CLAIMS

What is claimed is:

1. A channel listening method, wherein the method is applied to a nonsimultaneous transmit and receive multi-link device (NSTR MLD), and the method comprises:

~~the nonsimultaneous transmit and receive multi-link device comprises a first station STA and a second station STA, wherein the first STA transmits a first frame on a first link, the second STA transmits a second frame on a second link, the first frame is an acknowledgment block BA, the second frame is a BA, and an end time of the first frame is later than an end time of the second frame;~~

receiving, by the NSTR MLD, a first frame on a first link, wherein the first frame is a response frame;

receiving, by the NSTR MLD, a second frame on a second link, wherein the second frame is a response frame, and an end time of the first frame is later than an end time of the second frame, wherein the first link and the second link belong to a NSTR link pair;

determining, by the NSTR MLD, that at least one of the first frame and the second frame fails to be ~~transmitted~~received;

performing, by the NSTR MLD~~first STA~~, channel listening in a first interframe space after the first frame ends, wherein duration of the first interframe space is less than or equal to duration of a point coordination function interframe space (PIFS)~~; or~~

~~performing, by the second STA, channel listening in a second interframe space after the second frame ends, wherein duration of the second interframe space is greater than or equal to duration of a short interframe space SIFS and less than or equal to the duration of the PIFS~~.

2. The method according to claim 1, wherein when the first frame fails to be ~~transmitted~~received, the duration of the first interframe space is a difference between the PIFS and first time; and

a value range of the first time is 0 to 4 microseconds.

3. The method according to claim 1, wherein when the first frame fails to be received, the duration of the first interframe space is [PIFS–4, PIFS].

4. The method according to claim 1, wherein when the first frame is correctly received, the duration of the first interframe space is a difference between the PIFS and first time; and

a value range of the first time is 0 to 9 microseconds.

5. The method according to claim 1, wherein when the first frame is correctly received, the duration of the first interframe space is greater than or equal to a short interframe space SIFS.

6. The method according to any one of claims 1 to 5, wherein the method further comprises:

sending, by the NSTR MLD when the second frame is correctly received, a next physical protocol data unit (PPDU) after a second interframe space, wherein the second interframe space is equal to the duration of the PIFS.

7. The method according to any one of claims 1 to 5, wherein the method further comprises:

performing, by the NSTR MLD, channel listening in a second interframe space after the second frame ends, wherein duration of the second interframe space is the duration of the PIFS.

8. The method according to any one of claims 1 to 7, wherein at least one of the first frame and the second frame fails to be transmitted comprises:

the first frame triggers a physical layer receiving start indication (PHY-RXSTART.indication), and a frame check sequence (FCS) check of a media access control MAC layer of the first frame fails; or

the second frame triggers a PHY-RXSTART.indication, and a FCS check of a MAC layer of the second frame fails; or

the first frame triggers a PHY-RXSTART.indication, a frame check sequence (FCS) check of a MAC layer of the first frame fails, and the second frame triggers a PHY-RXSTART.indication, and a FCS check of a MAC layer of the second frame fails.

~~3. The method according to any one of claims 1 and 2, wherein when the second frame fails to be transmitted, the duration of the first interframe space is the difference between the PIFS and the first time; and~~

~~the value range of the first time is 0 to 4 microseconds, or the value range of the first time is 0 to 8 microseconds, or the value range of the first time is 0 to 9 microseconds, or the value range of the first time is 0 to 12 microseconds.~~

~~4. The method according to any one of claims 1 to 3, wherein when the first frame fails to be transmitted and the second frame fails to be transmitted, the duration of the first interframe space is the difference between the PIFS and the first time; and~~

~~the value range of the first time is 0 to 4 microseconds.~~

~~5. The method according to any one of claims 1 to 4, wherein when the first frame fails to be~~

~~transmitted, duration of the second interframe space is a sum of the short interframe space SIFS and second time; and~~

