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(54) **HOST WITH MULTIPLE ANTENNAS**

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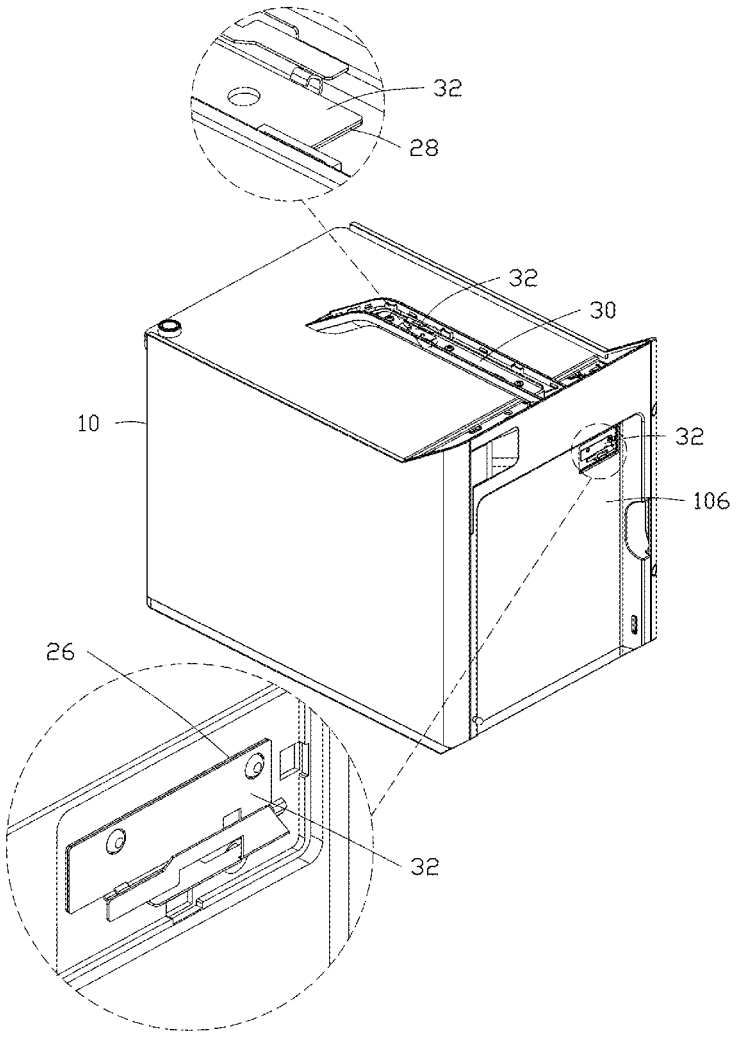
CPC ***H01Q 1/523*** (2013.01); ***H01Q 9/0421*** (2013.01); ***H01Q 5/20*** (2015.01); ***H01Q 1/24*** (2013.01)

(57) **ABSTRACT**

A host with multiple antennas so as to be capable of Wi-Fi and X-box functioning includes a chassis, and first to fourth antennas. The first antenna and the second antenna are each on an edge area of a first side wall of the chassis, the third antenna is located on a second side wall of the chassis, and the fourth antenna is located on a third side wall of the chassis. The first side wall is located between the second side wall and the third side wall, and the second side wall is located opposite to the third side wall. A separation distance between every two antennas of the first to fourth antennas is greater than a predetermined distance and enables isolation requirements for all antenna types to be met.



