[5] Regarding mainstream 802.11 devices, WLAN sensing application typically involves performing channel measurements and tracking one or more wireless links over time to classify channel variations into events or activities. Since Channel State Information (CSI) provides information that describes how wireless signals propagate in the channel with the various effects such as time delay, amplitude attenuation and phase shift on each subcarrier, CSI is a popular channel measurement parameter for WLAN sensing. However, existing WLAN devices do not provide standardized interfaces for high layer application to obtain the CSI, or to configure the parameters used for channel measurement.

[6] In particular, IEEE 802.11 Project Authorization Request (PAR) states that the new Task Group (TG) formed for WLAN Sensing, 802.11bf, will be a media access control (MAC) amendments, i.e. no changes to the physical layer, for sub-7 GHz frequencies. Legacy 802.11 devices may support 802.11bf features using existing hardware by performing a firmware/software update. In other words, when 802.11bf specification is released, it is likely that 802.11n, 802.11ac, 802.11ax, 802.11az and 802.11be devices will be in use in the market.

[7] It is prominent to explore issues when 11bf is implemented on different 802.11 amendments, and whether WLAN sensing can be performed even with 802.11 devices that do not implement 11bf. Thus, there is a need for communication apparatuses and methods that provide feasible technical solutions for WLAN sensing in the context of a mix of various types (amendments) of 802.11 devices. Furthermore, other desirable features and characteristics will become apparent from the subsequent detailed description and the appended claims, taken in conjunction with the accompanying drawings and this background of the disclosure.

SUMMARY

[8] Non-limiting and exemplary embodiments facilitate providing communication apparatuses and communication methods for wireless local area network (WLAN) sensing across different 802.11 devices.

[9] In an aspect, the present disclosure provides a communication apparatus comprising: a transmitter, which, in operation, transmits a request frame to one or more peer communication apparatuses, the request frame carrying

transmission parameters to be used by each of the one or more peer communication apparatuses to transmit a physical layer protocol data unit (PPDU) used for channel measurements; a sensing module configured to perform the channel measurements based on the respective PPDU(s) received from the one or more peer communication apparatuses; and an interface configured to obtain sensing parameters from higher layer applications and pass a result of the channel measurements to the higher layer applications, characterized in that the transmission parameters comprise a session identifier identifying a sensing session.

[10] In an example, the present disclosure provides a peer communication comprising: a receiver, which, in operation, receives a request frame comprising transmission parameters from a communication apparatus; and a transmitter, which, in operation, transmits a physical layer protocol data unit (PPDU) to be used for channel measurements, the PPDU applying the transmission parameters.

[11] In an example, the present disclosure provides a peer communication comprising: a transmitter, which, in operation, transmits an unsolicited sounding PPDU in a periodic basis used for channel measurements.

[12] In an example, the present disclosure provides a communication method comprising: obtaining sensing parameter from higher layer applications; transmitting a request frame to one or more peer communication apparatuses, the request frame carrying transmission parameters to be used by each of the one or more peer communication apparatuses to transmit a physical layer protocol data unit (PPDU) used for channel measurements; performing the channel measurements based on the respective PPDU(s) received from the one or more peer communication apparatuses; and passing a result of the channel measurements to the higher layer applications.

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

[14] Additional benefits and advantages of the disclosed embodiments will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments 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.

CLAIMS

1. A communication apparatus comprising:

a transmitter, which, in operation, transmits a request frame to one or more peer communication apparatuses, the request frame carrying transmission parameters to be used by each of the one or more peer communication apparatuses to transmit a physical layer protocol data unit (PPDU) used for channel measurements;

a sensing module configured to perform the channel measurements based on the respective PPDU(s) received from the one or more peer communication apparatuses; and

an interface configured to obtain sensing parameters from higher layer applications and pass a result of the channel measurements to the higher layer applications,

characterized in that

the transmission parameters comprise a session identifier identifying a sensing session.

2. The communication apparatus of claim 1, wherein the PPDU(s) received from the one or more peer communication apparatuses used for channel measurements is transmitted using a same PPDU format and a same channel bandwidth as a request PPDU comprising the request frame.

3. The communication apparatus of claim 1, wherein the transmission parameters comprise at least one of: a group identifier, respective identifier(s) of the one or more peer communication apparatuses, and a PPDU format, a number of spatial streams, a channel bandwidth, a target receive power and a transmit power.

4. The communication apparatus of claim 1, wherein the request frame further comprises a Transmit Power Hold field that indicates to one or more peer communication apparatuses to transmit the PPDU(s) using a same transmit power during a sensing session.

5. The communication apparatus of claim 1, wherein the transmission parameters are negotiated with the one or more communication apparatus during a setup of a sensing session.

6. The communication apparatus of claim 1, wherein the interface comprises a primitive to request for a transmission of the request frame to the one or more peer communication apparatuses, and pass, from the higher layer applications: a group identifier, a session identifier, respective identifier(s) of the one or more peer apparatus or a media access control address of one of the one or more peer communication apparatuses, a PPDU format, a number of spatial streams and a channel bandwidth.

7. The communication apparatus of claim 1, wherein the interface comprises a primitive to pass, to the higher layer applications: a session identifier, a media access control address of one of the one or more peer communication apparatuses, a PPDU format, a channel bandwidth and the result of the channel measurements.

8. The communication apparatus of claim 1, wherein the sensing module is further configured to perform channel measurements on a periodic basis based on unsolicited PPDUs received from at least one of the one or more peer communication apparatuses.

9. The communication apparatus of claim 8, wherein each of the at least one of the one or more peer communication apparatuses is identified by a transmitter address field of a frame received immediately prior to the unsolicited PPDU.

10. The communication apparatus of claim 1, wherein the interface comprises a primitive to request the one or more peer communication apparatuses to initiate a legacy channel measurement procedure.