~~a value range of the second time is 0 to 4 microseconds.~~

~~6. The method according to any one of claims 1 to 5, wherein when the second frame fails to be transmitted, the duration of the second interframe space is a sum of the short interframe space SIFS and the second time; and~~

~~the value range of the second time is 0 to 4 microseconds, or the value range of the second time is 0 to 8 microseconds.~~

~~7. The method according to any one of claims 1 to 6, wherein when the first frame fails to be transmitted and the second frame fails to be transmitted, the duration of the second interframe space is the sum of the short interframe space SIFS and the second time; and~~

~~the value range of the second time is 0 to 4 microseconds, or the value range of the second time is 0 to 8 microseconds.~~

~~8~~9. A channel listening method, wherein the method is applied to a nonsimultaneous transmit and receive multi-link device (NSTR MLD), and the method comprises:

~~the nonsimultaneous transmit and receive multi-link device comprises a first station STA and a second station STA, wherein the first STA transmits a first frame on a first link, the second STA transmits a second frame on a second link, the first frame is a physical layer protocol data unit PPDU, the second frame is a PPDU, and an end time of the first frame is later than an end time of the second frame;~~

transmitting, by the NSTR MLD, a first frame on a first link, wherein the first frame is a physical layer protocol data unit (PPDU);

transmitting, by the NSTR MLD, a second frame on a second link, wherein the second frame is a PPDU, and an end time of the first frame is later than an end time of the second frame, wherein the first link and the second link belong to a NSTR link pair;

determining, by the NSTR MLD, that the first frame and the second frame fail to be transmitted;

performing, by the NSTR MLD~~first STA~~, channel listening in a third interframe space after the first frame ends, wherein the third interframe space is less than or equal to duration of a PIFS; or

performing, by the NSTR MLD~~second STA~~, channel listening in a fourth interframe space

after the second frame ends, wherein the fourth interframe space is greater than or equal to duration of a short interframe space (SIFS) and less than or equal to the duration of the PIFS.

~~9. The method according to claim 8, wherein time of the third interframe space is a difference between the PIFS and a third time; and~~

~~a value range of the third time is 0 to 4 microseconds, or a value range of the third time is 0 to 8 microseconds.~~

~~10. The method according to any one of claims 8 and 9, wherein the duration of the fourth interframe space is a sum of the short interframe space SIFS and a fourth time; and~~

~~a value range of the fourth time is 0 to 4 microseconds, or a value range of the fourth time is 0 to 8 microseconds.~~

~~11. The method according to any one of claims 8 to 10, wherein the method further comprises:~~

~~performing, by the second STA, channel listening in a fifth interframe space after fifth time after the second frame ends, wherein a sum of duration of the fifth interframe space and the fifth time is less than or equal to the duration of the PIFS.~~

~~12. The method according to claim 11, wherein a value range of the fifth time is 0 to 8 microseconds.~~

~~13~~10. A channel listening method, wherein the method is applied to a nonsimultaneous transmit and receive multi-link device (NSTR MLD), and the method comprises:

~~the nonsimultaneous transmit and receive multi-link device comprises a first station STA and a second station STA, wherein the first STA transmits a first frame on a first link, the second STA transmits a second frame on a second link, the first frame is an acknowledgment block physical layer protocol data unit PPDU, the second frame is a PPDU, and an end time of the first frame is later than an end time of the second frame;~~

transmitting, by the NSTR MLD, a first frame on a first link, wherein the first frame is a physical layer protocol data unit (PPDU);

transmitting, by the NSTR MLD, a second frame on a second link, wherein the second frame is a PPDU, and an end time of the first frame is later than an end time of the second frame, wherein the first link and the second link belong to a NSTR link pair;

performing, by the NSTR MLD~~second STA~~, channel listening in a sixth interframe space after the second frame ends, wherein duration of the sixth interframe space is a sum of an acknowledgment timeout (AckTimeout) and sixth time.