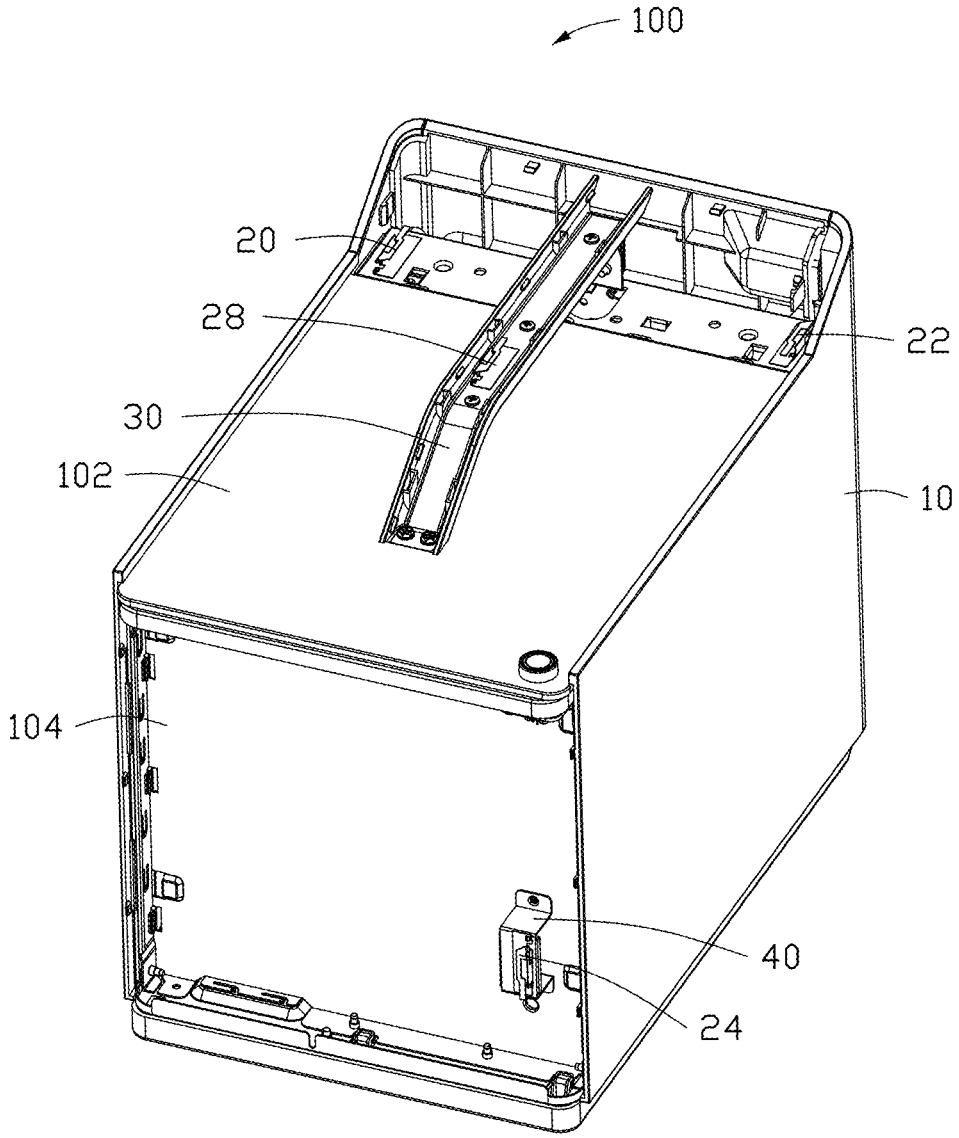


FIG. 1

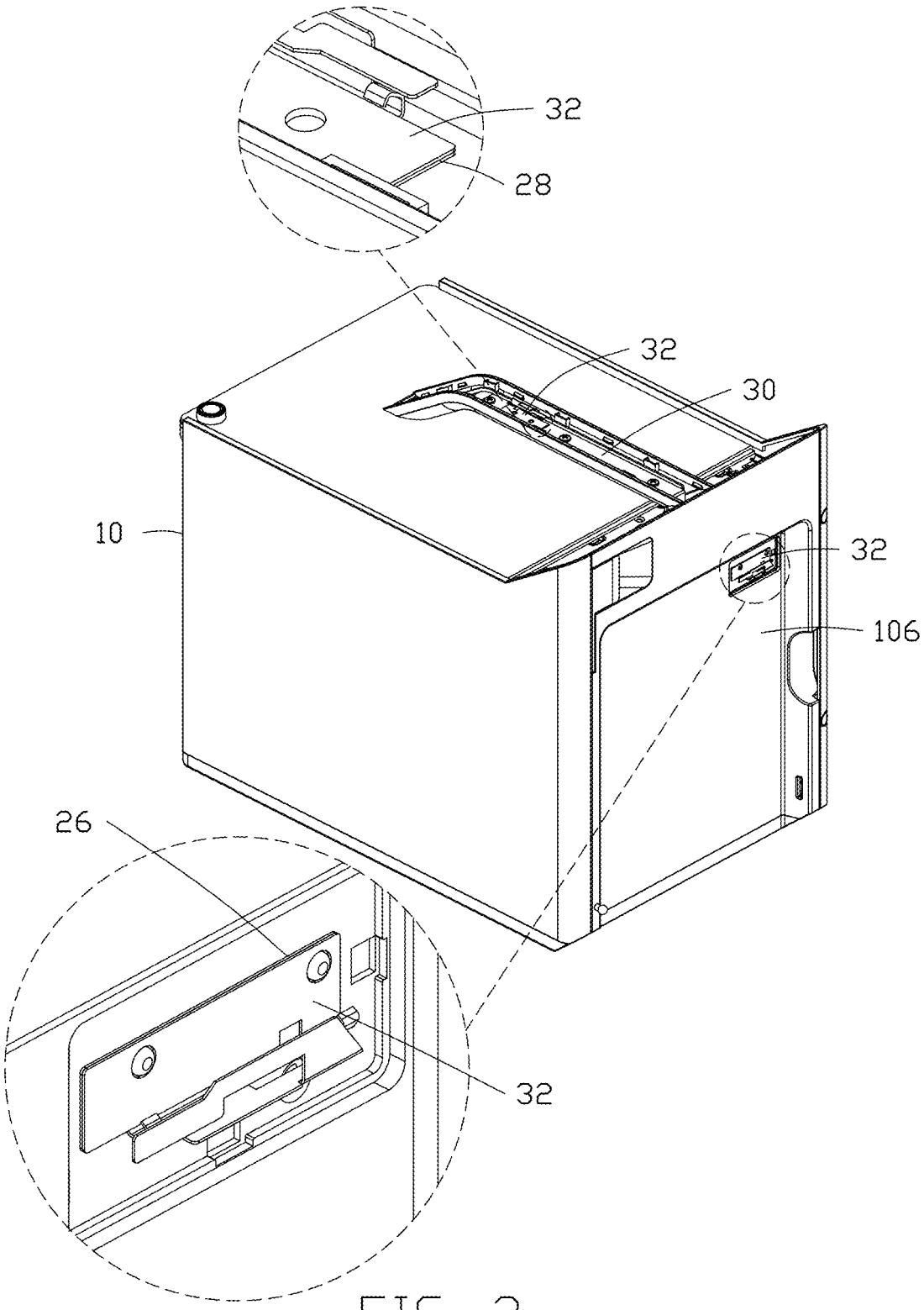


FIG. 2

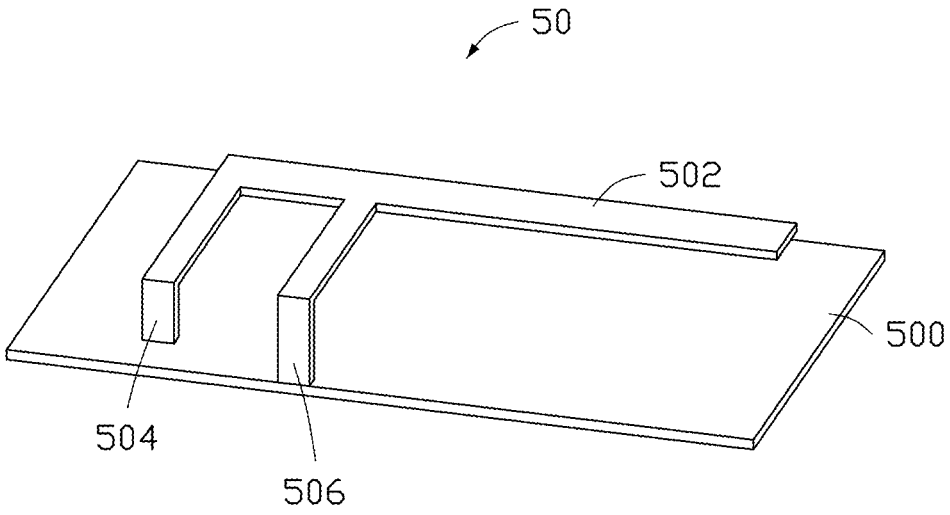


