IEEE P802.11  
Wireless LANs

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| 802.11 TGac WG Letter Ballot LB190  Proposed resolutions to comments assigned to the author | | | | |
| Date: 2012-11-12 | | | | |
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|  |  |  |  |  |

Abstract

This submission contains proposed comment resolutions to comments received during WG letter ballot 190.

Comments:

7198, 7298, 7227, 7109, 7386, 7229, 7300, 7110, 7097, 7305, 7236, 7237, 7302, 7303, 7382, 7112, 7113, 7114, 7304, 7119, 7120, 7334, 7122, 7123, 7339, 7342, 7353, 7400, 7013

R1: updated during .11ac ad-hoc meeting.

R2: updated in prep for 802.11ac session

R3: updated during Monday at 802.11ac session.

R4 & R5: updated with input from Mark Rison

# 

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Owning Ad-hoc** |
| --- | --- | --- | --- | --- | --- |
| 7198 | 2.15 | 3.1. | Section 22.3 has been changed to VHT PHY Sublayer therefore it is quite unclear what PLCP data unit in case of VHT. PLCP is used several times in Definitions sections and those definitions are not really valid now for VHT | Clarify somewhere how PLCP should be understood in case of VHT. | MAC |

We now have the issue that “PLCP” is used throughout the baseline in a way that is specific to having a PMD interface and a PLCP. The following resolution fixes that.

Proposed resolution:

Revised. The following changes make the term PLCP “generic” to either PMD or non-PMD PHYs.

Add the following definition in 3.2:

“physical layer (PHY) protocol data unit (PPDU): The unit of data exchanged between two peer

PHY entities to provide the PHY data service. When the PHY is partitioned into physical layer convergence protocol (PLCP) and physical medium dependent (PMD) sublayers, the format of the PPDU is defined by the PLCP.”

Change the abbrevion of PPDU (in the baseline) to read: “PPDU physical layer protocol data unit”

In the 802.11ac draft change all “physical layer convergence procedure (PLCP) protocol data unit (PPDU)” to “physical layer protocol data unit (PPDU)”

Insert an editing instruction after the definition of PPDU as follows:

Change all “physical layer convergence procedure (PLCP) protocol data unit (PPDU)” to “physical layer protocol data unit (PPDU)”

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| 7298 | 2.16 | 3.1 | Does this defenition and specifically "sending a PPDU to multiple receving non-AP STAs ..." imply sending a different MPDU/AMPDU to each receving station? In P2L28 "independent data streams" is mentiond. | Propose to change the defenition so that it implies sending differenet data to each receving station in DL MU MIMO (similar to P2L28) | MAC |

Context:

“**downlink multi-user multiple input, multiple output (DL-MU-MIMO):** A technique by which an access

point (AP) with more than one antenna simultaneously transmits a physical layer convergence procedure

(PLCP) protocol data unit (PPDU) to multiple receiving non-AP stations (STAs) over the same radio frequencies.”

Proposed Resolution

Revised.

Add “, wherein each non-AP STA simultaneously receives one or more distinct space-time streams.”

Delete “simultaneously” from “one antenna simultaneously transmits”.

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| 7227 | 3.15 | 3.2 | Clause 18 also defines channel bandwidth other than 20MHz. | add using BANDWIDTH 20MHz when mentioning clause 18, 19, 16, 17 | MAC |

Context:

“**20 MHz physical layer convergence procedure (PLCP) protocol data unit (PPDU)**: A Clause 16 PPDU,

Clause 18 PPDU, Clause 17 PPDU, Clause 19 orthogonal frequency division multiplexing (OFDM) PPDU,

or Clause 20 20 MHz high-throughput (HT) PPDU with the TXVECTOR parameter CH\_BANDWIDTH

equal to HT\_CBW20 or Clause 22 20 MHz very high throughput (VHT) PPDU with the TXVECTOR

parameter CH\_BANDWIDTH equal to CBW20.”

Proposed resolution:

Revised. Change “Clause 18 PPDU” to “Clause 18 PPDU (when using 20 MHz channel spacing)”

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| --- | --- | --- | --- | --- | --- |
| 7109 | 4.01 | 3.2 | Need to define both "high throughput control" and "+high throughput control", since these have no formal definition in clause 8, yet are used to describe a type of frame, a type of support, and as a general noun (whatever that might refer to). | Define "High throughput (HT) control (HTC)", including "+HTC", as these are not formally defined objects in clause 8, but are general terms that are used extensively. Note that there is a partial definition of "HTC frame" included in the definition of NDP announcement further down this page. | MAC |

Proposed Resolution:

Rejected. The +HTC term is defined in 802.11-2012. See 381.10.

