### IEEE P802.11Wireless LANs

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| 11ax D0.1 Comment Resolution for MU RTS/CTS procedure |
| Date: 2016-06-28 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Po-Kai Huang | Intel Corporation | 2200 Mission College Blvd, Santa Clara, CA 950542200  |  | po-kai.huang@intel.com |
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Abstract

This submission proposes resolutions for comments in clause 10.3.2.8a of TGax Draft 0.1 with the following CIDs:

* 963, 128, 214, 2171, 2428, 692, 124, 2906, 2840, 2603, 2599, 1209, 2264, 15, 13, 126, 1071, 693, 1768, 401, 1727, 403, 1644, 2281, 2282, 2279, 160

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revise based on the editorial comments from Mark. Revise the resolution descriptoin for CID 2840 and CID 15.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax D0.1 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax D0.1 Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **Commenter** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 963 | Kaiying Lv | 41 | 10.3.2.8a.3 |  "The CTS sent in response to an MU-RTS frame shall be transmitted on one or more 20 MHz channels" is redundant with the sentence below. | Suggest to remove it | Accepted –The format of responding CTS and the bandwidth of responding CTS shall be specifically described. Since this sentence does not provide specific details, agree to remove this sentence.  |
| 128 | Alfred Asterjadhi | 59.22 | 10.3.2.8a.3 | "The CTS sent in response to an MU RTS frame shall be transmitted on one or more 20 MHz channels". Actually the MU RTS is providing this indication to the STA in the RU Allocation. Hence the CTS frame shall be sent according to the RU Allocation provided by the RTS (see next paragraph). Remove this sentence. | As in comment. | Accepted –As discussed in CID 963, agree to remove this sentence. |
| 214 | Alfred Asterjadhi | 59.22 | 10.3.2.8a.3 | Are the 20MHz channels contiguous? | Please clarify that they are contiguous. | Revised – As discussed in CID 963, this sentence does not provide specific details and may create confusion. Hence, the sentence is removed.Further, currently only contiguous response, i.e., primary 20MHz, primary 40 MHz, primary 80MHz, 160/80+80MHz is agreed in the SFD with the exception of 80+80 MHz channel indication. This fact is reflected in the description of RU allocation subfield in 9.3.1.23.2 MU-RTS variant. |
| 2171 | stephane baron | 41.22 | 10.3.2.8a.3 | CTS Response to MU-RTS : channel contiguityThe CTS shall be transmitted on one or more 20 MHz channels.Does this enclose transmission over non-contiguous 20 MHz channels ? | Clarify the behaviour when a duplicated RTS is collided on a 20MHZ subchannel by legacy STA. Should the HE STA send a CTS on non-contiguous (secondary) sub channels ? | Revised – As discussed in CID 963, this sentence does not provide specific details and may create confusion. Hence, the sentence is removed.Further, currently only contiguous response, i.e., primary 20MHz, primary 40 MHz, primary 80MHz, 160/80+80MHz is agreed in the SFD with the exception of 80+80 MHz channel indication. This fact is reflected in the description of RU allocation subfield in 9.3.1.23.2 MU-RTS variant. |
| 2428 | Yongho Seok | 22.43 | 9.3.1.23.2 | Second paragraph of 9.3.1.23.2 is redundant with second paragraph of 10.3.2.8a.2.Remove either one. | As per comment | Revised –The author refers to the RU indication for CTS response bandwidth.Keep the sentence in 9.3.1.23.2 to specify the the allowed indication.Delete the sentence in 10.3.2.8a.2 since the sentence is duplicated in 9.3.1.23.2.Revise the sentence in 10.3.2.8a.3 to clarify that STA will not send CTS if the indication is not an allowed indication as defined in 9.3.1.23.2 MU-RTS variant. |
| 692 | Jae Seung Lee | 40.61 | 10.3.2.8a.2 | Other indications are TBD. | Define the other indications | Revised –As discussed in CID 2428, since the feasible allocation is described in 9.3.1.23.2 MU-RTS variant, we remove the sentence to avoid duplicatioin.Note that there are no TBD indication for the description of allowed indication in 9.3.1.23.2 MU-RTS variant.  |
| 124 | Alfred Asterjadhi | 58.60 | 10.3.2.8a.2 | What other indications are TBD for the RU Allocation subfield of the MU RTS variant of the Trigger frame? This is the only way you could protect the transmission from legacy devices. Hence this statement should be removed "Other indications are TBD". | As in comment. | Revised –As discussed in CID 2428, since the feasible allocation is described in 9.3.1.23.2 MU-RTS variant, we remove the sentence to avoid duplicatioin.Note that there are no TBD indication for the description of allowed indication in 9.3.1.23.2 MU-RTS variant. |