FIG. 3

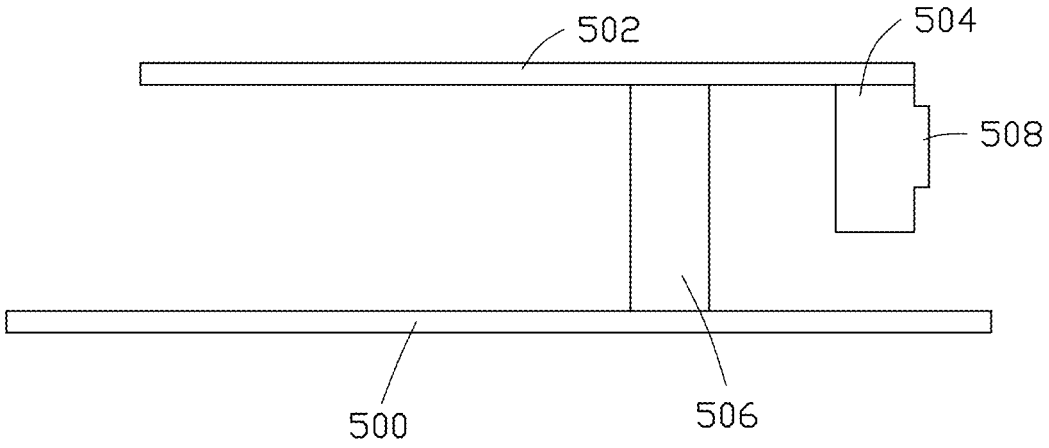
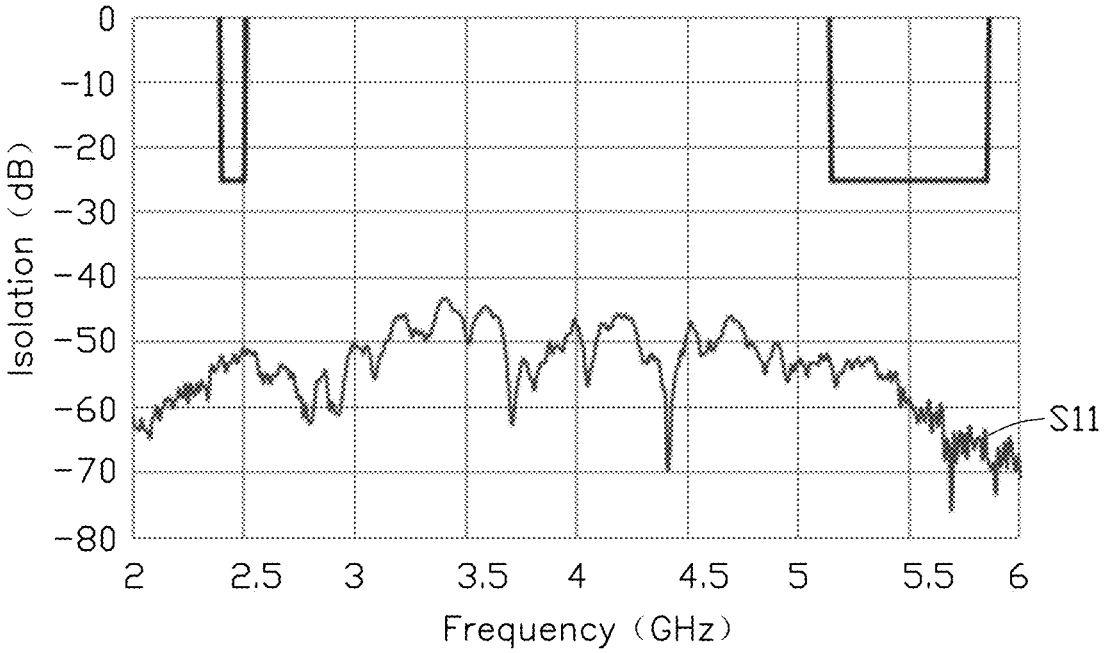


FIG. 4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