There is no need to add a definition for “high throughput control” as this is the name of a field in 802.11-2012.

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| 7386 | 4.36 | 3.2 | This definition only covers HT NDPAs, not VHT NDPAs | Either change it to a "HT NDPA" definition and add a "VHT NDPA" definition talking about the control frame, or make the definition cover both HT NDPAs and VHT NDPAs | MAC |

Context:

“**null data packet (NDP) announcement**: A physical layer convergence procedure (PLCP) protocol data

unit (PPDU) that contains one or more +HTC frames (i.e., frames with an HT (high-throughput) Control

field) that have the HT NDP Announcement subfield equal to 1.”

Discussion:

There is no need to add a definition for a VHT NDP announcement, frame.

Proposed Resolution:

Revised.

Add “high throughput (HT)” at the start of the cited definition, and reorder to taste.

In reply to the commenter, there is no need to add a definition for VHT NDP Announcement, because this is merely a type of frame, rather than a more complicated setting of fields & subfields.

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| 7299 | 5.53 | 3.2 | "to indicate the presence of additional signaling related to the bandwidth to be used" -> "to indicate the presence of additional signaling related to the bandwidth in the scrambling sequence to be used" | As in comment | MAC |

Context:

“**bandwidth signaling transmitter address (TA):** A TA that is used by a VHT STA to indicate the presence

of additional signaling related to the bandwidth to be used in subsequent transmission in an EDCA TXOP. It

is represented by the IEEE MAC individual address of the transmitting VHT STA but with the Individual/

Group bit set to 1.”

Proposed Resolution:

Rejected.

The cited location is correct. The proposed change adds more detail of how the bandwidth signaling TA is used to interpret the contents of the service field, but that would go too far into describing how it is used, rather than what it is.

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| 7300 | 5.59 | 3.2 | The defenition could be improved if "non-HT duplicate RTS and CTS frames" appears earlier. | A feature of a VHT STA in which the RTS/CTS exchange, using non-HT duplicate PPDU, negotiates a potentially reduced channel width (compared to the channel width indicated by the RTS) for subsequent transmissions within the current TXOP. | MAC |

Context:

“**dynamic bandwidth operation:** A feature of a VHT STA in which the RTS/CTS exchange negotiates a

potentially reduced channel width (compared to the channel width indicated by the RTS) for subsequent

transmissions within the current TXOP using non-HT duplicate RTS and CTS frames.”

Commenter’s proposed change:

“**dynamic bandwidth operation:** A feature of a VHT STA in which the RTS/CTS exchange, using non-HT duplicate PPDU, negotiates a potentially reduced channel width (compared to the channel width indicated by the RTS) for subsequent transmissions within the current TXOP.”

Proposed resolution.

Revised.

Make changes as proposed, except “PPDU” -> “physical layer protocol data units (PPDUs)”.

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| --- | --- | --- | --- | --- | --- |
| 7110 | 6.25 | 3.2 | "forced" sounds like some special procedure is necessary. Perhaps a virus keeps setting the bit, so we need a realtime driver to force it back to 0? | Replace "is forced to the value" with "has the value", or replace "the Individual/Group bit is forced to the value 0" with "the value of the Individual/Group bit is 0." | MAC |

Context:

“**non-bandwidth signaling transmitter address (TA)**: An address in the TA field of an MPDU in which the

Individual/Group bit is forced to the value 0.”

Proposed Resolution:

Revised. Replace “is forced to” with “has” at cited location.

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| 7097 | 6.34 | 3.2 | Since the data transmission of secondary AC in MU-MIMO is piggyback transmission, the definition of "piggyback" should be modified. | Add the text for modifying the definition of "piggyback" for the secondary AC in MU-MIMO transmission. | MAC |

Propose Resolution:

Rejected. While the baseline does use the term “piggyback”, it does so in the context of merging data and acknowledgement. The 802.11ac draft has wisely avoided introducing any reference to this term, so there is no need to complicate the definition of a term that is not used for any purpose in .11ac.

