

CLAIMS

What is claimed is:

1. A method for transmitting a random access signal, comprising:

receiving configuration information, wherein the configuration information is used to

5 indicate a random access preamble length, a random access signal subcarrier spacing, and a data subcarrier spacing;

determining a subcarrier quantity parameter based on at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing, wherein the subcarrier quantity parameter comprises a first subcarrier quantity used to indicate a
10 frequency resource start location of a random access preamble and a frequency resource start location of a physical random access channel, and/or a second subcarrier quantity used to indicate a frequency resource end location of the random access preamble and a frequency resource end location of the physical random access channel;

generating a random access signal based on the subcarrier quantity parameter; and

15 sending the random access signal.

2. The method according to claim 1, wherein a value of the random access signal subcarrier spacing is any one of 120 kHz, 240 kHz, 480 kHz, 960 kHz, 1920 kHz, and 3840 kHz.

3. The method according to claim 1 or 2, wherein a value of the data subcarrier spacing is any one of 240 kHz, 480 kHz, 960 kHz, 1920 kHz, and 3840 kHz.

20 4. The method according to at least one of claims 1 to 3, wherein a value of the subcarrier quantity parameter is any one of -15 , -7 , -5 , -3 , -1 , 0 , 1 , 2 , 3 , 19 , 23 , 83 , and 107 .

5. The method according to any one of claims 1 to 4, wherein the determining a subcarrier quantity parameter based on at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing comprises:

25 determining a total subcarrier quantity frequency domain width based on the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing; and

determining the subcarrier quantity parameter based on the total subcarrier quantity frequency domain width, the random access signal subcarrier spacing, and the data subcarrier

spacing.

6. The method according to any one of claims 1 to 4, wherein the determining a subcarrier quantity parameter based on at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing comprises:

5 determining the subcarrier quantity parameter in the second target parameter based on the random access signal subcarrier spacing and the data subcarrier spacing in the first target parameter.

7. The method according to any one of claims 1 to 6, wherein the first subcarrier quantity and the second subcarrier quantity are the same.

10 8. The method according to claim 7, wherein the determining the subcarrier quantity parameter based on the total subcarrier quantity frequency domain width, the random access signal subcarrier spacing, and the data subcarrier spacing comprises:

the subcarrier quantity parameter $\bar{k}$ conforms to:

15
$$\bar{k} = \frac{(\frac{GP}{2} - \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5, \quad \bar{k} = \text{floor}(\frac{((12N_{RB}^{RA} - 1) \times \Delta f - (L_{RA} - 1) \times \Delta f_{RA})}{2\Delta f_{RA}})$$

wherein GP represents the total subcarrier quantity frequency domain width, Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, and $\bar{k}$ represents the subcarrier quantity parameter.

20 9. The method according to claim 7 or 8, wherein L_{RA} , Δf , Δf_{RA} , and $\bar{k}$ meet at least one of the following correspondences:

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	240	240	2
139	480	480	2
139	960	960	2
139	1920	1920	2
139	3840	3840	2
571	240	240	2

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
571	960	960	2
571	1920	1920	2
571	3840	3840	2
1151	480	480	0
1151	960	960	0
1151	1920	1920	0
1151	3840	3840	0

wherein Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, $\bar{k}$ represents the subcarrier quantity parameter, and L_{RA} represents the random access preamble length.

- 5 10. The method according to claim 7 or 8, wherein L_{RA} , Δf , Δf_{RA} , and $\bar{k}$ meet at least one of the following correspondences:

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	120	240	2
139	120	480	1
139	240	480	2
139	120	960	23
139	240	960	1
139	480	960	2
139	120	1920	19
139	240	1920	23
139	480	1920	1
139	960	1920	2
139	120	3840	107
139	240	3840	19

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	480	3840	23
139	960	3840	1
139	1920	3840	2
571	120	240	2
571	120	480	1
571	240	480	2
571	120	960	-1
571	240	960	1
571	480	960	2
571	120	1920	-5
571	240	1920	-1
571	480	1920	1
571	960	1920	2
571	120	3840	83
571	240	3840	-5
571	480	3840	-1
571	960	3840	1
571	1920	3840	2
1151	120	240	0
1151	120	480	-1
1151	240	480	0
1151	120	960	-3
1151	240	960	-1
1151	480	960	0
1151	120	1920	-7
1151	240	1920	-3
1151	480	1920	-1

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
1151	960	1920	0
1151	120	3840	-15
1151	240	3840	-7
1151	480	3840	-3
1151	960	3840	-1
1151	1920	3840	0

wherein Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, $\bar{k}$ represents the subcarrier quantity parameter, and L_{RA} represents the random access preamble length.

