CLAIMS

1. A method for wireless communication by a user equipment (UE), comprising:

receiving, from a network device, a configuration of random access channel resources for transmission of a random access message that includes a random access preamble and a random access payload;

and

transmitting, to the network device, the random access message based at least in part on a time duration of a transmission gap between an ending time of the random access preamble and a starting time of the random access payload, the time duration of the transmission gap being based at least in part on the configuration of the random access channel resources, and the starting time of the random access payload being aligned with a starting time of a random access occasion time window at the network device based at least in part on the time duration of the transmission gap.

2. The method of claim 1, wherein:

the configuration of the random access channel resources is provided at least in part in one or more of a synchronization signal block (SSB), system information block (SIB), or a reference signal (RS) transmission from the network device.

3. The method of claim 1, wherein:

the random access preamble and the random access payload are transmitted without any adjustment based on a propagation delay of transmissions between the UE and the network device.

4. The method of claim 1, wherein the random access preamble is transmitted in a first transmission slot and the random access payload is transmitted in a second transmission slot that is different than the first transmission slot.

5. The method of claim 1, wherein the random access preamble and the random access payload have one or more of a different sub-carrier spacing (SCS), transmission

power, transmission channel bandwidth, transmission or receiving beam configurations, fast Fourier transform (FFT) sampling rate, or any combinations thereof.

6. The method of claim 1, wherein the determining the time duration of the transmission gap comprises:

selecting an initial transmission gap duration based at least in part on the configuration of the random access channel resources; and

adjusting the initial transmission gap duration based at least in part on a timing adjustment for uplink transmissions from the UE to the network device to obtain the time duration of the transmission gap.

7. The method of claim 6, wherein the adjusting the initial transmission gap duration comprises:

subtracting the timing adjustment from the initial transmission gap duration.

8. The method of claim 6, wherein the selecting the initial transmission gap duration comprises:

identifying a guard time of the random access preamble based at least in part on a random access preamble length configuration;

identifying an error vector measurement (EVM) window of the random access payload based at least in part on the configuration of the random access channel resources; and

selecting the initial transmission gap duration from a set of available transmission gap durations based at least in part on the guard time and the EVM window.

9. The method of claim 8, wherein the set of available transmission gap durations include a plurality of transmission gap durations that are mapped to different combinations of values of the guard time and the EVM window.

10. The method of claim 8, wherein at least a subset of the set of available transmission gap durations are based at least in part on a transient period time mask duration for switching a wireless transmitter at the UE between a power-on state and a power-off state.

11. The method of claim 1, wherein the random access message is transmitted using shared radio frequency spectrum, and wherein the time duration of the transmission gap is

further based on a channel occupancy time of the random access message and an outcome of a listen-before-talk (LBT) procedure.

12. The method of claim 11, wherein at least a subset of a set of available transmission gap durations are based at least in part on the channel occupancy time of the random access message and the outcome of the LBT procedure.

13. The method of claim 1, further comprising:

estimating a propagation delay between the UE and the network device; and

determining a timing adjustment based at least in part on the estimated propagation delay, wherein the time duration of the transmission gap is further based at least in part on the timing adjustment.

14. The method of claim 11, further comprising:

determining whether to adjust the time duration of the transmission gap or both the time duration of the transmission gap and a starting time of the random access preamble based at least in part on one or more measurements of one or more downlink transmissions from the network device.

15. The method of claim 1, further comprising:

decoding one or more of a synchronization signal block (SSB), system information block (SIB), or a reference signal (RS) transmission from the network device;

determining the configuration of the random access channel resources based at least in part on the decoding;

estimating a propagation delay between the UE and the network device based at least in part on one or more of the SSB, SIB, or RS;

determining a timing adjustment based at least in part on the propagation delay;

generating the random access preamble and the random access payload for transmission in the random access message;

inserting the transmission gap between the random access preamble and the random access payload; and

applying the timing adjustment to one or more of the random access preamble or the random access payload.

16. The method of claim 1, wherein the random access message is a first message of a two-step random access procedure, and wherein the method further comprises:

receiving a second message of the two-step random access procedure from the network device responsive to transmitting the first message; and

performing a connection establishment procedure with the network device based at least in part on the second message.

