COMMUNICATION APPARATUS AND COMMUNICATION METHOD FOR MULTI-BAND OPERATION

BACKGROUND

1. TECHNICAL FIELD

[0001] The present disclosure generally relates to multi-band communication apparatus, multi-band access point and communication methods for multi-band operation, and more particularly relates to multi-band communication devices that operate on multiple frequency bands in a wireless network.

2. DESCRIPTION OF RELATED ART

[0002] Wireless networks that offer multi-band communication enable electronic devices to communication over multiple different frequency bands. Such networks have advantages over other wireless networks in which wireless communication is limited to a single frequency band.

SUMMARY

[0003] One non-limiting and exemplary example~~embodiment~~ facilitates providing communication over multiple frequency bands between electronic devices in a wireless network. By way of example, this communication includes authenticating and/or associating, via a single frequency band, multi-band communication devices over multiple different frequency bands.

[0004] In one general example~~aspect~~, the techniques disclosed here feature a multi-band communication apparatus that includes a transmitter and a receiver. The transmitter, which in operation, transmits, in a wireless network and to multi-band communication devices, frames on a frequency band that include actions related to the frequency band and to at least one other frequency band in which the multi-band communication apparatus transmits. The receiver, which

in operation, receives, in the wireless network, from the multi-band communication devices, frames on the frequency band that include actions related to the frequency band and to the at least one other frequency band in which the multi-band communication apparatus receives.

[0004a] In one aspect, the present disclosure refers to a non-Access Point (non-AP) multi-band communication apparatus comprising a transmitter, which, in operation, transmits an Association Request frame to an Access Point (AP) multi-band communication device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands and a receiver, which, in operation, receives from the AP multi-band communication device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully associated.

[0004b] In another aspect, the present disclosure refers to a communication method for a non-Access Point (non-AP) multi-band communication apparatus, the communication method comprising transmitting an Association Request frame to an Access Point (AP) multi-band communication device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands and receiving from the AP multi-band communication device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully associated.

[0004c] In yet another aspect, the present disclosure refers to an integrated circuit controlling: transmitting an Association Request frame to an Access Point (AP) multi-band communication device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands

and receiving from the AP multi-band communication device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully associated.

[0005] It should be noted that general or specific examples ~~embodiments~~ may be implemented as a system, a method, an integrated circuit, a computer program, a storage medium, or any selective combination thereof.

[0006] Additional benefits and advantages of the disclosed ~~embodiments~~ examples will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various ~~embodiments~~ examples and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to illustrate various embodiments and to explain various principles and advantages in accordance with present embodiments.

[0008] Figure 1 shows a multi-band wireless network in which a wireless transmitter/receiver operates over multiple different frequency bands with multi-band communication devices.

[0009] Figure 2 shows a multi-band wireless network in which a wireless transmitter/receiver operates over multiple different frequency bands with multi-band communication devices.

[0010] Figure 3 is an element that advertises multi-band capability.

[0011] Figure 4 is an element that advertises multi-band capabilities of neighbor APs.

CLAIMS

1. A non-Access Point (non-AP) multi-band communication apparatus comprising:

a transmitter, which, in operation, transmits an Association Request frame to an Access Point (AP) multi-band communication ~~apparatus~~device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands; and

a receiver, which, in operation, receives from the AP multi-band communication ~~apparatus~~device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully ~~accepted~~associated ~~and frequency band(s) that are not~~.

2. The non-AP multi-band communication apparatus of claim 1, wherein the multi-band setup can be performed on any of the plurality of frequency bands.

3. The non-AP multi-band communication apparatus of claim 1, wherein the Association Request frame includes a common information field and a plurality of band specific fields.

4. The non-AP multi-band communication apparatus of claim 1, wherein a single association record is maintained by the AP multi-band communication ~~apparatus~~device for the plurality of frequency bands.

5. The non-AP multi-band communication apparatus of claim 4, wherein the single association record includes at least one of an association state variable, an Association ID (AID), and security keys for each of the plurality of frequency bands.

6. The non-AP multi-band communication apparatus of claim 1, wherein a unified MAC address is used to identify the non-AP multi-band communication apparatus.

7. The non-AP multi-band communication apparatus of claim 6, wherein a single Association ID (AID) is allocated to the non-AP multi-band communication apparatus.

8. The non-AP multi-band communication apparatus of claim 1, wherein a ~~single~~unified MAC Service Access Point (SAP) is used to manage a plurality of band-specific MAC layers and a plurality of band-specific PHY layers.

9. The non-AP multi-band communication apparatus of claim 1, wherein after the multi-band setup is ~~established~~completed, the receiver simultaneously receives a plurality of signals over the successfully ~~accepted~~associated frequency band(s).

10. A communication method for a non-Access Point (non-AP) multi-band communication apparatus, the communication method comprising:

transmitting an Association Request frame to an Access Point (AP) multi-band communication ~~apparatus~~device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands; and

receiving from the AP multi-band communication ~~apparatus~~device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully ~~accepted~~associated ~~and frequency band(s) that are not~~.

11. The communication method of claim 10, wherein the multi-band setup can be performed on any of the plurality of frequency bands.

12. The communication method of claim 10, wherein the Association Request frame includes a common information field and a plurality of band specific fields.

13. The communication method of claim 10, wherein a single association record is maintained by the AP multi-band communication ~~apparatus~~device for the plurality of frequency bands.

14. The communication method of claim 13, wherein the single association record includes at least one of an association state variable, an Association ID (AID), and security keys for each of the plurality of frequency bands.

15. The communication method of claim 10, wherein a unified MAC address is used to identify the non-AP multi-band communication apparatus.

16. The communication method of claim 10, wherein a single Association ID (AID) is allocated to the non-AP multi-band communication apparatus.

17. The communication method of claim 10, wherein a ~~single~~unified MAC Service Access Point (SAP) is used to manage a plurality of band-specific MAC layers and a plurality of band-specific PHY layers.

18. The communication method of claim 10, comprising:

simultaneously receiving a plurality of signals over the successfully ~~accepted~~associated frequency band(s) after the multi-band setup is ~~established~~completed.

19. An integrated circuit controlling:

transmitting an Association Request frame to an Access Point (AP) multi-band communication device over a single frequency band, the Association Request frame indicating a plurality of frequency bands requested for a multi-band setup for simultaneous communication on multi-bands; and

receiving from the AP multi-band communication device an Association Response frame over the single frequency band, the Association Response frame indicating frequency band(s) that are successfully associated.