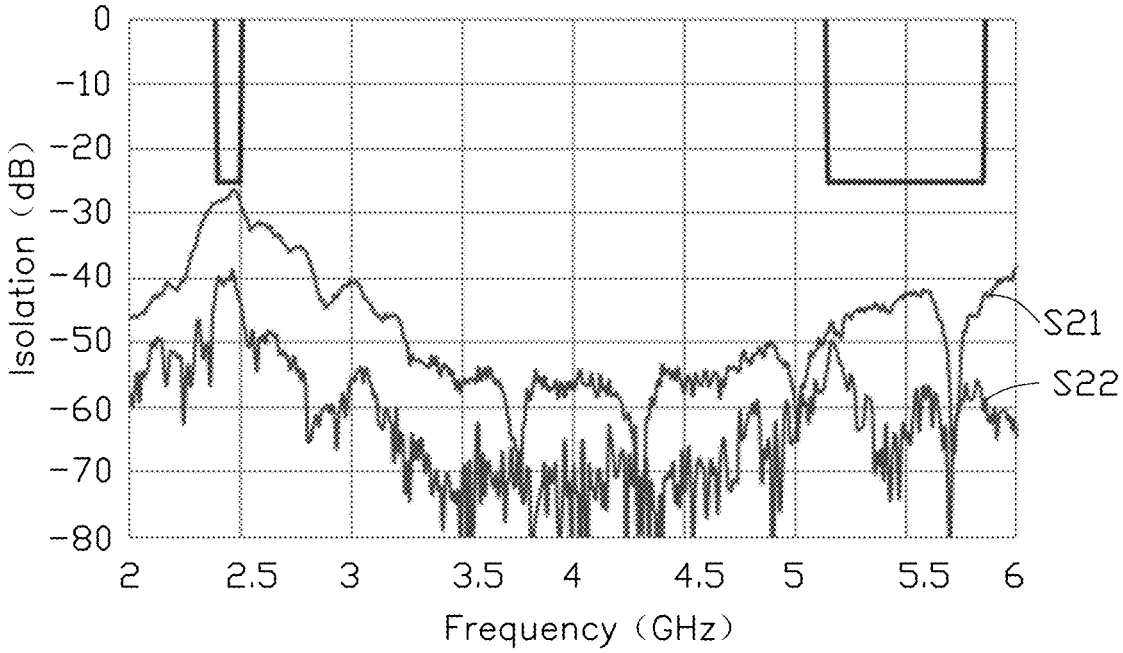
-10
-20
-30
-40
-50
-60
-70
-80
Isolation (dB)
2
2.5
3
3.5
4
4.5
5
5.5
6
Frequency (GHz)
S11