5 11. The method according to any one of claims 1 to 5, wherein the first subcarrier quantity and the total subcarrier quantity frequency domain width are the same, and the second subcarrier quantity is zero.

12. The method according to claim 11, wherein the determining the subcarrier quantity parameter based on the total subcarrier quantity frequency domain width, the random access
10 signal subcarrier spacing, and the data subcarrier spacing comprises:

the subcarrier quantity parameter $\bar{k}$ conforms to:

$$\bar{k} = \frac{(GP - \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5,$$

wherein GP represents the total subcarrier quantity frequency domain width, Δf
represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier
15 spacing, and $\bar{k}$ represents the subcarrier quantity parameter.

13. The method according to any one of claims 1 to 6, wherein the first subcarrier quantity is zero, and the second subcarrier quantity and the total subcarrier quantity frequency domain width are the same.

14. The method according to claim 13, wherein the determining the subcarrier quantity
20 parameter based on the random access signal subcarrier spacing and the data subcarrier spacing

comprises:

the subcarrier quantity parameter $\bar{k}$ conforms to:

$$\bar{k} = \frac{(GP - \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5,$$

wherein GP represents the total subcarrier quantity frequency domain width, Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, and $\bar{k}$ represents the subcarrier quantity parameter.

15. A method for transmitting a random access signal, comprising:

sending configuration information, wherein the configuration information is used to indicate a random access preamble length, a random access signal subcarrier spacing, and a data subcarrier spacing; and

receiving a random access signal, wherein the random access signal is generated based on a subcarrier quantity parameter, the subcarrier quantity parameter is determined by at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing, and the subcarrier quantity parameter comprises a first subcarrier quantity used to indicate a frequency resource start location of a random access preamble and a frequency resource start location of a physical random access channel, and/or a second subcarrier quantity used to indicate a frequency resource end location of the random access preamble and a frequency resource end location of the physical random access channel.

16. An apparatus for transmitting a random access signal, comprising:

a transceiver module, configured to receive configuration information, wherein the configuration information is used to indicate a random access preamble length, a random access signal subcarrier spacing, and a data subcarrier spacing; and

a processing module, configured to determine a subcarrier quantity parameter based on at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing, wherein the subcarrier quantity parameter comprises a first subcarrier quantity used to indicate a frequency resource start location of a random access preamble and a frequency resource start location of a physical random access channel, and/or a second subcarrier quantity used to indicate a frequency resource end location of the random

access preamble and a frequency resource end location of the physical random access channel, wherein

the processing module is further configured to generate a random access signal based on the subcarrier quantity parameter; and

5 the transceiver module is further configured to send the random access signal.

17. The apparatus according to claim 16, wherein a value of the random access signal subcarrier spacing is any one of 120 kHz, 240 kHz, 480 kHz, 960 kHz, 1920 kHz, and 3840 kHz.

18. The apparatus according to claim 16 or 17, wherein a value of the data subcarrier spacing is any one of 240 kHz, 480 kHz, 960 kHz, 1920 kHz, and 3840 kHz.

10 19. The apparatus according to at least one of claims 16 to 18, wherein a value of the subcarrier quantity parameter is any one of -15, -7, -5, -3, -1, 0, 1, 2, 3, 19, 23, 83, and 107.

20. The apparatus according to any one of claims 16 to 19, wherein the processing module is specifically configured to:

15 determine a total subcarrier quantity frequency domain width based on the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing; and

determine the subcarrier quantity parameter based on the total subcarrier quantity frequency domain width, the random access signal subcarrier spacing, and the data subcarrier spacing.

20 21. The apparatus according to any one of claims 16 to 19, wherein the processing module is specifically configured to:

determine the subcarrier quantity parameter in the second target parameter based on the random access signal subcarrier spacing and the data subcarrier spacing in the first target parameter.

25 22. The apparatus according to any one of claims 16 to 21, wherein the first subcarrier quantity and the second subcarrier quantity are the same.

23. The apparatus according to claim 22, wherein the subcarrier quantity parameter $\bar{k}$ conforms to:

$$\bar{k} = \frac{(\frac{GP}{2} - \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5,$$

wherein GP represents the total subcarrier quantity frequency domain width, Δf

represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, and $\bar{k}$ represents the subcarrier quantity parameter.

