IEEE P802.11
Wireless LANs

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| Timing Measurement related fixes to Clause 21 and 22 PHYs |
| Date: 2014-05-09 |
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Abstract

This document updates the Clause 21 (802.11ad) and Clause 22 (802.11ac) PHYs in order for them to be usable in the Timing Measurement Protocol (10.24.5).

When Timing Measurement action frame and the corresponding ACK are transmitted/received, timestamps t1, t2, t3 and t4 corresponding to the time of departure of the Timing Measurement action frame at the transmitter (t1), the time of arrival of the Timing Measurement action frame at the receiver (t2), the time of departure of the ACK to the Timing Measurement action frame at the receiver (t3) and the time of arrival of the ACK to the Timing Measurement action frame at the transmitter (t4) are captured by the corresponding PHY.

Clause 7.3.4.2 describes the PHY-SAP that the PHY exposes to the MAC – specifically, PHY-TXSTART.request(TXVECTOR), PHY-TXSTART.confirm(TXSTATUS) and PHY-RXSTART.indication(RXVECTOR) are of interest to the Timing Measurement protocol.

In each of the PHY clauses,

1. TXVECTORwas extended to include a TIME\_OF\_DEPARTURE\_REQUESTED to indicate that in the corresponding PHY-TXSTART.confirm we expect TIME of Departure values to be returned in TXSTATUS; and
2. RXVECTOR was extended to include a RX\_START\_OF\_FRAME\_OFFSET

The Transmit PHY (similar to 16.3.6, 17.2.5, 18.3.11, 20.3.21) and Receive PHY (similar to 16.3.7, 17.2.6, 18.3.12, 20.3.22) corresponding to Clause 21 (802.11ad) and Cluse 21 (802.11ac) need to describe conditions under which the TXVECTOR, TXSTATUS and RXVECTOR would include Time of Departure (TIME\_OF\_DEPARTURE, TIME\_OF\_DEPARTURE\_ClockRate and TX\_START\_OF\_FRAME\_OFFSET) and Time of Arrival parameters (RX\_START\_OF\_FRAME\_OFFSET).

The editor instructions in this submission are relative to 802.11REVmc\_D2.8.

NOTE 1—Clause 23 (802.11af) does not require any changes as it reuses Clause 22 PHY

NOTE 2 – Clause 24 (802.1ah) requires changes similar to the one described above and will be in a submission to TG ah.

***Editor: Change the following row to Table 21-1 – TXVECTOR and RXVECTOR parameters:***

|  |  |  |  |
| --- | --- | --- | --- |
| RX\_START\_OF\_FRAME\_OFFSET | 0 to 232–1. An estimate of the offset (in 10 nanosecond units) from the point in time at which the start of the preamble corresponding to the incoming frame arrived at the receive antenna connector to the point in time at which this primitive is issued to the MAC.If dot11TimingMsmtActivated is true Otherwise |  |  |
| N | Y |
| N | N |

***Editor: Insert the following after tge first paragraph in Clause 21.8 PHY transmit procedure:***

Transmission of the PHY preamble may start if TIME\_OF\_DEPARTURE\_REQUESTED is false, and shall start immediately if TIME\_OF\_DEPARTURE\_REQUESTED is true, based on the parameters passed in the PHY-TXSTART.request primitive.

If all of the following conditions are met:

1. if dot11TODImplemented and dot11TODActivated are true or if dot11TimingMsmtActivated is true,
2. the TXVECTOR parameter TIME\_OF\_DEPARTURE\_REQUESTED is true,

then the PHY shall issue a PHY-TXSTART.confirm(TXSTATUS) primitive to the MAC, forwarding the TIME\_OF\_DEPARTURE corresponding to the time when the first frame energy is sent by the transmitting port and TIME\_OF\_DEPARTURE\_ClockRate parameter within the TXSTATUS vector. If dot11TimingMsmtActivated is true, then the PHY shall forward the value of TX\_START\_OF\_FRAME\_OFFSET in TXSTATUS vector.

***Editor: Delete the first statement of the second paragraph in Clause 21.8 PHY transmit procedure:***

***Editor: Change the third paragraph in Clause 21.9 PHY receive procedure as follows:***

After the PHY-CCA.indication(BUSY) is issued, the PHY entity shall search for the CE field and begin receiving the CE field. The PHY demodulates the header according to the PHY typedetermined the reception of the CE field. If the CE field indicated a SC PHY, the receiver is capable of receiving low-power SC PHY, and dot11LowPowerSCPHYActivated is true, then the PHY shall attempt to demodulate both a SC header and an SC low-power header. The PHY shall decode the header and determine the MCS, length and other parameters needed for the demodulation of the packet.