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| --- | --- | --- | --- | --- | --- |
| 7305 | 6.59 | 3.2 | There is secondary channel and secondary 20MHz channel definitions, and unlike the case of primary/primary 20MHz channels, the definitions are not linked. It would be less confusing and helpful to link the two defenitions. | Add to the end of the definition: "In a VHT BSS, the secondary 20 MHz channel is also the secondary channel." Also, change in the baseline the definition: "secondary channel: A 20 MHz channel associated with a primary channel used by high-throughput (HT) stations (STAs) for the purpose of creating a 40 MHz channel, or used by very high-throughput (VHT) stations (STAs) for the purpose of creating the primary 40 MHz channel." | MAC |

Context:

(802.11-2012) “**secondary channel:** A 20 MHz channel associated with a primary channel used by high-throughput (HT) stations (STAs) for the purpose of creating a 40 MHz channel.”

(802.11ac) “**secondary 20 MHz channel**: In a 40 MHz very high throughput (VHT) basic service set (BSS), the 20 MHz channel adjacent to the primary 20 MHz channel that together form the 40 MHz channel of the 40 MHz

VHT BSS. In an 80 MHz very high throughput (VHT) basic service set (BSS), the 20 MHz channel adjacent

to the primary 20 MHz channel that together form the primary 40 MHz channel of the 80 MHz VHT BSS. In

a 160 MHz or 80+80 MHz VHT BSS, the 20 MHz channel adjacent to the primary 20 MHz channel that

together form the primary 40 MHz channel of the 160 MHz or 80+80 MHz VHT BSS.”

Commenter’s proposed changes:

(802.11-2012) “**secondary channel:** A 20 MHz channel associated with a primary channel used by high-throughput (HT) stations (STAs) for the purpose of creating a 40 MHz channel or used by very high-throughput (VHT) stations (STAs) for the purpose of creating the primary 40 MHz channel.”

(802.11ac) “**secondary 20 MHz channel**: In a 40 MHz very high throughput (VHT) basic service set (BSS), the 20 MHz channel adjacent to the primary 20 MHz channel that together form the 40 MHz channel of the 40 MHz

VHT BSS. In an 80 MHz very high throughput (VHT) basic service set (BSS), the 20 MHz channel adjacent

to the primary 20 MHz channel that together form the primary 40 MHz channel of the 80 MHz VHT BSS. In

a 160 MHz or 80+80 MHz VHT BSS, the 20 MHz channel adjacent to the primary 20 MHz channel that

together form the primary 40 MHz channel of the 160 MHz or 80+80 MHz VHT BSS. In a VHT BSS, the secondary 20 MHz channel is also the secondary channel.”

Discussion:

I think the changes are correct and help clarify the relationship.

Proposed Resolution

Accepted

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| 7236 | 7.55 | 3.2 | VHT MU Beamformee is not defined (unlike e.g. VHT Beamformee) | Add defintion of VHT MU Beamformee | MAC |

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| --- | --- | --- | --- | --- | --- |
| 7237 | 7.59 | 3.2 | VHT MU Beamformer is not defined | Add defintion of VHT MU Beamformer | MAC |

Context:

“**very high throughput (VHT) single user only (SU-only) beamformee**: A VHT beamformee that is not a

VHT multi-user (MU) beamformee.

**very high throughput (VHT) single user only (SU-only) beamformer**: A VHT beamformer that is not a

VHT multi-user (MU) beamformer.”

Discussion:

I think we deleted these or similar definitions last time round. So I suggest we reword to avoid thrashing them in and out of existence.

Proposed resolution:

Revised.

Change definition of

**“very high throughput (VHT) single user only (SU-only) beamformee**” to read “A VHT beamformee that does not receive VHT multi-user (MU) physical layer convergence procedure (PLCP) protocol data units (PPDUs)”.

**Change definition of**

**“very high throughput (VHT) single user only (SU-only) beamformer**” to read “A VHT beamformer that does not transmit VHT multi-user (MU) physical layer convergence procedure (PLCP) protocol data units (PPDUs).”

