IEEE P802.11
Wireless LANs

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| TGme Resolution to CIDs on Annex G“Multiple Frame Transmissions”  |
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Abstract

Adendum to 21/1606 TGme Resolutions to CIDs on Annex G

21/1606 contains changes required for removing references to ANNEX G

Satisfying CIDS 81 and 109

This document discusses further edits to cover “multiple frame transmissions”

**BACKGROUND**

Section 10.23.2.3 concerns “**multiple frame transmissions**” within a TXOP. In particular, there is a sentence

*Multiple frame transmission within the TXOP occurs when an EDCAF retains the right to access the medium following the completion of a frame exchange sequence, such as on receipt of an Ack frame.*

“multiple frame transmission” needs to be addressed as it is somewhat confusing as we know that multiple frame exchange seqiuences take place within a TXOP and “multiple frame transmissions” should be the same concept and this is not clear.

There are 35 instances of “multiple frame transmission” but many refer to Clause 10.23.2.8. which we need to first edit.

**10.23.2.8 Multiple frame transmission in an EDCA TXOP**

A frame exchange, in the context of multiple frame transmission in an EDCA TXOP, may be one of the following:

— A frame not requiring immediate acknowledgment (such as a group addressed frame or a frame transmitted with an ack policy that does not require immediate acknowledgment) or an A-MPDU containing only such frames.

— A frame requiring immediate acknowledgment (such as an individually addressed frame transmitted with an ack policy that requires immediate acknowledgment) or an A-MPDU containing at least one such frame, followed after SIFS by a corresponding acknowledgment frame.

— A triggering frame or an A-MPDU containing at least one such frame, followed after SIFS by an HE

TB PPDU where the HE TB PPDU is optionally followed after SIFS by an acknowledgment.(11ax)

— One of the following:(11ax)

— A VHT NDP Announcement frame followed after SIFS by a VHT NDP followed after SIFS by an A-MPDU containing one or more VHT Compressed Beamforming frames.(11ax)

— A Beamforming Report Poll frame followed after SIFS by an A-MPDU containing one or more VHT Compressed Beamforming frames.

— An HE NDP Announcement frame followed after SIFS by an HE sounding NDP followed after SIFS by a PPDU containing one or more HE Compressed Beamforming/CQI frames.(11ax)

— A broadcast HE NDP Announcement frame followed after SIFS by an HE sounding NDP followed after SIFS by a BFRP Trigger frame followed by HE TB PPDUs.(11ax)

— A BFRP Trigger frame followed after SIFS by an HE TB PPDU containing one or more HE

Compressed Beamforming/CQI frames.(11ax)

**Why do we need such a detailed list? Dangerous, as new frames are introduced in me Amendments. What it seems to be trying to say is that frame exchange sequences are transmitted in an EDCA TXOP (as per the definition). Are these special cases? Can’t be as any frame requiring an immediate ack is covered, i.e., a frame exchange sequence.**

**The definition of TXOP is clear “**

***transmission opportunity (TXOP*): An interval of time during which a particular quality-of-service (QoS)station (STA) has the right to initiate frame exchange sequences onto the wireless medium (WM).**

**The question is, “Do we need this “other” concept of ‘multiple frame transmission’”?**

**10.23.2.3. EDCA TXOPs**

There are three modes of EDCA TXOP defined: initiation of an EDCA TXOP, sharing an EDCA TXOP, and multiple frame transmission within an EDCA TXOP. Initiation of the TXOP occurs when the EDCA rules permit access to the medium. Sharing of the EDCA TXOP occurs when an EDCAF within an AP that supports DL-MU-MIMO has obtained access to the medium, making the corresponding AC the primary AC, and includes traffic from queues associated with other ACs in VHT(11ay), EDMG, or S1G MU PPDUs transmitted during the TXOP. Multiple frame transmission within the TXOP occurs when an EDCAF retains the right to access the medium following the completion of a frame exchange sequence, such as on receipt of an Ack frame.

Looking at the 3rd mode “multiple frame transmission within an EDCA TXOP.” could quite accurately be phrased as

“transmission of frame exchange sequence(s) within an EDCA TXOP.”