FIG. 5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-40
-50
-60
-70
-80
Isolation (dB)
2
2.5
3
3.5
4
4.5
5
5.5
6
Frequency (GHz)
S21
S22

FIG. 6

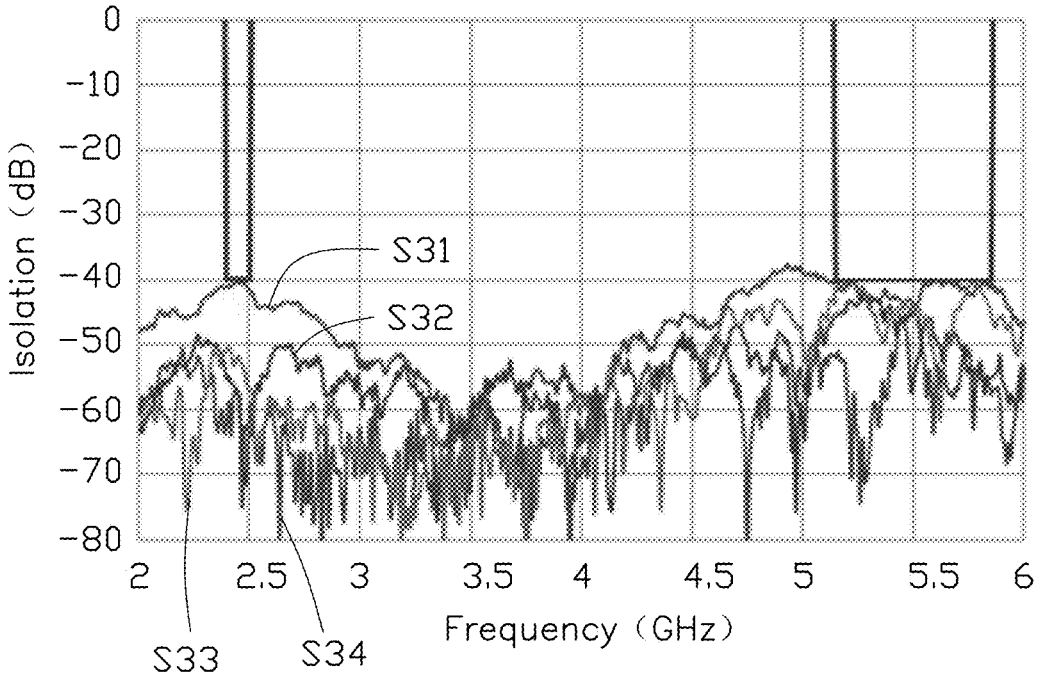
0
-10
-20
-30
-40
-50
-60
-70
-80
Isolation (dB)
2
2.5
3
3.5
4
4.5
5
5.5
6
Frequency (GHz)
S31
S32
S33
S34

FIG. 7

HOST WITH MULTIPLE ANTENNAS

FIELD

[0001] The subject matter herein generally relates to wireless communication.

BACKGROUND

[0002] A computer host may comprise a plurality of antennas. Mutual interference may occur between two or more antennas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Implementations of the present technology will now be described, by way of example only, with reference to the attached figures.

[0004] FIG. **1** is an isometric view of an embodiment of a host with multiple antennas.