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| 7302 | 7.55 | 3.2 | Wouldn't be better to have an independent definition and not to relate the defenition to MU BFee? | Change to something like: A station (STA) that receives a physical layer convergence procedure (PLCP) protocol data unit (PPDU) that was transmitted using a single-user beamforming steering matrix. | MAC |

Proposed Resolution:

Revised

Change definition of

**“very high throughput (VHT) single user only (SU-only) beamformee**” to read “A VHT beamformee that does not receive VHT multi-user (MU) physical layer convergence procedure (PLCP) protocol data units (PPDUs)”

(Note this is part of the changes indicated in resolution to comment 7236)

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| 7303 | 7.59 | 3.2 | Wouldn't be better to have an independent definition and not to relate the defenition to MU BFer? | Change to something like: A station (STA) that transmits a physical layer convergence procedure (PLCP) protocol data unit (PPDU) using a single-user beamforming steering matrix | MAC |

Proposed Resolution:

Revised.

**Change definition of**

**“very high throughput (VHT) single user only (SU-only) beamformer**” to read “A VHT beamformer that does not transmit VHT multi-user (MU) physical layer convergence procedure (PLCP) protocol data units (PPDUs).”

(Note this is part of the changes indicated in resolution to comment 7236)

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| 7382 | 8.00 | 3.3 | Add a definition of NUM\_STS to 3.3 | As it says | MAC |

Straw poll:

Add an abbreviation 1

Reject the comment 15

Don’t care / won’t say 2

Proposed Resolution:

Rejected.

The term NUM\_STS is a TXVECTOR/RXVECTOR parameter and a field name, and as such there is no need to add it to the abbreviations.

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| 7112 | 8.08 | 3.3 | Add definition of "LTF" | Add "LTF long training field". | MAC |

Proposed Resolution:

Rejected. A subclause 3.3 entry already exists in the baseline.

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| 7113 | 8.09 | 3.3 | "NES" is used, but not defined, in 802.11-2012. | Add "NES number of encoding streams". | MAC |

Proposed Resolution:

Rejected.

This term is defined in Table 20-7 and Table 22-6. It is not necessary to have an abbreviations entry for terms that are defined within and used within a particular PHY clause.

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| 7114 | 8.11 | 3.3 | Add definition of "STF" | Add "STF short training field". | MAC |

Discussion: while the baseline has “LTF” it does not have “STF”. This is inconsistent.

Proposed Resolution:

Revised. Add a subclause 3.3 entry: “STF short training field”

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| 7304 | 10.35 | 4.3 | "in a non-HT RTS frame" -> "in a non-HT duplicate RTS frame" | As in comment | MAC |

Context:

“The main MAC features in a VHT STA that are not present in an HT STA are the following:

— Mandatory support for the A-MPDU padding of a VHT PPDU

— Mandatory support for VHT single MPDU

— Mandatory support for responding to a bandwidth indication (provided by the RXVECTOR parameters

CH\_BANDWIDTH\_IN\_NON\_HT and DYN\_BANDWIDTH\_IN\_NON\_HT) in a non-HT RTS

frame

— Optional support for MPDUs of up to 11 454 octets

— Optional support for A-MPDU pre-EOF padding (see 9.12.2 (A-MPDU length limit rules)) of up to

1 048 575 octets

— Optional support for VHT link adaptation”

Proposed Resolution:

Revised. Change “in a non-HT RTS frame” to “in a non-HT or a non-HT duplicate RTS frame”

There is mandatory behaviour related to VHT STA operation in resonding to a non-HT RTS PPDU, see 123.08 (D4). So describing this as “mandatory support” for a non-HT PPDU is correct.

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| 7119 | 12.12 | 3.2 | "user" -- very poor choice as a technical name, especially since "user" has extensive use in 802.11-2012 -- especially "user priority", but also "user accounts", "to the user", etc. | Replace "user" in this definiton with a term that is not used extensively in 802.11-2012. How about "RA-user" or "ruser" (a robust ruser could then be a "bruser")? | MAC |

Proposed Resolution:

Rejected.

The term “user” can be safely disambiguated according to its context, and is a term widely associated outside 802.11 with the concept of “multi-user” MIMO.

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| 7120 | 12.15 | 3.2 | "user position" is used in several locations in this draft, but has no definition. | Define "user position". | MAC |

Proposed Resolution:

Rejected.

“User Position” is used in the names of two fields, and an upper case variant as a TXVECTOR parameter. These terms define their meanings. Other uses of “user position” in the draft are closely related to references to these fields and need no additional definition.

