IEEE P802.11  
Wireless LANs

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| D6 Comment Resolution, brianh, part 2 | | | | |
| Date: 2013-09-09 | | | | |
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##### Baseline is 11ac D6.0. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Tex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb .

CIDs: 11012

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 11012 | Adachi, Tomoko | 3.1 | 2 | 44 | This comment relates to my previous comments # i-144 (10144) and # i-145 (10145). I am almost there. But, my understanding was that the terms MU PPDU and SU PPDU are exclusive, which is contrary to what is said in the disposition detail to #i-144, "the transmission of an MU PPDU to a single receiver is considered to be an SU transmission." I would like to reconfirm this point. And although the group gave a conclusion that the definition of "user" in 3.1 is unambiguous when discussing # i-145, its definition is changed to "a recipient of an A-MPDU in an MU PPDU." From my understanding, a recipient is an individual STA. Then, why not reflect this to the defnition of MU PPDU and say "A PPDU that carries one or more PSDUs for more than one recipients using the DL-MU-MIMO technique."? | As in comment. | Revised. See changes in 13/1037 r1 that substantially address the commenter’s concern. |

***Discussion***

1. We use “MU PPDU” in two slightly different senses: a) VHT MU PPDU format, and b) a PPDU carrying >1 users. As well, the definition of SU PPDU is not positively disjoint from MU PPDU.
   1. Solution: We should be clearer that VHT MU PPDU is the PHY format not the number of users. As a corollary, the term “MU PPDU”, when read naively, is about number of users not the PHY format, so make the term more specific – i.e. “VHT MU PPDU”. Update the definition, and convert “MU PPDU”s to “VHT MU PPDU” (most are already “VHT MU PPDU”). Review usage of “MU PPDU”, and include “NUM\_USERS > 1” where that improves the clarity of the standard.
2. The previous LB changed the definition of “user” to include groupcast as a user, but as a side-effect the new definition was not well defined for SU PPDU.
   1. Solution: Change definition of user, closer to the old definition yet continue to allow a user to be an RA

***Change:***

3.1 Definitions

**very high thoughput (VHT) multi-user (MU) physical layer protocol data unit (PPDU)**: A VHT PPDU with a format that is capable of carrying up to four PSDUs for up to four users using the DL-MU-MIMO technique.

**single user (SU) physical layer protocol data unit (PPDU)**: A PPDU with a format that is capable of carrying only a single PHY service data unit (PSDU), or no PSDU.

**secondary access category (AC):** An access category (AC) that is not associated with the enhanced distributed channel access function (EDCAF) that gains channel access.

NOTE—Traffic associated with a secondary AC can be included in a VHT MU PPDU that includes traffic associated with the primary AC. There could be multiple secondary ACs at a given time.

**user**: An individual or group of STAs identified by a single RA in the context of single user (SU) multiple input, multiple output (MIMO) or multi user (MU) MIMO.



***11ac editor: replace “MU PPDU” by “VHT MU PPDU” in the above figures, 2 times***

**9.19.2.2 EDCA TXOPs**

A TXOP limit value of 0 indicates that the TXOP holder may transmit or cause to be transmitted (as responses)

the following within the current TXOP:

a) ~~A single MSDU, MMPDU, A-MSDU, or A-MPDU~~ One of the following at any rate, subject to the

rules in 9.7 (Multirate support):

1) SU PPDUs carrying fragments of a single MSDU or MMPDU

2) An SU PPDU or a VHT MU PPDU carrying a single MSDU, a single MMPDU, a single A-MSDU or a single A-MPDU

3) A VHT MU PPDU carrying A-MPDUs to different users

b) Any required acknowledgments

c) Any frames required for protection, including one of the following:

1) An RTS/CTS exchange

2) CTS to itself

3) Dual CTS as specified in 9.3.2.8 (Dual CTS protection)

d) Any frames required for beamforming as specified in 9.27 (Sounding PPDUs) and in 9.31.5 (VHT

sounding protocol)

e) Any frames required for link adaptation as specified in 9.28 (Link adaptation)

f) Any number of BlockAckReq and BlockAck frames

**9.19.2.3a Sharing an EDCA TXOP**

NOTE—An AP can protect the immediate response by preceding the VHT MU PPDU (which might have TXVECTOR parameter NUM\_USERS > 1) with an RTS/CTS exchange or a CTS-to-self transmission.