17. A method for wireless communication by a network device, comprising:

transmitting a random access channel configuration to at least a first user equipment (UE) and a second UE, wherein the random access channel configuration provides random access channel resources for transmission of random access messages to the network device and information for a configurable transmission gap within the random access messages;

monitoring the random access channel resources for one or more random access messages from at least the first UE and the second UE; and

decoding at least a first random access message from the first UE and a second random access message from the second UE based at least in part on a time alignment of at least a portion of the first random access message and the second random access message that is provided by the configurable transmission gap, the time alignment providing that at least the portion of the first random access message and the second random access message are aligned in time, frequency, spatial resources, or a combination thereof and allows decoding of multiple random access messages at a single random access channel occasion at the network device based at least in part on the time alignment.

18. The method of claim 17, wherein the decoding comprises:

demultiplexing superimposed random access preambles and superimposed random access payloads from each of the first UE and the second UE; and

performing a joint detection procedure to decode the superimposed random access preambles and superimposed random access payloads of each of the first UE and the second UE.

19. The method of claim 18, wherein the joint detection procedure comprises one or more of multi-user decoding (MUD) or successive interference cancellation (SIC) to

decode the superimposed random access preambles and superimposed random access payloads of each of the first UE and the second UE.

20. The method of claim 17, wherein the configurable transmission gap is based at least in part on an initial transmission gap duration associated with the random access channel configuration and a timing adjustment applied to the initial transmission gap duration by each UE.

21. The method of claim 20, wherein the initial transmission gap duration is indicated by the random access channel configuration.

22. The method of claim 20, wherein the random access channel configuration indicates one or more of a guard time of a random access preamble, an error vector measurement (EVM) window of a random access payload, a transient period time mask duration for switching a wireless transmitter at each UE between a power-on state and a power-off state, or any combinations thereof.

23. The method of claim 22, wherein the initial transmission gap duration is indicated based on a set of available transmission gap durations that are mapped to different combinations of values of the guard time, the EVM window, the transient period time mask duration, or any combinations thereof.

24. The method of claim 17, wherein each of the first random access message and the second random access message is an original transmission of an initial random access message of a two-step random access procedure, or a re-transmission of the initial random access message of the two-step random access procedure, and wherein the method further comprises:

transmitting a final random access message of the two-step random access procedure to each of the first UE and the second UE; and

performing a connection establishment procedure with the first UE and the second UE based at least in part on the final random access message transmitted to the first UE and the second UE.

25. An apparatus for wireless communication at a user equipment (UE), comprising:

a processor,

memory in electronic communication with the processor; and

instructions stored in the memory and executable by the processor to cause the apparatus to:

receive, from a network device, a configuration of random access channel resources for transmission of a random access message that includes a random access preamble and a random access payload;

and

transmit, to the network device, the random access message based at least in part on a time duration of a transmission gap between an ending time of the random access preamble and a starting time of the random access payload, the time duration of the transmission gap being based at least in part on the configuration of the random access channel resources, and the starting time of the random access payload being aligned with a starting time of a random access occasion time window at the network device based at least in part on the time duration of the transmission gap.

26. The apparatus of claim 25, wherein:

the configuration of the random access channel resources is provided at least in part in one or more of a synchronization signal block (SSB), system information block (SIB), or a reference signal (RS) transmission from the network device.

27. The apparatus of claim 25, wherein:

the random access preamble and the random access payload are transmitted without any adjustment based on a propagation delay of transmissions between the UE and the network device.

28. The apparatus of claim 25, wherein the random access preamble is transmitted in a first transmission slot and the random access payload is transmitted in a second transmission slot that is different than the first transmission slot.

29. The apparatus of claim 25, wherein the random access preamble and the random access payload have one or more of a different sub-carrier spacing (SCS), transmission power, transmission channel bandwidth, transmission or receiving beam configurations, fast Fourier transform (FFT) sampling rate, or any combinations thereof.

30. The apparatus of claim 25, wherein the instructions are further executable by the processor to cause the apparatus to:

select an initial transmission gap duration based at least in part on the configuration of the random access channel resources; and

adjust the initial transmission gap duration based at least in part on a timing adjustment for uplink transmissions from the UE to the network device to obtain the time duration of the transmission gap.

31. The apparatus of claim 30, wherein the instructions are further executable by the processor to cause the apparatus to:

subtract the timing adjustment from the initial transmission gap duration.