| 2906 | Zhou Lan | 40.59 | 10.3.2.8a.2 | "the RU Allocation subfield in the Per-User Info field addressed to the STA shall be set to a value indicating either primary 20 MHz channel, primary 40 MHz channel, primary 80 MHz channel, 160 MHz channel, or 80+80 MHz channel", the current RU indication can not differentiate 80+80 from 160. | Clarify or adding new rule to differentiate 80+80/160 | Revised –Similar to VHT AP, HE AP will determine the BSS bandwidth with a 20MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz BSS bandwidth. Hence, there is no need to indicate if it is 160MHz or 80+80 MHz in RU allocation subfield. Also note that in the RU allocation signalling agreed in MAC Motion 74, March 2016 (16/383r0), only one entry is used for 160MHz/80+80MHz case.  |
| 2840 | Yusuke Tanaka | 40.51 | 10.3.2.8a.2 | Is this restriction necessary? AP shall be allowed to request for CTS in subchannel that the MU-RTS is not sent | Remove paragraph starting, "An MU-RTS shall..." | Rejected – This limitation is based on MAC Motion #10, May 2015 as shown below.“An AP shall not allocate UL subchannel in any 20 MHz channel that is not occupied by the immediately preceding DL PPDU that contains trigger information. In each 20 MHz channel occupied by the immediately preceding DL PPDU that contains trigger information, there is at least one allocated subchannel.”The reason behind the motion is that if a 20 MHz channel is not occupied by the trigger frame, then the 20 MHz channel is not protected, and the TXOP is not granted to the TXOP holder on the 20MHz channel. Hence, it is then meaningless for MU-RTS to request for CTS response on the 20MHz channel.Since MU-RTS is a variant of trigger frame, AP then shall not request a STA to send CTS in any 20MHz channel that is not occupied by the immediately preceding PPDU that contains a MU-RTS. |
| 2603 | Young Hoon Kwon | 41.16 | 10.3.2.8a.3 | In case Dynamic bandwidth is set to Dynamic, each participating STA may choose different CH\_BANDWIDTH\_IN\_NON\_HT value depending on its CCA status, in which case RF combining cannot be made. Therefore, all participating STAs shall use the same value for CH\_BANDWIDTH\_IN\_NON\_HT. | Multiple ways available: (i) MU-RTS frame shall not carry bandwidth signaling TA. Or, (ii) DYN\_BANDWIDTH\_IN\_NON\_HT of MU-RTS frame shall be set to Static. Or, (iii) Regardless of transmission of CTS frame, the CTS frame's TXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT shall be set to the same value as the RTS frame's RXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT. | Revised –Bandwidth signalling TA is not required for MU-RTS because the CTS respdoning bandwidth for each solicited STA is already indicated in the Per-User info field.Further, as mentioned by the commenter, if STA reports different bandwidth, then CTS transmission from different STA will interfere with other.Hence, agree with the commenter that MU-RTS shall not carry bandwidth signalling TA. |
| 2599 | Young Hoon Kwon | 39.65 | 10.3.2.8a.1 | In current REVc\_D5.2 spec. (10.3.2.6), a VHT STA transmitting an RTS frame carried in non-HT or non-HT duplicate format and addressed to a VHT STA shall set the TA field to a bandiwdth signaling TA and shall set the TXVECTOR parameters CH\_BANDWIDTH\_IN\_NON\_HT and CH\_BANDWIDTH to the same value. However, it is not clear if a HE STA transmitting a MU-RTS frame carried in non-HT or non-HT duplicate format needs to follow the similar rule. | As mentioned in the comment, clarify if a HE AP transmitting a MU-RTS frame carried in non-HT or non-HT duplicate format needs to follow the similar rule on bandwidth signaling TA. | Revised –As discussed in CID 2603, Bandwidth signalling TA shall not be used for MU-RTS. Hence, clarify that MU-RTS shall not carry bandwidth signalling TA |
| 1209 | Liwen Chu | 41.1 | 10.3.2.8a.3 | Allowing CTS with different BW to a MU-RTS is not reasonable since the AP can't figure out the BW. All the CTS shall use same BW of MU-RTS. | As in comment. | Rejected –Not all STAs can be allocated the same bandwidth of MU-RTS. For example, if a STA chooses to operate only on primary 20MHz channel, then MU-RTS can not force the STA to respond CTS beyond primary 20MHz channel. Hence, we shall not limit all the solicited STAs to transmit CTS on the same bandwidth of MU-RTS. |