[0005] FIG. **2** is similar to FIG. **1**, but shown from another angle.

[0006] FIG. **3** is a stereoscopic view of an embodiment of an inverted-F antenna of the multiple antennas of FIG. **1**.

[0007] FIG. **4** is a side view of an embodiment of the inverted-F antenna of FIG. **3**.

[0008] FIG. **5** is an isolation parameter graph of an embodiment of two Wi-Fi antennas of the multiple antennas of FIG. **1**.

[0009] FIG. **6** is an isolation parameter graph of an embodiment of a 2.4 GHz X-Bob antenna and the two Wi-Fi antennas of the multiple antennas of FIG. **1**.

[0010] FIG. **7** is an isolation parameter graph of an embodiment of two 5 GHz X-Bob antennas and the two Wi-Fi antennas of the multiple antennas of FIG. **1**.

DETAILED DESCRIPTION

[0011] It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features of the present disclosure. It should be noted that references to "an" or "one" embodiment in this disclosure are not necessarily to the same embodiment, and such references mean "at least one".

[0012] Several definitions that apply throughout this disclosure will now be presented.

[0013] The term "coupled" is defined as connected, whether directly or indirectly through intervening components, and is not necessarily limited to physical connections. The connection can be such that the objects are permanently connected or releasably connected. The term "comprising," when utilized, means "including, but not necessarily limited to"; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series, and the like.

[0014] FIG. **1** illustrates a multi-antenna host **100** in accordance with an embodiment. The multi-antenna host **100** may be a desktop host.

[0015] The multi-antenna host **100** comprises a chassis **10**, a first antenna **20**, a second antenna **22**, a third antenna **24**, a fourth antenna **26** (as shown in FIG. **2**), and a fifth antenna **28** (as shown in FIG. **2**). The chassis **10** may be a quasi-cuboid shape and comprise six side walls. The first antenna **20** and the second antenna **22** are each located on an edge area of a first side wall **102** of the chassis **10**. The third antenna **24** is located on a second side wall **104** of the chassis **10** and the fourth antenna **26** is located on a third side wall **106** of the chassis **10**. The first side wall **102** is located between the second side wall **104** and the third side wall **106**, and the second side wall **104** is located opposite to the third side wall **106**.

[0016] The multi-antenna host **100** further comprises a carrying handle **30**. The carrying handle **30** is installed on a middle area of the first side wall **102**, and the fifth antenna **28** is set in the carrying handle **30**. To avoid antenna interference among the antennas **20-28**, a separation distance between every two antennas is greater than a predetermined distance.

[0017] In one embodiment, the carrying handle **30** can be made of insulating materials. The carrying handle **30** is made of plastic for example. The predetermined distance can be 150 millimeters for example.

[0018] In one embodiment, the first antenna **20** is arranged parallel to the second antenna **22**, the third antenna **24** is arranged vertical to the first antenna **20**, and the fourth antenna **26** is arranged vertical to the first antenna **20**. The antennas **20-26** are orthogonally arranged in the space. Each antenna **20-26** can thus have good transmitting/receiving efficiency.

[0019] In one embodiment, the first antenna **20** and the second antenna **22** are arranged symmetrically relative to the carrying handle **30**.

[0020] Referring to FIG. **2**, the multi-antenna host **100** comprises a plurality of antenna covers **32**, each of the plurality of antenna covers **32** covers an antenna. For example, the multi-antenna host **100** comprises five antenna covers to protect the first antenna **20**, the second antenna **22**, the third antenna **24**, the fourth antenna **26**, and the fifth antenna **28**.

[0021] In one embodiment, the first antenna **20** can be a first X-Box antenna and a frequency of the first X-Box antenna can be 2.4 GHz. The second antenna **22** can be a second X-Box antenna and a frequency of the second X-Box antenna can be 5 GHz. The third antenna **24** can be a first Wi-Fi antenna and a frequency of the first Wi-Fi antenna can be 2.4 GHz. The fourth antenna **26** can be a second Wi-Fi antenna and a frequency of the second Wi-Fi antenna can be 5 GHz. The fifth antenna **28** can be a third X-Box antenna and a frequency of the third X-Box antenna can be 5 GHz.

[0022] In one embodiment, the multi-antenna host **100** further comprises an antenna bracket **40**. A location of the third antenna **24** comprises a plurality of metal parts and the third antenna **24** is located on the antenna bracket **40** to avoid being sheltered by such metal parts.