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| 7334 | 14.00 | 6 | What does it mean to provide both a VHT Capabilities element and a VHTOperationalMCSSet parameter in a primitive, seeing as the latter is derived solely from the former. What happens if they differ? Which is the value used? Ditto for VHT Operation element and VHTBSSBasicMCSSet. | Delete the operational/basic set information from primitives which already have VHT capabilities/operation information | MAC |

Proposed Resolution:

Revised.

Delete the BSSBasicVHTMCS\_NSSSet parameter at 15.03, 23.63, 24.15.

Delete the OperationalVHTMCS\_NSSSet parameter at 15.16, 23.65, 24.24.

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| 7122 | 24.11 | 6.3.1.2.2 | "necessary" is a vague "shall", which does not appear to be intended. | Delete "necessary" -- besides, "Provides additional information for operating.." is clearer. | MAC |

Proposed Resolution:

Rejected.

Dictionary.com defines “necessary” as:

“being essential, indispensable, or requisite: a necessary part of the motor. “

The VHT Operation element contains a number of parameters that are essential to the operation of a VHT BSS, such as its basic MCS information and channel width. As such the wording “Provides additional information necessary for operating the VHT BSS.” is correct.

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| 7123 | 25.28 | 6.5.4.2 | "requires" is a vague "shall", which does not appear to be intended. | Replace "that the PHY requires to change" with "for the PHY to change". | MAC |

Proposed Resolution

Rejected. This comment is out of scope. This comment is on text that is not changed in this recirculation, is not affected by other changes in this recirculation, and is not the subject of an unsatisfied comment.

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| 7339 | 29.00 | 7.3.4.5 | "BSS, mesh and TDLS interfaces" implies a mesh is not a BSS, but it is (a.k.a. MBSS) | Delete the ", mesh" (twice) | MAC |

Context:

“The PARTIAL\_AID\_LIST\_GID00

parameter includes the list of partial

AIDs that the STA is an intended

recipient of on its BSS, mesh and

TDLS interfaces associated with

group ID 0. The settings of the

PARTIAL\_AID are specified in

9.17a (Group ID and partial AID in

VHT PPDUs)).”

Proposed Resolution:

Accepted.

(Note that this is a subset of the resolution to CID 7342, which also deletes the cited text).

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| 7342 | 29.00 | 7.3.4.5 | What exactly does "interfaces" mean here? | Clarify | MAC |

Discussion.

Perhaps we need help from ARC here. My take is that “interfaces” was supposed to appeal to the existence of separate “ports” into which traffic for BSS and TDLS operation flowed indepdendently.

I don’t believe this is any model described by 802.11. We have a single MAC Data SAP per MAC entity, end of story. That MAC entity can be receiving data from a TDLS peer and its AP, and there is nothing at the MAC SAP to differentiate it.

Proposed Resolution:

Revised. Delete “on its BSS, mesh and TDLS interfaces” at 29.24 and 29.34.

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| 7353 | 376.00 | G | There are vague rumours that multiple RTS/CTSes are allowed in a TXOP involving MU PPDUs, but this is not allowed by Annex G | Either publicly deny the rumours, or extend Annex G (and probably some stuff in clause 9) | MAC |

Discussion:

In R0, I proposed a reject. At the TGac ad-hoc we determined that this response was incorrect.

RTS/CTS/Data/Ack/RTS/CTS/Data/Ack appears to be allowed in Clause 9.

So does RTS/CTS/RTS/CTS/data/ack – e.g. where the RTS/CTS exchanges are to different STAs, and the data is MU.

|  |
| --- |
| In D4 149.11 we have:  A STA shall save the TXOP holder address for the BSS in which it is associated, which is the MAC address  from the Address 2 field of the frame that initiated a frame exchange sequence except when this is a CTS  frame, in which case the TXOP holder address is the Address 1 field. If the TXOP holder address is obtained  from a control frame, a VHT STA shall save the non-bandwidth signaling TA value obtained from the Address  2 field. If an RTS frame is received with the RA address matching the MAC address of the STA and the  MAC address in the TA field in the RTS frame matches the saved TXOP holder address, then the STA shall  send the CTS frame after SIFS, without regard for, and without resetting, its NAV. When a STA receives a  frame addressed to it that requires an immediate response, except for RTS, it shall transmit the response independent  of its NAV. The saved TXOP holder address shall be cleared when the NAV is reset or when the  NAV counts down to 0.  At 123.0 we have:  A STA that receives an RTS frame addressed to it considers the NAV to determine whether to respond with  CTS unless the NAV was set by a frame originating from the STA sending the RTS frame (see 9.19.2.2 (EDCA  TXOPs)). Thus, in this subclause, “NAV indicates idle” means that the NAV count is zero or that the  NAV count is nonzero but the non-bandwidth signaling TA obtained from the TA field of the RTS frame  matches the saved TXOP holder address.  This now comes before the following text from 802.11-2012 (831.03):  “A STA that is addressed by an RTS frame shall transmit a CTS frame after a SIFS period if the NAV at the  STA receiving the RTS frame indicates that the medium is idle.” |