| 2264 | Woojin Ahn | 41.30 | 10.3.2.8a.3 | OBSS STAs cannot set NAV from simultaneous CTS unless the channel, where simultaneous CTS is transmitted, is the primary channel of that OBSS. For a transmitter, therefore, as the number of channels they sends the simultaneous CTS increases, they will have more chance to be protected by the CTS transmission. With the current channel allocation rule of simultaneous CTS, as a result, STAs assigned in the primary channel will have the least probability of being protected by NAV setting. | Need discussion | Rejected – Similar protection topic has been discussed in 16/395 for preamble transmission of UL OFDMA, and the conclusion is that protection is only required on the 20 MHZ band allocated for UL data transmission rather than the whole bandwidth.For MU-RTS case, it is then benefical for AP to request each STA to transmit CTS with smallest and supported 20MHz responding bandwidth that covers the bands allocated to the STA for the following DL/UL MU transmission. |
| 15 | Ahmadreza Hedayat | 41.25 | 10.3.2.8a | Regarding "If the CTS sent in response to an MU-RTS frame is transmitted in a non-HT or non-HT duplicate PPDU, then the CTS response shall be transmitted on the indicated 20 MHz channels identified in the RU Allocation subfield of the Per-User Info field.", the responding STA may end up using a subset of the indicated channels. | Suggested text: If the CTS sent in response to an MU-RTS frame is transmitted in a non-HT or non-HT duplicate PPDU, then the CTS response shall be transmitted on the Primary 20MHz, Primary40MHz or Primary 80MHz subset of the indicated channels identified in the RU Allocation subfield of the Per-User Info field. | Rejected – Currently, only static CS mode for response to trigger frame is agreed, and the agreement is based on the following motion.*When required to sense the medium before its UL MU transmission in response to a trigger frame, if a STA detects the 20MHz channels containing the allocated UL RU are not all idle, then the STA shall not transmit anything in the allocated UL RU.**[MU Motion 42, January 2016]*Since MU-RTS is a variant of trigger frame, STA can then either transmit CTS with the bandwidth equal to the indicated bandwidth in MU-RTS or does not transmit CTS. The reason behind this motion is that static CS mode leads to simple design. (See 16/054.) Further, for the MU-RTS variant of Trigger frame, if the STA can choose to transmit on a subset of the indicated bandwidth, then MU-RTS is the only Trigger frame variant that allows dynamic CS mode, which will also complicate the implmenetation of UL MU CS for response to Trigger frame variant.  |
| 13 | Ahmadreza Hedayat | 41.13 | 10.3.2.8a | "HE STAs may transmit CTS responses to an MU-RTS frame in a non-HT or non-HT duplicate PPDU with frame format as defined in 9.3.1.3 based on the request in MU-RTS frame. The method of request is TBD." | Specify the method that the MURTS sender request the format of the CTS response, e.g. an indicator in the Common Info of the MU-RTS frame. | Revised –Agree in principle with the commenter. As discussed in 16/648. CTS response to MU-RTS shall be carried in non-HT or non-HT duplicate PPDU. Hence, revise the sentence to reflect the agreement in SFD.  |
| 126 | Alfred Asterjadhi | 59.15 | 10.3.2.8a.3 | Couple of issues in this paragraph: "HE STAs may transmit CTS responses" is technically not correct as you have a stronger statemnt in the preceding paragraph. You simply need to specify that these CTS responses are CTS frames. Also the method of request is not TBD since we have defined the MU RTS as the MU RTS variant Trigger frame. | As in comment. | Revised –Agree in principle with the commenter. Revise the sentence based on the discussion in CID 13.  |
| 1071 | Kiseon Ryu | 41.13 | 10.3.2.8a.3 | Transmission of the simultaneous CTSs from multiple STAs is requested by MU-RTS. No need "The method of request is TBD." | Delete the following text:The method of request is TBD. | Revised –Revise the sentence based on the discussion in CID 13. |
| 693 | Jae Seung Lee | 41.11 | 10.3.2.8a.3 | There are TBDs in the subclause. | Define the transmission conditions, and the method of request | Revised –Revise the sentence based on the discussion in CID 13.The TBD for transmission condition is removed. |
| 1768 | Po-Kai Huang | 41.13 | 10.3.2.8a.3 | When RTS is carried in non-HT or non-HT duplicate format, CTS response is also carried in non-HT or non-HT duplicate format. Similar to the CTS response to RTS, when MU-RTS is carried in non-HT or non-HT duplicate format, CTS response shall be carried in non-HT or non-HT duplicate format. | Clarify that when MU-RTS is carried in non-HT or non-HT duplicate format, CTS response shall be carried in non-HT or non-HT duplicate format. | Revised –Agree in principle with the commenter. Revise the sentence based on the discussion in CID 13. |