[0023] Referring to FIG. **3**, the first antenna **20**, the second antenna **22**, the third antenna **24**, the fourth antenna **26**, and

the fifth antenna **28** are inverted-F antennas **50**. The sizes of the first antenna **20**, the second antenna **22**, the third antenna **24**, the fourth antenna **26**, and the fifth antenna **28** are each different. The inverted-F antenna **50** comprises a base board **500**, a radiating portion **502**, a feeding portion **504**, and a ground portion **506**. The radiating portion **502** is parallel to the base board **500**, and the feeding portion **504** and the ground portion **506** are vertically coupled to the radiating portion **502**.

[0024] Referring to FIG. **4**, the ground portion **506** is vertically coupled to the base board **500**, and the feeding portion **504** is vertical to the base board **500**. The feeding portion **504** and the base board **500** define an interval D**1** therebetween. The feeding portion **504** comprises a feeding point **508** and a signal flows to the feeding point **508** to activate the radiating portion **502**.

[0025] FIG. **5** illustrates an embodiment of a first isolation parameter graph S**11** as between the third antenna **24** and the fourth antenna **26**. As FIG. **5** shows, a first isolation between the third antenna **24** and the fourth antenna **26** is less than −50 dB in 2.4 GHz frequency and 5 GHz frequency. The first isolation between the third antenna **24** and the fourth antenna **26** matches isolation requirement as between two Wi-Fi antennas.

[0026] FIG. **6** illustrates an embodiment of a second isolation parameter graph S**21** as between the first antenna **20** and the third antenna **24**. A third isolation parameter graph S**22** between the first antenna **20** and the fourth antenna **26** is also shown. According to FIG. **6**, a second isolation between the first antenna **20** and the third antenna **24** is less than −25 dB in 2.4 GHz frequency and 5 GHz frequency, and a third isolation between the first antenna **20** and the fourth antenna **26** is also less than −25 dB in 2.4 GHz frequency and 5 GHz. The second isolation and the third isolation match isolation requirement as between a 2.4 GHz X-Box antenna and a Wi-Fi antenna.

[0027] FIG. **7** illustrates an embodiment of a fourth isolation parameter graph S**31** as between the second antenna **22** and the third antenna **24**, and a fifth isolation parameter graph S**32** as between the fifth antenna **28** and the third antenna **24**. A sixth isolation parameter graph S**33** between the second antenna **22** and the fourth antenna **26**, and a seventh isolation parameter graph S**34** between the fifth antenna **28** and the fourth antenna **26** are also shown. According to FIG. **7**, a fourth isolation between the second antenna **22** and the third antenna **24** is less than −40 dB in 2.4 GHz frequency and 5 GHz frequency, and a fifth isolation between the fifth antenna **28** and the third antenna **24** is less than −40 dB in 2.4 GHz frequency and 5 GHz. The sixth isolation between the second antenna **22** and the fourth antenna **26** is less than −40 dB in 2.4 GHz frequency and 5 GHz frequency, and the seventh isolation between the fifth antenna **28** and the fourth antenna **26** is also less than −40 dB in 2.4 GHz frequency and 5 GHz. The fourth isolation, the fifth isolation, the sixth isolation, and the seventh isolation match isolation requirements between a 5 GHz X-Box antenna and a Wi-Fi antenna.

[0028] The embodiments shown and described above are only examples. Many details known in the field are neither shown nor described. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may be made in the detail, including in matters of shape, size, and arrangement of the parts within the principles of the present disclosure, up to and including the full extent established by the broad general meaning of the terms used in the claims. It will therefore be appreciated that the embodiments described above may be modified within the scope of the claims.

What is claimed is:

1. A multi-antenna host comprising:

a chassis being a quasi-cuboid shape and comprising a first side wall, a second side wall, and a third side wall;

a first antenna;

a second antenna;

a third antenna; and

a fourth antenna;

wherein the first antenna and the second antenna are each located on an edge area of the first side wall, the third antenna is located on the second side wall, and the fourth antenna is located on the third side wall; the first side wall is located between the second side wall and the third side wall, and the second side wall is located opposite to the third side wall; and a separation distance between every two antennas of the first antenna, the second antenna, the third antenna, and the fourth antenna is greater than a predetermined distance.

2. The multi-antenna host of claim **1**, further comprising a fifth antenna, wherein a carrying handle is installed on a middle area of the first side wall and the fifth antenna is set in the carrying handle, and a separation distance between every two antennas of the first antenna, the second antenna, the third antenna, the fourth antenna, and the fifth antenna is greater than the predetermined distance.