The RTS/CTS/Data/Ack/RTS/CTS/Data/Ack exchange is allowed, as this is two txop-sequences, and “(\* A TXOP (either polled or EDCA) may be filled with txop-sequences, which are initiated by the TXOP

holder. \*)”

However, nothing in Annex B appears to allow RTS/CTS/RTS/CTS.

We also have the question of how to reflect 151.10: “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.”

Straw poll: “we should do whatever it takes to stop pre-VHT devices from sending RTS/CTS/RTS/CTS in one EDCA TXOP.”

Yes

No

Additional discussion:

It appears based on some research in the baseline that REVmc is contratictory as to whether 802.11e/n devices can use RTS/CTS more than once in the same TXOP.

1) 9.3.2.6: "If the NAV at the STA receiving the RTS indicates the

medium is not idle, that STA shall not respond to the RTS frame [with a CTS]."

2) 9.19.2.2: "If an RTS frame is received [from] the saved TXOP

holder address, then the STA shall send the CTS frame after SIFS, without regard for [...] its NAV."

Given this contradiction, I believe we should leave pre-VHT behaviour alone.

Proposed Resolution - updated

Revised.

Make changes in <this-document> under CID 7353. These allow multiple RTS/CTS for VHT STA.

***Change 149.18 as follows:***

If the TXOP holder address is obtained from a control frame, a VHT STA shall save the non-bandwidth signaling TA value obtained from the Address 2 field. If a non-VHT STA receives an RTS frame with the RA address matching the MAC address of the STA and the MAC address in the TA field in the RTS frame matches the saved TXOP holder address, then the STA shall send the CTS frame after SIFS, without regard for, and without resetting, its NAV.

If a VHT STA receives an RTS frame with the RA address matching the MAC address of the STA and the non-bandwidthsignaling TA value obtained from the Address 2 field in the RTS frame matches the saved TXOP holder address, then the STA shall send the CTS frame after SIFS, without regard for, and without resetting, its NAV.

***Change the “nav-set” term as follows:***

(\* These are the series of frames that establish NAV protection for an HT sequence \*)

nav-set = (**RTS**[*+HTC*] **CTS**[*+HTC*]) |

**CTS**+*self* |

**(Data**[*+HTC*]+*individual*[+*null*][+*QoS*+*normal-ack*] **ACK)** |

**Data**[*+HTC*]+*individual*[+*QoS*+(*block-ack*)] |

**Data**+*group*[+*null*][+*QoS*] |

( 1{ **Data**[+*HTC*]+*individual*+*QoS*+*implicit-bar*+*a-mpdu*}+*a-mpdu-end*

**BlockAck**[+*HTC*]

) |

(**BlockAckReq**[*+HTC*] (**BlockAck**[*+HTC*]**|ACK**[*+HTC*])) |

(**BlockAck**[*+HTC*] **ACK**) |

1{vht-rts-cts};

(\* The vht-rts-cts term applies to RTS transmitted by a VHT STA to another VHT STA.When the RTS is transmitted using a non-HT or non-HT duplicate PPDU, the transmission of the RTS is delayed so that at least a PIFS has elapsed since the previous frame exchange sequence (see 9.19.2.4) and the RTS is transmitted with a signaling TA (see 9.3.2.5a). \*)

vht-rts-cts = **RTS***+pifs*[*+HTC*] **CTS**[*+HTC*];

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| 7400 | 376.00 | G | Annex G is missing VHT frame sequences | Add VHT frame sequences | MAC |

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| --- | --- | --- | --- | --- | --- |
| 7013 | 376.16 | G | "This annex does not describe the operation of VHT features."  But it should. | Add a description of VHT frame sequences. Please assign comment to me and I will attempt to provide an update to Annex G. | MAC |

Proposed Resolution:

Revised. Make changes in <this-document> under CID 7400, which add the VHT frame sequences.

