What is claimed is:

1. A spectrum sensing method, comprising:

determining feature data of a target sub-band; and

inputting the feature data into a trained spectrum sensing model to obtain a spectrum sensing result,

wherein the spectrum sensing result comprises a first result, the first result being used for indicating whether the target sub-band is occupied; and

in response to the first result indicating that the target sub-band is occupied, the spectrum sensing result further comprises a second result, the second result being used for indicating an angle of occupation of the target sub-band.

2. The method of claim 1, wherein the spectrum sensing model comprises a signal energy and angle sensing model configured for performing feature extraction of the feature data to obtain a signal energy feature and a signal angle feature, outputting the first result according to the signal energy feature and the signal angle feature, and outputting the second result in response to the first result indicating that the target sub-band is occupied.

3. The method of claim 1, wherein the spectrum sensing model comprises a signal energy sensing model and a signal angle sensing model, wherein:

the signal energy sensing model is configured for outputting the first result according to the feature data; and

the signal angle sensing model is configured for outputting the second result according to the feature data in response to the first result indicating that the target sub-band is occupied.

4. The method of claim 3, wherein the feature data comprises at least one of a horizontal-antenna covariance matrix, a vertical-antenna covariance matrix, or an all antenna covariance matrix.

5. The method of claim 4, wherein in response to the feature data comprising the horizontal-antenna covariance matrix and the vertical-antenna covariance matrix, the signal energy sensing model comprises:

a first signal energy sensing submodel, configured for performing feature extraction on the horizontal-antenna covariance matrix and outputting a horizontal antenna energy feature;

a second signal energy sensing submodel, configured for performing feature extraction on the vertical-antenna covariance matrix and outputting a vertical antenna energy feature; and

a third signal energy sensing submodel, configured for outputting the first result according to the horizontal antenna energy feature and the vertical antenna energy feature.

6. The method of claim 4, wherein in response to the feature data comprising the horizontal-antenna covariance matrix and the vertical-antenna covariance matrix, the signal angle sensing model comprises:

a first signal angle sensing submodel, configured for performing feature extraction on the horizontal-antenna covariance matrix and outputting a horizontal antenna angle feature;

a second signal angle sensing submodel, configured for performing feature extraction on the vertical-antenna covariance matrix and outputting a vertical antenna angle feature; and

a third signal angle sensing submodel, configured for outputting the second result according to the horizontal antenna angle feature and the vertical antenna angle feature.

7. The method of claim 1, wherein the feature data is an antenna covariance matrix; and

determining feature data of a target sub-band comprises:

acquiring first frequency-domain data of the target sub-band according to a predefined sensing granularity; and

obtaining an antenna covariance matrix of the target sub-band through calculation according to the first frequency-domain data.

8. The method of claim 7, wherein the predefined sensing granularity comprises a time-domain sensing granularity and a frequency-domain sensing granularity, the time-domain sensing granularity is used for indicating a number of time-domain sensing units, and the frequency-domain sensing granularity is used for indicating a number of frequency-domain sensing units; and

acquiring first frequency-domain data of the target sub-band according to a predefined sensing granularity comprises:

acquiring a time-domain received signal from a target antenna;

performing a discrete Fourier transform on the time-domain received signal to obtain full-bandwidth frequency-domain data of the target antenna; and

acquiring the first frequency-domain data of the target sub-band in the target antenna from the full-bandwidth frequency-domain data, wherein the first frequency-domain data comprises a plurality of pieces of second frequency-domain data, each corresponding to one time-domain sensing unit and one frequency-domain sensing unit.

9. The method of claim 8, wherein the target antenna comprises a plurality of receiving antennas in an antenna array, and the antenna covariance matrix comprises a horizontal-antenna covariance matrix; and

obtaining an antenna covariance matrix of the target sub-band through calculation according to the first frequency-domain data comprises:

grouping the plurality of receiving antennas into a plurality of horizontal antenna groups;

for each respective one of the horizontal antenna groups, constructing a plurality of first data matrices corresponding to the respective horizontal antenna group according to the first frequency-domain data corresponding to the respective horizontal antenna group and the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain data in the first frequency-domain data, wherein each of the first data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit;