Hence if we can substitute “transmission of frame exchange sequence(s)” for “mulitple frame transmission”

BUT

The last sentence indicates that “multiple frame transmission” only occurs when at least one frame exchange has been transmitted. This, on reflection, is probably wrong. There is nothing special about consequent frame exchange sequences after the first. Surely sending one frame exchange sequence is still the third mode of the TXOP after ‘initiation’ and ‘sharing’. Hence, in the proposed editing, this concept is removed.

PROPOSAL:

Make changes as indicated below (reference D0.3)

P2154.22

**10.23.2.3. EDCA TXOPs**

There are three modes of EDCA TXOP defined: initiation of an EDCA TXOP, sharing an EDCA TXOP, and ~~multiple frame transmission~~ transmission of frame exchange sequence(s) within an EDCA TXOP. Initiation of the TXOP occurs when the EDCA rules permit access to the medium. Sharing of the EDCA TXOP occurs when an EDCAF within an AP that supports DL-MU-MIMO has obtained access to the medium, making the corresponding AC the primary AC, and includes traffic from queues associated with other ACs in VHT(11ay), EDMG, or S1G MU PPDUs transmitted during the TXOP. ~~Multiple frame transmission~~ Transmission of frame exchange sequence(s) within the TXOP occurs when an EDCAF ~~retains~~ gains the right to access the medium ~~following the completion of a frame exchange sequence, such as on receipt of an Ack frame.~~

P2161.49

**10.23.2.8 ~~Multiple frame transmission~~ Transmission of frame exchange sequences in an EDCA TXOP**

~~A frame exchange, in the context of multiple frame transmission in an EDCA TXOP, may be one of the following:~~

~~— A frame not requiring immediate acknowledgment (such as a group addressed frame or a frame transmitted with an ack policy that does not require immediate acknowledgment) or an A-MPDU containing only such frames.~~

~~— A frame requiring immediate acknowledgment (such as an individually addressed frame transmitted with an ack policy that requires immediate acknowledgment) or an A-MPDU containing at least one such frame, followed after SIFS by a corresponding acknowledgment frame.~~

~~— A triggering frame or an A-MPDU containing at least one such frame, followed after SIFS by an HE~~

~~TB PPDU where the HE TB PPDU is optionally followed after SIFS by an acknowledgment.(11ax)~~

~~— One of the following:(11ax)~~

~~— A VHT NDP Announcement frame followed after SIFS by a VHT NDP followed after SIFS by an A-MPDU containing one or more VHT Compressed Beamforming frames.(11ax)~~

~~— A Beamforming Report Poll frame followed after SIFS by an A-MPDU containing one or more VHT Compressed Beamforming frames.~~

~~— An HE NDP Announcement frame followed after SIFS by an HE sounding NDP followed after SIFS by a PPDU containing one or more HE Compressed Beamforming/CQI frames.(11ax)~~

~~— A broadcast HE NDP Announcement frame followed after SIFS by an HE sounding NDP followed after SIFS by a BFRP Trigger frame followed by HE TB PPDUs.(11ax)~~

~~— A BFRP Trigger frame followed after SIFS by an HE TB PPDU containing one or more HE~~

~~Compressed Beamforming/CQI frames.(11ax)~~

~~Multiple frames~~ Frame exchange sequences of the primary AC may be transmitted in an EDCA TXOP that was acquired following the rules in 10.23.2.4 (Obtaining an EDCA TXOP). Frames that are pending in other ACs shall not be transmitted in this EDCA TXOP except when permitted by the rules in 10.23.2.7 (Sharing an EDCA TXOP). If a TXOP holder has in its transmit queue an additional frame exchange sequence of the primary AC (or, where permitted, a secondary AC) and the duration of transmission of that frame exchange sequence ~~plus any expected acknowledgment for that frame~~ is less than the remaining TXNAV timer value and, if dot11MCCAActivated is true, the remaining RAV timer value, then the TXOP holder may commence transmission of that frame exchange sequence a SIFS (or RIFS, if the conditions defined in 10.3.2.3.2 (RIFS) are met, or PIFS, if the frame contains a bandwidth signaling TA) after the completion of the immediately preceding frame exchange sequence, subject to the TXOP limit restriction as described in 10.23.2.9 (TXOP limits). A STA shall not commence the transmission of an RTS with a bandwidth signaling TA until at least a PIFS after the immediately preceding frame exchange sequence. A CMMG STA shall not commence the transmission of an RTS frame until at least PIFS time after the immediately preceding frame exchange sequence. An HT STA that is a TXOP holder may transmit multiple MPDUs of the same AC within an A-MPDU as long as the duration of transmission of the A-MPDU plus any expected BlockAck frame response is less than the remaining TXNAV timer value and, if dot11MCCAActivated is true, the remaining RAV timer value. An S1G STA that is a TXOP holder may transmit multiple MPDUs of the same AC within an A-MPDU as long as the duration of transmission of the A-MPDU plus any expected (NDP) BlockAck frame response is less than the remaining TXNAV timer value.