24. The apparatus according to claim 22 or 23, wherein L_{RA} , Δf , Δf_{RA} , and $\bar{k}$ meet at least one of the following correspondences:

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	240	240	2
139	480	480	2
139	960	960	2
139	1920	1920	2
139	3840	3840	2
571	240	240	2
571	960	960	2
571	1920	1920	2
571	3840	3840	2
1151	480	480	0
1151	960	960	0
1151	1920	1920	0
1151	3840	3840	0

5

wherein Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, $\bar{k}$ represents the subcarrier quantity parameter, and L_{RA} represents the random access preamble length.

25. The apparatus according to claim 22 or 23, wherein L_{RA} , Δf , Δf_{RA} , and $\bar{k}$ meet at least one of the following correspondences:

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	120	240	2
139	120	480	1

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L_{RA}	Δf_{RA}	Δf	$\bar{k}$
139	240	480	2
139	120	960	23
139	240	960	1
139	480	960	2
139	120	1920	19
139	240	1920	23
139	480	1920	1
139	960	1920	2
139	120	3840	107
139	240	3840	19
139	480	3840	23
139	960	3840	1
139	1920	3840	2
571	120	240	2
571	120	480	1
571	240	480	2
571	120	960	-1
571	240	960	1
571	480	960	2
571	120	1920	-5
571	240	1920	-1
571	480	1920	1
571	960	1920	2
571	120	3840	83
571	240	3840	-5
571	480	3840	-1
571	960	3840	1

L_{RA}	Δf_{RA}	Δf	$\bar{k}$
571	1920	3840	2
1151	120	240	0
1151	120	480	-1
1151	240	480	0
1151	120	960	-3
1151	240	960	-1
1151	480	960	0
1151	120	1920	-7
1151	240	1920	-3
1151	480	1920	-1
1151	960	1920	0
1151	120	3840	-15
1151	240	3840	-7
1151	480	3840	-3
1151	960	3840	-1
1151	1920	3840	0

wherein Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, $\bar{k}$ represents the subcarrier quantity parameter, and L_{RA} represents the random access preamble length.

5 26. The apparatus according to any one of claims 16 to 20, wherein the first subcarrier quantity and the total subcarrier quantity frequency domain width are the same, and the second subcarrier quantity is zero.

27. The apparatus according to claim 26, wherein the subcarrier quantity parameter $\bar{k}$ conforms to:

$$10 \quad \bar{k} = \frac{(GP + \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5,$$

wherein GP represents the total subcarrier quantity frequency domain width, Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, and $\bar{k}$ represents the subcarrier quantity parameter.

28. The apparatus according to claim 21, wherein the first subcarrier quantity is zero, and the second subcarrier quantity and the total subcarrier quantity frequency domain width are the same.

29. The apparatus according to claim 28, wherein the subcarrier quantity parameter $\bar{k}$ conforms to:

$$\bar{k} = \frac{(0 - \frac{\Delta f}{2})}{\Delta f_{RA}} + 0.5,$$

wherein Δf represents the data subcarrier spacing, Δf_{RA} represents the random access signal subcarrier spacing, and $\bar{k}$ represents the subcarrier quantity parameter

30. An apparatus for transmitting a random access signal, comprising:

a sending module, configured to send configuration information, wherein the configuration information is used to indicate a random access preamble length, a random access signal subcarrier spacing, and a data subcarrier spacing; and

a receiving module, configured to receive a random access signal, wherein the random access signal is generated based on a subcarrier quantity parameter, the subcarrier quantity parameter is determined by at least one of the random access preamble length, the random access signal subcarrier spacing, and the data subcarrier spacing, and the subcarrier quantity parameter comprises a first subcarrier quantity used to indicate a frequency resource start location of a random access preamble and a frequency resource start location of a physical random access channel, and/or a second subcarrier quantity used to indicate a frequency resource end location of the random access preamble and a frequency resource end location of the physical random access channel.

31. An apparatus, comprising a processor, configured to invoke a program stored in a memory, to perform the method according to any one of claims 1 to 14.

32. An apparatus, comprising a processor and an interface circuit, wherein the processor is configured to communicate with another apparatus by using the interface circuit, and perform the method according to any one of claims 1 to 14.

33. An apparatus, comprising a processor, configured to invoke a program stored in a memory, to perform the method according to claim 15.

34. An apparatus, comprising a processor and an interface circuit, wherein the processor is configured to communicate with another apparatus by using the interface circuit, and perform the method according to claim 15.

35. A terminal, comprising the apparatus according to claim 31 or 32.

36. A network device, comprising the apparatus according to claim 33 or 34.

37. A computer storage medium, wherein the computer storage medium stores instructions; and when the instructions are run, the method according to any one of claims 1 to 15 is implemented.

38. A computer program product, wherein when the computer program product runs on a processor, the processor is enabled to perform the method according to any one of claims 1 to 15.