calculating a horizontal-antenna-group covariance matrix corresponding to the respective horizontal antenna group according to the plurality of first data matrices corresponding to the respective horizontal antenna group; and

calculating a horizontal-antenna covariance matrix of the target sub-band according to the horizontal-antenna-group covariance matrices; or

wherein the target antenna comprises a plurality of receiving antennas in an antenna array, and the antenna covariance matrix comprises a vertical-antenna covariance matrix; and

obtaining an antenna covariance matrix of the target sub-band through calculation according to the first frequency-domain data comprises:

grouping the plurality of receiving antennas into a plurality of vertical antenna groups;

for each respective one of the vertical antenna groups, constructing a plurality of second data matrices corresponding to the respective vertical antenna group according to the first frequency-domain data corresponding to the respective vertical antenna group and the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain data in the first frequency-domain data, wherein each of the second data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit;

calculating a vertical-antenna-group covariance matrix corresponding to the respective vertical antenna group according to the plurality of second data matrices corresponding to the respective vertical antenna group; and

calculating a vertical-antenna covariance matrix of the target sub-band according to the vertical-antenna-group covariance matrices; or

wherein the target antenna comprises a plurality of receiving antennas in an antenna array; the antenna covariance matrix comprises an all antenna covariance matrix; and

obtaining an antenna covariance matrix of the target sub-band through calculation according to the first frequency-domain data comprises:

constructing a plurality of third data matrices according to the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain data in the first frequency-domain data, wherein each of the third data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit; and

obtaining the all antenna covariance matrix of the target sub-band through calculation according to the plurality of third data matrices.

10. The method of claim 7, wherein before acquiring first frequency-domain data of the target sub-band according to a predefined sensing granularity, the method further comprises:

dividing a full bandwidth into a plurality of sub-bands, wherein a number of frequency-domain sensing units in each of the sub-bands is less than or equal to a number of frequency-domain sensing units indicated by a frequency-domain sensing granularity.

11. The method of claim 1, wherein a process of training the spectrum sensing model comprises:

acquiring a training sample set of a sub-band, wherein the training sample set comprises a plurality of first training samples and a plurality of second training samples, the first training samples each comprise sample feature data corresponding to the sub-band in an unoccupied state and a first label, the second training samples each comprise sample feature data corresponding to the sub-band in an occupied state, a second sample label, and a third sample label, the first sample label is used for indicating that the sub-band is not occupied, the second sample label is used for indicating that the sub-band is occupied, and the third sample label is used for indicating an angle of occupation of the sub-band; and

training the spectrum sensing model based on the training sample set until a preset training ending condition is satisfied, to obtain the trained spectrum sensing model.

12. The method of claim 11, wherein the spectrum sensing model comprises a signal energy and angle sensing model configured for performing feature extraction of the sample feature data to obtain a signal energy feature and a signal angle feature, outputting the first result according to the signal energy feature and the signal angle feature, and outputting the second result in response to the first result indicating that the sub-band is occupied.

13. The method of claim 11, wherein the spectrum sensing model comprises a signal energy sensing model and a signal angle sensing model, wherein:

the signal energy sensing model is configured for outputting the first result according to the sample feature data; and

the signal angle sensing model is configured for outputting the second result according to the sample feature data in response to the first result indicating that the sub-band is occupied.

14. The method of claim 13, wherein the sample feature data comprises at least one of a horizontal-antenna covariance matrix, a vertical-antenna covariance matrix, or an all antenna covariance matrix.

15. The method of claim 14, wherein in response to the sample feature data comprising the horizontal-antenna covariance matrix and the vertical-antenna covariance matrix, the signal energy sensing model comprises:

a first signal energy sensing submodel, configured for performing feature extraction on the horizontal-antenna covariance matrix and outputting a horizontal antenna energy feature;

a second signal energy sensing submodel, configured for performing feature extraction on the vertical-antenna covariance matrix and outputting a vertical antenna energy feature; and

a third signal energy sensing submodel, configured for outputting the first result according to the horizontal antenna energy feature and the vertical antenna energy feature; or

wherein in response to the sample feature data comprising the horizontal-antenna covariance matrix and the vertical-antenna covariance matrix, the signal angle sensing model comprises:

a first signal angle sensing submodel, configured for performing feature extraction on the horizontal-antenna covariance matrix and outputting a horizontal antenna angle feature;

a second signal angle sensing submodel, configured for performing feature extraction on the vertical-antenna covariance matrix and outputting a vertical antenna angle feature; and

a third signal angle sensing submodel, configured for outputting the second result

according to the horizontal antenna angle feature and the vertical antenna angle feature.