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

***Change 9.19.2.4 as follows:***

Multiple frames may be transmitted in an EDCA TXOP that was acquired following the rules in 9.19.2.3 (Obtaining

an EDCA TXOP) if there is more than one frame pending in the primary AC for which the channel

has been acquired. However, those frames that are pending in other ACs shall not be transmitted in this EDCA

TXOP except when sent in a VHT MU PPDU with TXVECTOR parameter NUM\_USERS > 1 and if allowed by the rules in 9.19.2.3a (Sharing an EDCA

TXOP). If a TXOP holder has in its transmit queue an additional frame of the ~~same~~ primary AC as the one

just transmitted and the duration of transmission of that frame plus any expected acknowledgment for that

frame is less than the remaining TXNAV timer value, then the ~~STA~~TXOP holder may commence transmission

of that frame a SIFS (or RIFS, ~~under~~if the conditions defined in 9.3.2.3.2 (RIFS) are met) after the completion

of the immediately preceding frame exchange sequence. A STA shall not commence the transmission

of an RTS with a bandwidth signaling TA 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 response

is less than the remaining TXNAV timer value.

Note that, as for an EDCA TXOP, a multiple frame transmission is granted to an EDCAF, not to a STA, so

that the multiple frame transmission is permitted only for the transmission of a frame of the same AC as the

frame that was granted the EDCA TXOP, unless the EDCA TXOP obtained is used by an AP for a PSMP

sequence or an VHT MU PPDU with TXVECTOR parameter NUM\_USERS > 1.

When permitted by the rules in 9.19.2.3a (Sharing an EDCA

TXOP), traffic from secondary ACs may be transmitted in a VHT MU PPDU that has TXVECTOR parameter NUM\_USERS > 1 and that carries traffic for the primary AC.

**9.19.2.5 EDCA backoff procedure**

After transmitting an MPDU (~~regardless of whether~~ even if it is carried in an A-MPDU or as part of

a VHT MU PPDU that might have TXVECTOR parameter NUM\_USERS > 1) that requires an immediate frame as a response, the STA shall wait for a timeout

interval of duration of aSIFSTime + aSlotTime + aPHY-RX-START-Delay, starting at the PHYTXEND.

confirm. If a PHYRXSTART.indication does not occur during the timeout interval, the

STA concludes that the transmission of the MPDU has failed.

**9.25.1 Reverse direction (RD) exchange sequence**

***Change the note and add a note as follows:***

NOTE 1—An RD initiator might include multiple RD exchange sequences within a single TXOP or SP. Each RD

exchange sequence within a single TXOP or SP might be addressed to a different recipient, and any single recipient

might be given more than one RDG within a single TXOP or SP.

NOTE 2—If the RD responder is a VHT AP, the RD response burst can contain VHT MU PPDUs that might have TXVECTOR parameter NUM\_USERS > 1.

**9.29.4 VHT MU beamforming**

When transmitting a VHT MU PPDU, an MU beamformer shall order the per-user arrays of TXVECTOR parameters

so that the per-user USER\_POSITION array is in ascending order.

**10.40 Group ID management operation**

An AP determines the possible combinations of STAs that can be addressed by a VHT MU PPDU by assigning

STAs to groups and to specific user positions within those groups.

Group ID values of 0 and 63 are used for SU PPDU and the PHY filtering of such PPDUs is controlled by the

PHYCONFIG\_VECTOR primitive LISTEN\_TO\_GID00 and LISTEN\_TO\_GID63 parameters. The UserPosition in Group ID information is interpreted by a STA receiving a VHT MU PPDU as explained in 22.3.11.4

(Group ID).

**22.1.4 PPDU formats**

A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. A VHT PPDU using a

group ID value of 0 or 63 is a VHT SU PPDU, and either carries only one PSDU or no PSDU. A VHT PPDU

using a group ID value in the range of 1 to 62 is a VHT MU PPDU, and carries one or more PSDUs to one

or more users.