Discussion

There are two essential sequences we need to show for VHT

* VHT Beamforming training
* MU transmission

The hard part is that we have no notation for users, so we will have to create one.

**Proposed changes:**

***Delete*** “This annex does not describe the operation of VHT features.”

The attribute specifies a condition that applies to the frame (or alternatively, for the attributes which start +mu, the A-MPDU) that precedes it.

***Change the descriptions of a-mpdu and a-mpdu-end as shown and add the following attributes and notes to table G-1: (and renumber NOTE to NOTE1)***

|  |  |
| --- | --- |
| **Attribute** | **Description** |
| *a-mpdu* | Frame is part of an A-MPDU aggregate.  See NOTE 3 |
| *a-mpdu-end* | Frame is the last frame in an A-MPDU aggregate.  See NOTE 3 |
| *mu-ppdu-end* | This attribute delineates the end of an MU PPDU.  See NOTE 2 |
| *mu-user-respond* | The preceding frame or A-MPDU is part of an MU PPDU and is addressed to a user from which an immediate response is expected.  See NOTE 2 |
| *mu-user-not-respond* | The preceding frame or A-MPDU is part of an MU PPDU and is addressed to a user from which no immediate response is expected.  See NOTE 2 |
| NOTE2 – *+mu-ppdu-end, +user-respond* and *+user-other* are used in productions that generate MU PPDUs, according to the pattern: [“an A-MPDU (which might contain a VHT single MPDU) needing a response” *+mu-user-respond* ] {“an A-MPDU (which might contain a VHT single MPDU) not needing a response” *+user-other*} +*mu-ppdu-end.* There is at least one of *mu-user-respond* or *mu-user-not-respond* in a MU PPDU.  NOTE3 – In the case of VHT single MPDU, a single MPDU is carried in a VHT PPDU. The attributes *+a-mpdu* and *+a-mpdu-end*  are not used in this case.  NOTE 4 – in the sequence **A**+*mu-user-respond* **B**+*mu-user-not-respond* … +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 MU-PPDU. | |

***Change G.4 as follows:*G.4 HT and VHT sequences**

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

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

(\* These are sequences that occur within an ht-txop-sequence that have an ack response \*)

ht-ack-sequence = (**BlockAck**+*delayed*[*+HTC*] [+*mu-user-respond* other-users] **ACK**[+*HTC*]) |

(**BlockAckReq**+*delayed*[*+HTC*] [+*mu-user-respond* other-users] **ACK**[+*HTC*]) |

**(Data**[*+HTC*]+*individual*[+*null*][+*QoS+normal-ack*] [+*mu-user-respond* other-users] **ACK**[+*HTC*]**)**;

(\* The per-user part of a PPDU not requiring a response is either a single frame not requiring response, or an A-MPDU of such frames.\*)

ppdu-not-requiring-response-per-user =

frame-not-requiring-response-non-ampdu | (\* Includes VHT single MPDU \*)

1{frame-not-requiring-response-ampdu+*a-mpdu*}+*a-mpdu-end*;

(\* A PPDU not requiring a response is either a single frame not requiring response, or an A-MPDU of such frames.\*)

ppdu-not-requiring-response =

ppdu-not-requiring-response-per-user [*+mu-user-not-respond* other-users];

(\* A PPDU containing a BlockAckReq is either a non-A-MPDU BlockAckReq, or an A-MPDU containing Data carrying implicit Block Ack request\*).

ppdu-bar=

**(**

**BlockAckReq**[*+HTC*] |

(1{**Data**[*+HTC*]+*QoS+implicit-bar+a-mpdu*} + *a-mpdu-end*)

) [+*mu-user-respond* other-users];

(\* A PPDU containing a BlockAckReq is either a non-A-MPDU BlockAckReq, or an A-MPDU containing Data carrying implicit Block Ack request\*).(\* A PPDU containing both BlockAck and BlockAckReq is an A-MPDU that contains a BlockAck, plus either a BlockAckReq frame, or 1 or more data frames carrying implicit Block Ack request. \*)

ppdu-ba-bar=

( **BlockAck**[*+HTC*]+*a-mpdu*

(

**BlockAckReq**[*+HTC*]+*a-mpdu* |

1{**Data**[*+HTC*]+*QoS+implicit-bar+a-mpdu*}

) **+** *a-mpdu-end*

*)* [+*mu-user-respond* other-users]*;*

(\*A PPDU containing BlockAck is either a non-A-MPDU BlockAck, or an A-MPDU containing a