16. The method of claim 11, wherein the sample feature data is an antenna covariance matrix; and

a process of acquiring the sample feature data comprises:

acquiring first frequency-domain sample data of the sub-band according to a predefined sensing granularity; and

obtaining an antenna covariance matrix of the sub-band through calculation according to the first frequency-domain sample data.

17. The method of claim 16, wherein the predefined sensing granularity comprises a time-domain sensing granularity and a frequency-domain sensing granularity, the time-domain sensing granularity is used for indicating a number of time-domain sensing units, and the frequency-domain sensing granularity is used for indicating a number of frequency-domain sensing units; and

acquiring first frequency-domain sample data of the sub-band according to a predefined sensing granularity comprises:

acquiring a time-domain received sample signal from a target antenna;

performing a discrete Fourier transform on the time-domain received sample signal to obtain full-bandwidth frequency-domain sample data of the target antenna; and

acquiring the first frequency-domain sample data of the sub-band in the target antenna from the full-bandwidth frequency-domain sample data, wherein the first frequency-domain sample data comprises a plurality of pieces of second frequency-domain sample data, each corresponding to one time-domain sensing unit and one frequency-domain sensing unit.

18. The method of claim 17, wherein the target antenna comprises a plurality of receiving antennas in an antenna array, and the antenna covariance matrix comprises a horizontal-antenna covariance matrix; and

obtaining an antenna covariance matrix of the sub-band through calculation according to the first frequency-domain sample data comprises:

grouping the plurality of receiving antennas into a plurality of horizontal antenna groups;

for each respective one of the horizontal antenna groups, constructing a plurality of first data matrices corresponding to the respective horizontal antenna group according to the

first frequency-domain sample data corresponding to the respective horizontal antenna group and the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain sample data in the first frequency-domain sample data, wherein each of the first data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit;

calculating a horizontal-antenna-group covariance matrix corresponding to the respective horizontal antenna groups according to the plurality of first data matrices corresponding to the respective horizontal antenna group; and

calculating a horizontal-antenna covariance matrix of the sub-band according to the horizontal-antenna-group covariance matrices; or

wherein the target antenna comprises a plurality of receiving antennas in an antenna array, and the antenna covariance matrix comprises a vertical-antenna covariance matrix; and

obtaining an antenna covariance matrix of the sub-band through calculation according to the first frequency-domain sample data comprises:

grouping the plurality of receiving antennas into a plurality of vertical antenna groups;

for each respective one of the vertical antenna groups, constructing a plurality of second data matrices corresponding to the respective vertical antenna group according to the first frequency-domain sample data corresponding to the respective vertical antenna group and the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain sample data in the first frequency-domain sample data, wherein each of the second data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit;

calculating a vertical-antenna-group covariance matrix corresponding to the respective vertical antenna groups according to the plurality of second data matrices corresponding to the respective vertical antenna group; and

calculating a vertical-antenna covariance matrix of the sub-band according to the vertical-antenna-group covariance matrices; or

wherein the target antenna comprises a plurality of receiving antennas in an antenna array; the antenna covariance matrix comprises an all antenna covariance matrix; and

obtaining an antenna covariance matrix of the sub-band through calculation according to the first frequency-domain sample data comprises:

constructing a plurality of third data matrices according to the time-domain sensing unit and the frequency-domain sensing unit corresponding to each piece of second frequency-domain sample data in the first frequency-domain sample data, wherein each of the third data matrices corresponds to one time-domain sensing unit and one frequency-domain sensing unit; and

obtaining the all antenna covariance matrix of the sub-band through calculation according to the plurality of third data matrices.

19. An electronic device, comprising:

a processor and a memory,

the memory stores program instructions which, when executed by the processor, cause the processor to perform the method of any of claims 1 to 18.

20. A computer-readable storage medium, storing program instructions which, when executed by a computer, cause the computer to perform the method of any of claims 1 to 18.