**Table 22-1—TXVECTOR and RXVECTOR parameters *(continued)***

|  |  |  |
| --- | --- | --- |
| STBC | FORMAT is VHT | Indicates whether or not STBC is used. 0 indicates no STBC (*NSTS=NSS* in the Data field). 1 indicates STBC is used (*NSTS=2NSS* in the Data field)*.* This parameter is 0 for an VHT MU PPDU. |

**22.3.8.3.3 VHT-SIG-A definition**

The VHT-SIG-A field contains the fields listed in Table 22-12 (Fields in the VHT-SIG-A field). The mapping

of the fields is also described in Table 22-12 (Fields in the VHT-SIG-A field). Note that the mapping of the

NSTS/Partial AID field, the SU/MU[0] Coding field, the SU VHT-MCS/MU[1-3] Coding field, and the

Beamformed field is different for VHT SU and MU PPDUs.

**22.3.10.1 General**

The padding flow is as follows. The MAC delivers a PSDU that fills the available octets in the Data field of

the PPDU for each user *u*. The PHY determines the number of pad bits to add and appends them to the PSDU.

The number of pad bits added will always be 0 to 7 per user. When user *u* of a VHT MU PPDU uses BCC encoding,

the number of pad bits is calculated using Equation (22-56). In the case of SU ignore *u* in Equation (22-

56).

For a VHT MU PPDU, if LDPC encoding is used for user *u* then the PHY padding bits are calculated using

Equation (22-58).

**22.3.20 PHY transmit procedure**

NOTE 1—For a VHT MU PPDU the A-MPDU is per user in the MAC sublayer and the VHT Training Symbols, VHT-SIGB,

and Data are per user in the PHY layer in Figure 22-32, with the number VHT Training Symbols depending on the

total number of space-time streams across all users.

**Annex C**

dot11VHTMUMaxUsersImplemented OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of users to which this device

is capable of transmitting within a VHT MU PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 15 }

dot11VHTMUMaxNSTSPerUserImplemented OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of space-time streams per user

that this device is capable of transmitting within a VHT MU PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 16 }

dot11VHTMUMaxNSTSTotalImplemented OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of space-time streams for all

users that this device is capable of transmitting within a VHT MU PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 17 }

**Table G.1**

*vht-mu-ppdu-end* This attribute delineates the end of a VHT MU PPDU. See NOTE 3 and

NOTE 4.

*vht-mu-user-respond* The preceding frame or A-MPDU is part of a VHT MU PPDU and is addressed

to a user from which an immediate response is expected. See

NOTE 3 and NOTE 4.

*vht-mu-user-not-respond* The preceding frame or A-MPDU is part of a VHT MU PPDU and is addressed

to a user from which no immediate response is expected. See

NOTE 3 and NOTE 4.

NOTE 1—A control frame that contains the HT Control field is always transmitted using the

control wrapper frame.

NOTE 2—In the case of VHT single MPDU, a single MPDU is carried in a A-MPDU, but the

attributes *+a-mpdu* and *+a-mpdu-end* are not used.

NOTE 3—*+vht-mu-ppdu-end*, *+vht-mu-user-respond* and *+vht-mu-user-other* are used in productions that

generate VHT MU PPDUs, according to the pattern: ["an A-MPDU (which might contain a VHT single

MPDU) needing a response" *+vht-mu-user-respond* ] {"an A-MPDU (which might contain a

VHT single MPDU) not needing a response" *+vht-mu-user-not-respond*} *+vht-mu-ppdu-end*. There is

at least one of *+vht-mu-user-respond* or *+vht-mu-user-not-respond* in a VHT MU PPDU.

NOTE 4—In the sequence **A***+vht-mu-user-respond* **B***+vht-mu-user-not-respond* … *+vht-mu-ppdu-end*, although

the terms **A**, **B** … (which represent one or more frames) are listed sequentially in these

productions, the per-user sequence of frames represented by **A**, **B**, ... are transmitted simultaneously

per-user using an VHT MU PPDU.

NOTE 4.

**G.4 HT and VHT sequences**

(\* The per-user parts of a VHT MU PPDU that do not require a response \*)

other-users = {ppdu-not-requiring-response-per-user +*vht-mu-user-not-respond*} +*vht-mu-ppdu-end*;