BlockAck, and also containing data that does not carry implicit Block Ack request. \*)

ppdu-ba=

( **BlockAck**[*+HTC*] |

(

**BlockAck**[*+HTC*]+*a-mpdu*

1{**Data**[*+HTC*]+*QoS+*(*no-ack*|*block-ack*)+*a-mpdu*}

) + *a-mpdu-end*

) [+*mu-user-not-respond* other-users]*;*

(\* A PPDU delivering an RDG, but not delivering a BlockAckReq is either a data frame, not requiring immediate acknowledgment, or a BlockAck or BlockAckReq, not requiring immediate acknowledgment \*)

ppdu-rd=

( **Data***+HTC*[+*null*]+*QoS*+(*no-ack*|*block-ack*)+*RD* |

**(BlockAck|BlockAckReq)***+HTC*+*delayed-no-ack+RD* |

(

1{**Data***+HTC*+*QoS+RD+a-mpdu*}

) + *a-mpdu-end*

) [+*mu-user-respond* other-users];

(\* A PPDU containing a BlockAckReq and delivering an RDG is either an non-A-MPDU BlockAckReq

frame, or an A-MPDU containing at least one data frame with RD and implicit-bar. \*)

ppdu-rd-bar=

( **BlockAckReq***+HTC*+*RD* |

(

1{**Data***+HTC*+*QoS+implicit-bar+RD+a-mpdu*}

) + a-mpdu-end

) [+*mu-user-respond* other-users];

(\* A PPDU containing a BlockAck and granting RD is either an unaggregated BlockAck or an A-MPDU

that contains a BlockAck and at least one data frame containing RD, but not implicit Block Ack request. \*)

ppdu-ba-rd=

( **BlockAck**+*HTC+RD* |

(

**BlockAck**+*a-mpdu* (

1{**Data***+HTC*+*QoS*+(*no-ack*|*block-ack*)+*RD*+*a-mpdu*}

)) + *a-mpdu-end*

) [+*mu-user-respond* other-users]*;*

(\* A PPDU containing a BlockAck, BlockAckReq and granting RD is an A-MPDU that contains a

BlockAck and either an explicit BlockAckReq (and no data frames) or data frames carrying the implicit

Block Ack request. The RD attribute is present in all frames carrying an HT Control field, and at least one of

these frames is present. This constraint is not expressed in the syntax below. \*)

ppdu-ba-rd-bar=

(

(

**BlockAck**[*+HTC*+*RD*]+*a-mpdu*

**BlockAckReq**[*+HTC*+*RD*]+*a-mpdu*

) + *a-mpdu-end* |

(

**BlockAck**[*+HTC*+*RD*]+*a-mpdu*

1{**Data**[*+HTC+RD*]+*QoS*+*implicit-bar*+*a-mpdu*}

) + *a-mpdu-end*

) [+*mu-user-respond* other-users];

(\* A link adaptation exchange is a frame exchange sequence in which on-the-air signaling is used to control

or return the results of link measurements so that the initiator device can choose effective values for its

TXVECTOR parameters. \*)

link-adaptation-exchange =

mcs-adaptation |

implict-txbf |

explicit-txbf

vht-bf;

(\* The VHT beamforming sequence starts with a VHT NDP Announcement frame, followed by a VHT NDP. One of the STAs in the sequence responds immediately with explicit feedback. The VHT AP might poll the other STAs to obtain their feedback before generating an MU tranmission. The names of the frames include spaces, so they are delimited using parentheses. \*)

vht-bf =

(**VHT NDP Announcement) (VHT NDP)** vht-feedback {(**Beamforming Report Poll**) vht-feedback};

(\* VHT feedback is provided using VHT Compressed Beamforming frames. Multiple frames may be needed to provide feedback. \*)

vht-feedback =

(**VHT Compressed Beamforming frame**) | (\* VHT single MPDU or non-VHT PPDU \*)

1{(**VHT Compressed Beamforming frame**) +*a-mpdu*} +*a-mpdu-end;*