherein the processor transmits the payload using one or more PRU groups of the one or more PRU resource sets based on the mapping.

28. — A method of wireless communication at a base station, comprising:

- transmitting, to a user equipment (UE), random access configuration information, wherein the random access configuration information is transmitted using at least one of system information or radio resource control (RRC) signaling, and wherein the random access configuration information includes a mapping of a preamble to one or more physical uplink shared channel resource unit (PRU) resource sets; and
- receiving a random access message from the UE including the preamble on a random access occasion (RO), wherein the preamble is from a preamble group,

wherein the random access message includes a payload received in one or more PRU groups of the one or more PRU resource sets based on the mapping.

29. — The method of claim 28, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set.

30. — The method of claim 29, wherein the random access message comprises uplink control information (UCI) received using a first PRU group in the first PRU resource set, and the UCI allocates a second PRU group in the second PRU resource set for the payload of the random access message.

31. — The method of claim 29, wherein the random access message is received according to a frequency hopping pattern using the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first frequency of the frequency hopping pattern and using a second PRU group in the second PRU resource set in a second frequency of the frequency hopping pattern.

32. — The method of claim 31, wherein the payload is received using frequency hopping in the first PRU group and the second PRU group.

33. — The method of claim 28, wherein the one or more PRU resource sets comprise a plurality of PRU resource sets associated with the preamble, and wherein the plurality of PRU resource sets are orthogonal in at least one of a time domain, a frequency domain, or a code domain.

34. — The method of claim 28, wherein the one or more PRU resource sets comprise a plurality of PRU resource sets associated with the preamble, and wherein the preamble is associated with multiple PRU groups in a single PRU resource set.

35. — The method of claim 28, wherein the one or more PRU resource sets comprise a plurality of PRU resource sets associated with the preamble, and wherein the preamble is associated with at least one PRU group in different PRU resource sets.

36. — The method of claim 28, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set, wherein the random access message is received according to a multi-slot repetition pattern across the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first slot of the multi-slot repetition pattern and using a second PRU group in the second PRU resource set in a second slot of the multi-slot repetition pattern.

37. — The method of claim 36, wherein the payload is received using slot repetition in the first PRU group and the second PRU group.

38. — The method of claim 28, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received in the second PRU group of the second PRU resource set, and wherein the payload is frequency hopped across the second PRU group and a third PRU group in the second PRU resource set.

39. — The method of claim 28, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received in the second PRU group of the second PRU resource set, and wherein the payload is repeated across the second PRU group and a third PRU group in the second PRU resource set.

40. — An apparatus for wireless communication, comprising:

means for transmitting, to a user equipment (UE), random access configuration information, wherein the random access configuration information is transmitted using at least one of system information or radio resource control (RRC) signaling, and

wherein the random access configuration information includes a mapping of a preamble to one or more physical uplink shared channel resource unit (PRU) resource sets; and
—— means for receiving a random access message from the UE including the preamble on a random access occasion (RO), wherein the preamble is from a preamble group;

wherein the random access message includes a payload received in one or more PRU groups of the one or more PRU resource sets based on the mapping.

41. — The apparatus of claim 40, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set.

42. — The apparatus of claim 41, wherein the random access message comprises uplink control information (UCI) received using a first PRU group in the first PRU resource set, and the UCI allocates a second PRU group in the second PRU resource set for the payload of the random access message.

43. — The apparatus of claim 41, wherein the random access message is received according to a frequency hopping pattern using the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first frequency of the frequency hopping pattern and using a second PRU group in the second PRU resource set in a second frequency of the frequency hopping pattern.

44. — The apparatus of claim 41, wherein the random access message is received according to a multi-slot repetition pattern across the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first slot of the multi-slot repetition pattern and using a second PRU group in the second PRU resource set in a second slot of the multi-slot repetition pattern.

45. — The apparatus of claim 41, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received

in the second PRU group of the second PRU resource set, and wherein the payload is frequency hopped across the second PRU group and a third PRU group in the second PRU resource set.

46. — The apparatus of claim 41, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received in the second PRU group of the second PRU resource set, and wherein the payload is repeated across the second PRU group and a third PRU group in the second PRU resource set.

47. — An apparatus for wireless communication, comprising:
a memory; and
at least one processor coupled to the memory and configured to:
transmit, to a user equipment (UE), random access configuration information, wherein the random access configuration information is transmitted using at least one of system information or radio resource control (RRC) signaling, and wherein the random access configuration information includes for a mapping of a preamble to one or more physical uplink shared channel resource unit (PRU) resource sets; and
— receive a random access message from the UE including the preamble on a random access occasion (RO), wherein the preamble is from a preamble group, wherein the random access message includes a payload received in one or more PRU groups of the one or more PRU resource sets based on the mapping.

48. — The apparatus of claim 47, wherein the one or more PRU resource sets comprise a first PRU resource set and a second PRU resource set.

49. — The apparatus of claim 48, wherein the random access message comprises uplink control information (UCI) received using a first PRU group in the first PRU resource set, and the UCI allocates a second PRU group in the second PRU resource set for the payload of the random access message.

50. — ~~The apparatus of claim 48, wherein the random access message is received according to a frequency hopping pattern using the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first frequency of the frequency hopping pattern and using a second PRU group in the second PRU resource set in a second frequency of the frequency hopping pattern.~~

51. — ~~The apparatus of claim 48, wherein the random access message is received according to a multi-slot repetition pattern across the first PRU resource set and the second PRU resource set, wherein the random access message is received using a first PRU group in the first PRU resource set in a first slot of the multi-slot repetition pattern and using a second PRU group in the second PRU resource set in a second slot of the multi-slot repetition pattern.~~

52. — ~~The apparatus of claim 48, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received in the second PRU group of the second PRU resource set, and wherein the payload is frequency hopped across the second PRU group and a third PRU group in the second PRU resource set.~~

53. — ~~The apparatus of claim 48, wherein uplink control information (UCI) is received in a first PRU group of the first PRU resource set, the UCI allocating a second PRU group in the second PRU resource set for the payload, wherein the payload is received in the second PRU group of the second PRU resource set, and wherein the payload is repeated across the second PRU group and a third PRU group in the second PRU resource set.~~

54. — ~~A computer-readable medium storing computer-executable code, the code when executed by a processor cause the processor to:~~
~~transmit, to a user equipment (UE), random access configuration information,~~
~~wherein the random access configuration information is transmitted using at least one of~~

~~system information or radio resource control (RRC) signaling, and wherein the random access configuration information includes for a mapping of a preamble to one or more physical uplink shared channel resource unit (PRU) resource sets; and~~
~~— receive a random access message from the UE including the preamble on a random access occasion (RO), wherein the preamble is from a preamble group,~~
~~wherein the random access message includes a payload received in one or more PRU groups of the one or more PRU resource sets based on the mapping.~~

1. An invention not claimed in any divisional application.