~~14. The method according to claim 13, wherein a value range of the sixth time is 0 to 4 microseconds.~~

~~15. The method according to any one of claims 13 and 14, wherein the method further comprises:~~

~~performing, by the second STA, channel listening in a seventh interframe space after seventh time after the second frame ends, wherein a sum of the seventh time and the seventh interframe space is equal to the duration of the sixth interframe space.~~

~~16. The method according to claim 15, wherein a value range of the seventh time is 0 to 8 microseconds.~~

~~17~~11. A nonsimultaneous transmit and receive multi-link device (NSTR MLD), wherein the nonsimultaneous transmit and receive multi-link device comprises a first station (STA) and a second ~~station~~ STA, the first STA ~~transmits~~receives a first frame on a first link, the second STA receives~~transmits~~ a second frame on a second link, the first frame is a response frame~~an acknowledgment block BA~~, the second frame is a response frame~~BA~~, an end time of the first frame is later than an end time of the second frame, and the NSTR MLD comprises a processing module and a listening module;

the processing module is configured to determine that at least one of the first frame and the second frame fails to be transmitted; and

the listening module is configured to perform channel listening in a first interframe space after the first frame ends, wherein duration of the first interframe space is less than or equal to duration of a point coordination function interframe space (PIFS)~~; or~~

~~the listening module is configured to perform channel listening in a second interframe space after the second frame ends, wherein duration of the second interframe space is greater than or equal to duration of a short interframe space SIFS and less than or equal to the duration of the PIFS~~.

~~18. The NSTR MLD according to claim 17, wherein when the first frame fails to be transmitted, the duration of the first interframe space is a difference between the PIFS and first time; and~~

~~the value range of the first time is 0 to 4 microseconds.~~

~~19. The NSTR MLD according to any one of claims 17 and 18, wherein when the second frame fails to be transmitted, the duration of the first interframe space is the difference between~~

~~the PIFS and the first time; and~~

~~the value range of the first time is 0 to 4 microseconds, or the value range of the first time is 0 to 8 microseconds, or the value range of the first time is 0 to 9 microseconds, or the value range of the first time is 0 to 12 microseconds.~~

~~20. The NSTR MLD according to any one of claims 17 to 19, wherein when the first frame fails to be transmitted and the second frame fails to be transmitted, the duration of the first interframe space is the difference between the PIFS and the first time; and~~

~~the value range of the first time is 0 to 4 microseconds.~~

~~21. The NSTR MLD according to any one of claims 17 to 20, wherein when the first frame fails to be transmitted, duration of the second interframe space is a sum of the short interframe space SIFS and second time; and~~

~~a value range of the second time is 0 to 4 microseconds.~~

~~22. The NSTR MLD according to any one of claims 17 to 21, wherein when the second frame fails to be transmitted, the duration of the second interframe space is a sum of the short interframe space SIFS and the second time; and~~

~~the value range of the second time is 0 to 4 microseconds, or the value range of the second time is 0 to 8 microseconds.~~

~~23. The NSTR MLD according to any one of claims 17 to 22, wherein when the first frame fails to be transmitted and the second frame fails to be transmitted, the duration of the second interframe space is the sum of the short interframe space SIFS and the second time; and~~

~~the value range of the second time is 0 to 4 microseconds, or the value range of the second time is 0 to 8 microseconds.~~

~~24~~12. A nonsimultaneous transmit and receive multi-link device (NSTR MLD), wherein the NSTR MLD comprises a first station (STA) and a second ~~station~~ STA, the first STA transmits a first frame on a first link, the second STA transmits a second frame on a second link, the first frame is a physical layer protocol data unit (PPDU), the second frame is a PPDU, an end time of the first frame is later than an end time of the second frame, and the NSTR MLD comprises a processing module and a listening module;

the processing module is configured to determine that the first frame and the second frame fail to be transmitted;

the listening module is configured to perform channel listening in a third interframe space

after the first frame ends, wherein the third interframe space is less than or equal to duration of a PIFS; or

the listening module is further configured to perform channel listening in a fourth interframe space after the second frame ends, wherein the fourth interframe space is greater than or equal to duration of a short interframe space (SIFS) and less than or equal to the duration of the PIFS.