NOTE 1—PIFS is used by a VHT STA to perform CCA in the secondary 20 MHz, 40 MHz, and 80 MHz channels before receiving RTS (see 10.3.2 (Procedures common to the DCF and EDCAF)).

NOTE 2—An RD responder can transmit multiple MPDUs as described in 10.29.4 (Rules for RD responder).

(11ay)NOTE 3—PIFS is used by an EDMG STA to perform CCA in the secondary, secondary1, and secondary2 channels before receiving RTS (see 10.3.2 (Procedures common to the DCF and EDCAF)).

NOTE 4(11ay)—Within a BDT, STAs can transmit multiple MPDUs as described in 10.50 (Bidirectional TXOP).

NOTE 5(11ay)—A PIFS is required to be present preceding an RTS transmission by a CMMG STA in order to allow a recipient of the RTS to perform CCA in the secondary 540 MHz channels to determine the appropriate response to the RTS.

After a valid response ~~(see Annex G)~~ to the initial frame of a TXOP, if the Duration/ID field is set for the transmission of ~~multiple~~ one or more frame exchange sequences ~~transmission~~ and there is a subsequent transmission failure, the corresponding channel access function may transmit after the CS mechanism (see 10.3.2.1 (CS mechanism)) indicates that the medium is idle at the TxPIFS slot boundary (see Figure 10-31 (EDCA mechanism timing relationships)) provided that the duration of that transmission plus the duration of any expected acknowledgment and applicable IFS is less than the remaining TXNAV timer value and, if dot11MCCAActivated is true, the RAV timer. At the expiration of the TXNAV timer and if dot11MCCAActivated is true, the RAV timer, if the channel access function has not regained access to the medium, then the EDCAF shall invoke the backoff procedure that is described in 10.23.2.4 (Obtaining an EDCA TXOP). Transmission failure is defined in 10.23.2.12 (Retransmit procedures).

All other channel access functions at the STA shall treat the medium as busy until the expiration of the TXNAV timer.

NOTE 6(11ay)—~~A multiple frame~~ ~~transmission~~ The transmission of frame exchange sequences is granted to an EDCAF, not to a STA, so ~~that~~ the transmission ~~multiple frame~~ is permitted only for ~~the transmission of a frame of the same AC as the~~ a frame exchange sequence of the same AC that was granted the EDCA TXOP, except as specified in 10.23.2.7 (Sharing an EDCA TXOP).

In the case of PSMP, this AC transmission restriction does not apply to either the AP or the STAs participating in the PSMP sequence, but the specific restrictions on transmission during a PSMP sequence described in 10.30 (PSMP operation) do apply.

If a TXOP is protected by an RTS or CTS frame carried in a non-HT or a non-HT duplicate PPDU, the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of a PPDU as follows:

— To be the same or narrower than (11ax)the RXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT of the last received CTS frame in the same TXOP, if the RTS

frame with a bandwidth signaling TA and TXVECTOR parameter DYN\_BANDWIDTH\_IN\_NON\_HT set to Dynamic has been sent by the TXOP holder in the last RTS/CTS exchange.

— Otherwise, to be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the RTS frame that has been sent by the TXOP holder in the last RTS/CTS exchange in the same TXOP.

(11ax)If a TXOP is protected by an MU-RTS Trigger frame or CTS frame carried in a non-HT or a non-HT duplicate PPDU, the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of a PPDU as follows:

— To be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the MU-RTS Trigger frame that has been sent by the TXOP holder in the last MU-RTS Trigger/CTS frame exchange in the same TXOP, if the RU Allocation subfields of the MU-RTS Trigger frame for all intended receivers are equal to a value that corresponds to the channel bandwidth that is indicated in the UL BW subfield in the Common Info field of the MU-RTS Trigger frame.