3. The multi-antenna host of claim **2**, wherein the first antenna and the second antenna are arranged symmetrically relative to the carrying handle.

4. The multi-antenna host of claim **2**, wherein the predetermined distance is 150 millimeters.

5. The multi-antenna host of claim **2**, wherein the first antenna is a first X-Box antenna and a frequency of the first X-Box antenna is 2.4 GHz; the second antenna is a second X-Box antenna and a frequency of the second X-Box antenna is 5 GHz; the third antenna is a first wireless fidelity (Wi-Fi) antenna and a frequency of the first Wi-Fi antenna is 2.4 GHz; the fourth antenna is a second Wi-Fi antenna and a frequency of the second Wi-Fi antenna is 5 GHz; and the fifth antenna is a third X-Box antenna and a frequency of the third X-Box antenna is 5 GHz.

6. The multi-antenna host of claim **2**, wherein the first antenna, the second antenna, the third antenna, the fourth antenna, and the fifth antenna are inverted-F antennas; the inverted-F antenna comprises a base board, a radiating portion, a feeding portion, and a ground portion; the radiating portion is parallel to the base board, the feeding portion and the ground portion are vertically coupled to the radiating portion.

7. The multi-antenna host of claim **6**, wherein the ground portion is vertically coupled to the base board, the feeding portion is vertical to the base board, and the feeding portion and the base board define an interval therebetween.

8. The multi-antenna host of claim **1**, further comprising an antenna bracket, wherein the third antenna is located on the antenna bracket to avoid being sheltered by metal parts.

9. The multi-antenna host of claim **1**, wherein the first antenna is arranged parallel to the second antenna, the third

antenna is arranged vertical to the first antenna, and the fourth antenna is arranged vertical to the first antenna.

10. A multi-antenna host comprising:

a chassis being a quasi-cuboid shape and comprising a first side wall, a second side wall, and a third side wall;

a first antenna;

a second antenna;

a third antenna;

a fourth antenna; and

a plurality of antenna covers, each of the plurality of antenna covers is configured to cover each antenna;

wherein the first antenna and the second antenna are each located on an edge area of the first side wall, the third antenna is located on the second side wall, and the fourth antenna is located on the third side wall; the first side wall is located between the second side wall and the third side wall, and the second side wall is located opposite to the third side wall; and a separation distance between every two antennas of the first antenna, the second antenna, the third antenna, and the fourth antenna is greater than a predetermined distance.

11. The multi-antenna host of claim **10**, further comprising a fifth antenna, wherein a carrying handle is installed on a middle area of the first side wall and the fifth antenna is set in the carrying handle, and a separation distance between every two antennas of the first antenna, the second antenna, the third antenna, the fourth antenna, and the fifth antenna is greater than the predetermined distance.

12. The multi-antenna host of claim **11**, wherein the first antenna and the second antenna are arranged symmetrically relative to the carrying handle.

13. The multi-antenna host of claim **11**, wherein the predetermined distance is 150 millimeters.

14. The multi-antenna host of claim **11**, wherein the first antenna is a first X-Box antenna and a frequency of the first X-Box antenna is 2.4 GHz; the second antenna is a second X-Box antenna and a frequency of the second X-Box antenna is 5 GHz; the third antenna is a first wireless fidelity (Wi-Fi) antenna and a frequency of the first Wi-Fi antenna is 2.4 GHz; the fourth antenna is a second Wi-Fi antenna and a frequency of the second Wi-Fi antenna is 5 GHz; and the fifth antenna is a third X-Box antenna and a frequency of the third X-Box antenna is 5 GHz.

15. The multi-antenna host of claim **11**, wherein the first antenna, the second antenna, the third antenna, the fourth antenna, and the fifth antenna are inverted-F antennas; the inverted-F antenna comprises a base board, a radiating portion, a feeding portion, and a ground portion; the radiating portion is parallel to the base board, the feeding portion and the ground portion are vertically coupled to the radiating portion.

16. The multi-antenna host of claim **15**, wherein the ground portion is vertically coupled to the base board, the feeding portion is vertical to the base board, and the feeding portion and the base board define an interval therebetween.

17. The multi-antenna host of claim **10**, further comprising an antenna bracket, wherein the third antenna is located on the antenna bracket to avoid being sheltered by metal parts.

18. The multi-antenna host of claim **10**, wherein the first antenna is arranged parallel to the second antenna, the third antenna is arranged vertical to the first antenna, and the fourth antenna is arranged vertical to the first antenna.

* * * * *