32. An apparatus for wireless communication at a network device, comprising:

a processor,

memory in electronic communication with the processor; and

instructions stored in the memory and executable by the processor to cause the apparatus to:

transmit a random access channel configuration to at least a first user equipment (UE) and a second UE, wherein the random access channel configuration provides random access channel resources for transmission of random access messages to the network device and information for a configurable transmission gap within the random access messages;

monitor the random access channel resources for one or more random access messages from at least the first UE and the second UE; and

decode at least a first random access message from the first UE and a second random access message from the second UE based at least in part on a time

alignment of at least a portion of the first random access message and the second random access message that is provided by the configurable transmission gap, the time alignment providing that at least the portion of the first random access message and the second random access message are aligned in time, frequency, spatial resources, or a combination thereof and allows decoding of multiple random access messages at a single random access channel occasion at the network device based at least in part on the time alignment.

33. The apparatus of claim 32, wherein the instructions are further executable by the processor to cause the apparatus to:

demultiplex superimposed random access preambles and superimposed random access payloads from each of the first UE and the second UE; and

perform a joint detection procedure to decode the superimposed random access preambles and superimposed random access payloads of each of the first UE and the second UE.

34. The apparatus of claim 32, wherein the configurable transmission gap is based at least in part on an initial transmission gap duration associated with the random access channel configuration and a timing adjustment applied to the initial transmission gap duration by each UE.

35. The apparatus of claim 34, wherein the initial transmission gap duration is indicated by the random access channel configuration.

36. An apparatus for wireless communication at a user equipment (UE), comprising:

means for receiving, from a network device, a configuration of random access channel resources for transmission of a random access message that includes a random access preamble and a random access payload;

and

means for transmitting, to the network device, the random access message based at least in part on a time duration of a transmission gap between an ending time of the random access preamble and a starting time of the random access payload, the time duration of the transmission gap being based at least in part on the configuration of the random access channel

resources, and the starting time of the random access payload being aligned with a starting time of a random access occasion time window at the network device based at least in part on the time duration of the transmission gap.

37. The apparatus of claim 36, wherein:

the configuration of the random access channel resources is provided at least in part in one or more of a synchronization signal block (SSB), system information block (SIB), or a reference signal (RS) transmission from the network device.

38. The apparatus of claim 36, wherein:

the random access preamble and the random access payload are transmitted without any adjustment based on a propagation delay of transmissions between the UE and the network device.

39. The apparatus of claim 36, wherein the random access preamble is transmitted in a first transmission slot and the random access payload is transmitted in a second transmission slot that is different than the first transmission slot.

40. The apparatus of claim 36, wherein the random access preamble and the random access payload have one or more of a different sub-carrier spacing (SCS), transmission power, transmission channel bandwidth, transmission or receiving beam configurations, fast Fourier transform (FFT) sampling rate, or any combinations thereof.

41. An apparatus for wireless communication at a network device, comprising:

means for transmitting a random access channel configuration to at least a first user equipment (UE) and a second UE, wherein the random access channel configuration provides random access channel resources for transmission of random access messages to the network device and information for a configurable transmission gap within the random access messages;

means for monitoring the random access channel resources for one or more random access messages from at least the first UE and the second UE; and

means for decoding at least a first random access message from the first UE and a second random access message from the second UE based at least in part on a time alignment of at least a portion of the first random access message and the second random access message that is provided by the configurable transmission gap, the time alignment providing that at least the portion of the first random access message and the second random access message are aligned in time, frequency, spatial resources, or a combination thereof and allows decoding of multiple random access messages at a single random access channel occasion at the network device based at least in part on the time alignment.

42. The apparatus of claim 41, wherein the means for decoding demultiplexes superimposed random access preambles and superimposed random access payloads from each of the first UE and the second UE, and performs a joint detection procedure to decode the superimposed random access preambles and superimposed random access payloads of each of the first UE and the second UE.

43. The apparatus of claim 41, wherein the configurable transmission gap is based at least in part on an initial transmission gap duration associated with the random access channel configuration and a timing adjustment applied to the initial transmission gap duration by each UE.

44. The apparatus of claim 43, wherein the initial transmission gap duration is indicated by the random access channel configuration.