— Otherwise, to be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the preceding PPDU that it has transmitted in the same TXOP.

If there is no RTS/CTS (11ax)or MU-RTS Trigger/CTS frame exchange in non-HT duplicate format in a TXOP, and the TXOP includes at least one non-HT duplicate frame that does not include a PS-Poll, then the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of a PPDU sent after the first non-HT duplicate frame that is not a PS-Poll to be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the initial frame in the first non-HT duplicate frame in the same TXOP.

If there is no non-HT duplicate frame in a TXOP, the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of a non-initial PPDU to be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the preceding PPDU that it has transmitted in the same TXOP, subject to the following constraints:(11ax)

— If the preceding PPDU is a DL HE MU PPDU with preamble puncture, the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of the non-initial PPDU to a value whose corresponding 20 MHz channels are within a set of 20 MHz channels where pre-HE modulated fields of the preceding PPDU are located.(11ax)

— If the non-initial PPDU is a DL HE MU PPDU with preamble puncture, the TXOP holder shall set the TXVECTOR parameter RU\_ALLOCATION of the non-initial PPDU to a value whose corresponding RU is within a set of 20 MHz channels where pre-HE modulated fields of the preceding PPDU are located.(11ax)

If a TXOP is protected by a CTS-to-self frame carried in a non-HT or non-HT duplicate PPDU, the TXOP holder shall set the TXVECTOR parameter CH\_BANDWIDTH of a PPDU to be the same or narrower than the TXVECTOR parameter CH\_BANDWIDTH of the CTS-to-self frame in the same TXOP.

Note that when transmitting ~~multiple frames~~ frame exchange sequences in a TXOP ~~using~~ that use acknowledgment mechanisms other than immediate acknowledgment, a protective mechanism should be used (such as RTS/CTS or the protection mechanism described in 10.27 (Protection mechanisms)). A QoS AP or a mesh STA may send group addressed frames without using any protection mechanism. In a QoS IBSS, group addressed frames shall be sent one at a time, and backoff shall be performed after the transmission of each of the group addressed frames. In an MBSS, a mesh STA may send multiple group addressed frames in a TXOP, bounded by the TXOP limit, without performing backoff after the TXOP is obtained.

An S1G STA that intends to transmit an 8 MHz or 16 MHz PPDU invoking a backoff procedure in the primary 2 MHz channel using the channel busy conditions defined in 23.3.18.5.4.2 (CCA sensitivity for devices in type 2 channels implementing intended 8 or 16 MHz transmit channel width channel access procedure) shall not set the Dynamic Indication field to 1 in any RTS frame that is scheduled for transmission at the expiration of this backoff.

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Looking at all other instances of “multiple frame transmission”

10.3.2.3.4, P2036.11

*The PIFS is used to gain priority access to the medium.*

*The PIFS may be used as described in the following list and shall not be used otherwise:*

* A TXOP holder transmitting an RTS with a bandwidth signaling TA within a ~~multiple~~ frame exchange ~~transmission~~ sequence, as specified in 10.23.2.8 (Multiple frame transmission in an EDCA TXOP)

10.23.3.2.3, P2175.27

This subclause describes recovery from the absence of an expected reception in a CAP. Note that the recovery rules from the absence of an expected reception are different from EDCA because in this case the NAVs of all of the STAs in the BSS have already been set up by the transmissions by the HC. The recovery rules for the ~~multiple frame~~ transmission of frame exchange sequences in an EDCA TXOP are different because a STA may always be hidden and may have not set its NAV due to the transmission by another STA. Finally, since an HC is collocated with the AP, the AP may recover using the rules described in this subclause even if the recovery is from the absence of an expected reception.

10.36.5.1, P2306.34

NOTE 4—Recovery in the case of a missing response to a VHT NDP Announcement or Beamforming Report Poll frame follows the rules for ~~multiple frame transmission~~ transmission of frame exchange sequences in an EDCA TXOP (see 10.23.2.8 (Multiple frame transmission in an EDCA TXOP)).

P4067.9

**26.2.8 ~~Multiple frame transmission~~ Transmission of frame exchange sequences in an EDCA TXOP in the 6 GHz band**

**B.4.13, P4893.53**

**QD3** ~~Multiple frame transmission~~ Transmission of frame exchange sequences support