Subsequently, if dot11TimingMsmtActivated is true, a PHY-RXSTART.indication(RXVECTOR) shall be issued and RX\_START\_OF\_FRAME\_OFFSET parameter within the RXVECTOR shall be forwarded (see 21.2.2 (TXVECTOR and RXVECTOR parameters)).

NOTE—The RX\_START\_OF\_FRAME\_OFFSET value is used as described in 6.3.57 (Timing measurement) in order to estimate when the start of the preamble for the incoming frame was detected on the medium at the receive antenna connector.

At the end of the data portion of the packet, the PHY shall indicate a PHY-RXEND.indication(No\_Error) primitive to the MAC. If the header indicated the presence of training field, the PHY shall continue to receive these training fields after the data portion of the packet and measure the channel. After the end of the training fields, the PHY shall generate a PHY-CCA.indication(IDLE) primitive.

***Editor: Insert Clause 22.2.5 TX\_STATUS as follows:***

22.2.5 TXSTATUS parameters

The parameters listed in Table 21-2 (TXSTATUS parameters) are defined as part of the TXSTATUS parameter list in the PHY-TXSTART.confirm(TXSTATUS) primitive.

***Editor: Insert paragraphs to 22.3.20 VHT transmit specification as follows:***

The PHY indicates the state of the primary channel and other channels (if any) via the PHY-CCA.indication primitive (see 22.3.19.5 (CCA sensitivity) and 7.3.5.12 (PHY-CCA.indication)). Transmission of the PPDU shall be initiated by the PHY after receiving the PHY-TXSTART.request(TXVECTOR) primitive. The TXVECTOR elements for the PHY-TXSTART.request primitive are specified in Table 22-1 (TXVECTOR and RXVECTOR parameters (11ac)).

Transmission of the PHY preamble may start if TIME\_OF\_DEPARTURE\_REQUESTED is false, and shall start immediately if TIME\_OF\_DEPARTURE\_REQUESTED is true, based on the parameters passed in the PHY-TXSTART.request primitive.

If all of the following conditions are met:

(a) if dot11TODImplemented and dot11TODActivated are true or if dot11TimingMsmtActivated is true,

(b) the TXVECTOR parameter TIME\_OF\_DEPARTURE\_REQUESTED is true,

then the PHY shall issue a PHY-TXSTART.confirm(TXSTATUS) primitive to the MAC, forwarding the TIME\_OF\_DEPARTURE corresponding to the time when the first frame energy is sent by the transmitting port and TIME\_OF\_DEPARTURE\_ClockRate parameter within the TXSTATUS vector. If dot11TimingMsmtActivated is true, then the PHY shall forward the value of TX\_START\_OF\_FRAME\_OFFSET in TXSTATUS vector.

After the PHY preamble transmission isstarted, the PHY entity immediately initiates data scrambling and data encoding. The encoding method for the Datafield is based on the FEC\_CODING, CH\_BANDWIDTH, NUM\_STS, STBC, MCS, and NUM\_USERS parameter ofthe TXVECTOR, as described in 22.3.2 (VHT PPDU format).

***Editor: Change the paragraph in 22.3.21 VHT receive specification as follows:***

After receiving a valid L-SIG and VHT-SIG-A indicating a supported mode, the PHY entity shall begin receiving the VHT trainingsymbols and VHT-SIG-B. If the received group ID in VHT-SIG-A has a value indicating a VHT SU PPDU (see 9.19 (Group ID and partial AID in VHT PPDUs(11ac))), the PHY entity may choose not to decode VHT-SIG-B. If VHT-SIG-B is not decoded, subsequent to an indication of a valid VHT-SIG-A CRC, a PHY-RXSTART.indication(RXVECTOR) primitive shall be issued.

Subsequently, if dot11TimingMsmtActivated is true, a PHY-RXSTART.indication(RXVECTOR) shall be issued and RX\_START\_OF\_FRAME\_OFFSET parameter within the RXVECTOR shall be forwarded (see 21.2.2 (TXVECTOR and RXVECTOR parameters)).

NOTE—The RX\_START\_OF\_FRAME\_OFFSET value is used as described in 6.3.57 (Timing measurement) in order to estimate when the start of the preamble for the incoming frame was detected on the medium at the receive antenna connector.

The RXVECTOR associated with this primitive includes the parameters specified in Table 22-1 (TXVECTOR and RXVECTOR parameters (11ac)).