~~25. The NSTR MLD according to claim 24, wherein duration of the third interframe space is a difference between the PIFS and a third time; and~~

~~a value range of the third time is 0 to 4 microseconds, or a value range of the third time is 0 to 8 microseconds, or a value range of the third time is 0 to 9 microseconds.~~

~~26. The NSTR MLD according to any one of claims 24 and 25, wherein the duration of the fourth interframe space is a sum of the short interframe space SIFS and a fourth time; and~~

~~a value range of the fourth time is 0 to 4 microseconds, or a value range of the fourth time is 0 to 8 microseconds.~~

~~27. The NSTR MLD according to any one of claims 24 to 26, wherein~~

~~the listening module is further configured to perform channel listening in a fifth interframe space after fifth time after the second frame ends, wherein a sum of duration of the fifth interframe space and the fifth time is less than or equal to the duration of the PIFS.~~

~~28. The NSTR MLD according to claim 27, wherein a value range of the fifth time is 0 to 8 microseconds.~~

~~29~~13. A nonsimultaneous transmit and receive multi-link device (NSTR MLD), wherein the NSTR MLD comprises a first station (STA) and a second ~~station~~ STA, the first STA transmits a first frame on a first link, the second STA transmits a second frame on a second link, the first frame is a physical layer protocol data unit (PPDU), the second frame is a PPDU, an end time of the first frame is later than an end time of the second frame, and the NSTR MLD comprises a processing module and a listening module;

the processing module is configured to determine that the first frame and the second frame fail to be transmitted;

the listening module is configured to perform channel listening in a sixth interframe space after the second frame ends, wherein duration of the sixth interframe space is a sum of an acknowledgment timeout (AckTimeout) and sixth time.

~~30. The NSTR MLD according to claim 29, wherein a value range of the sixth time is 0 to 4~~

~~microseconds.~~

~~31. The NSTR MLD according to any one of claims 29 and 30, wherein~~

~~the listening module is further configured to perform channel listening in a seventh interframe space after seventh time after the second frame ends, wherein a sum of the seventh time and the seventh interframe space is equal to the duration of the sixth interframe space.~~

~~32. The NSTR MLD according to claim 31, wherein a value range of the seventh time is 0 to 8 microseconds.~~

~~33. A multi-link device, wherein the multi-link device comprises a processor; and~~

~~when the multi-link device runs, the processor executes computer-executable instructions stored in a memory, so that the multi-link device performs the method according to any one of claims 1 to 7, claims 8 to 12, or claims 13 to 16.~~

~~34~~14. A computer-readable storage medium, wherein the computer-readable storage medium comprises computer instructions, and when the computer instructions are run on a nonsimultaneous transmit and receive multi-link device, NSTR MLD, the NSTR MLD~~multi-link device, the multi-link device~~ is enabled to perform the method according to any one of claims 1 to 10~~7, claims 8 to 12, or claims 13 to 16~~.

~~35~~15. A computer program product, wherein the computer program product comprises computer instructions, and when the computer instructions are run on a nonsimultaneous transmit and receive multi-link device, NSTR MLD~~multi-link device~~, the NSTR MLD~~multi-link device~~ is enabled to perform the method according to any one of claims 1 to ~~7~~10~~, claims 8 to 12, or claims 13 to 16~~.

~~36~~16. A chip, wherein the chip comprises a processor and a communication interface, the communication interface is configured to communicate with a module outside the chip, and the processor is configured to run a computer program or instructions to cause a nonsimultaneous transmit and receive multi-link device, NSTR MLD, comprising the chip implement the method according to any one of claims 1 to ~~7~~10~~, claims 8 to 12, or claims 13 to 16~~.