| 401 | Brian Hart | 41.13 | 10.3.2.8a.3 | "HE STAs may transmit CTS responses" is dangerously weak. Subject to certain conditions, HE STAs shall transmit CTS responses. | Make it a shall, and list / cross ref the requirements ot make it a shall. A "may" here is unuseful | Revised –Revise the sentence based on the discussion in CID 13. |
| 1727 | Osama Aboulmagd | 41.25 | 10.3.2.8a.3 | there seems to be a bit of contradiction in the paragraph starting at line 25. Non-HT duplicate is transmitted on all 20's of a bonded channel. However the statement says the CTS shall be transmitted on the indicated 20 MHz channels identified in the RU allocation, implying it is not send on all 20s. | Clarify the apparent contradiction | Revised – Based on the agreed motion in SFD, CTS shall be transmitted on the indicated 20MHz from MU-RTS. Revise the sentence to simply describe the agreed motion. |
| 403 | Brian Hart | 41.25 | 10.3.2.888.3 | Spec needs to say behavior if transmitted in a HT/VHT/HE PPDU | Define or xref to definition. Likely same as non-HT rule. | Revised –Agree with the commenter. As discussed in CID 1727, revise the sentence to simply describe the fact that CTS shall be transmitted on the indicated 20MHz channel(s). Also, as discussed in CID 13, CTS response to MU-RTS shall be carried in non-HT or non-HT duplicate PPDU and the corresponding texts is included in CID 13. |
| 1644 | Matthew Fischer | 40.51 | 10.3.2.8a.2 | Language here is not well written. It needs to be rewritten to specify an entity performing an action. E.g. An HE AP shall transmit blah. For condition B, an HE AP shall include the value blah in the field hooha of the frame zippity. | Rewrite the language to indicate that the transmitter of the MU-RTS shall or shall not perform certain behaviors with specific conditions. | Revised –Agree in principle with the commenter. Rewrite the paragraph based on the suggestion of the commenter. |
| 2281 | Xiaofei Wang | 40.54 | 10.3.2.8a.2 | The phrase "immediately preceding DL PPDU" is confusing and should be removed, since there may not be a CTS transmitted in response to the DL PPDU, then there is no "immediate preceding DL PPDU" to speak of. | remove the phrase | Revised –As discussed in CID 1644, the sentence has been revised. |
| 2282 | Xiaofei Wang | 40.54 | 10.3.2.8a.2 | The phrase "there is at least one STA" is very confusing; what does it mean that there is at least one STA, does it mean receiving or transmitting. If it is meant that a STA is being requested to transmit on that 20 MHz channel, please clarify and rephrase; also this does not seem to be covered by the SFD. | clarify and rephrase to make the text clear. | Revised –As discussed in CID 1644, the sentence has been revised.Further, the rule is based on the following motion agreed in the spec framework for the trigger frame. Since MU-RTS is a variant of trigger frame, similar rule shall be followed.*An AP shall not allocate UL subchannel in any 20 MHz channel that is not occupied by the immediately preceding DL PPDU that contains trigger information. In each 20 MHz channel occupied by the immediately preceding DL PPDU that contains trigger information, there is at least one allocated subchannel. [MAC Motion #10, May 2015]* |
| 2279 | Xiaofei Wang | 39.23 | 10.3.1 | The phrase "prior to the actual data frames" is not needed. | remove the phrase | Rejected –Note that the sentence for RTS/CTS shown below in the current spec also has the phrase “prior to the actual data frames.”*The exchange of RTS and CTS frames prior to the actual Data frame is one means of distribution of this medium reservation information.*Hence, the phrase has it meaning in the sentence. |
| 160 | Alfred Asterjadhi | 1278.8 | 10.3.2.7 | This behavior needs to be followed for MU RTS as well (essentially the determination that the AP is the TXOP holder depends on the successful reception of the CTS frame). | As in comment. | Revised –The commenter refers to the procedure for the transmitter of RTS being identified as a TXOP holder. Agree with the commenter. Add corresponding sentence to reflect this behaviour. |

**Discussion:** *None.*

**Propose:**

Revised for CID 963 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Delete the sentence on page 41 line 22 as the following:***

~~The CTS sent in response to an MU-RTS frame shall be transmitted on one or more 20 MHz channels.~~

**Propose:**

Revised for CID 2428 and 693 per discussion and editing instructions in 11-16/0807r0

***TGax editor: Modify the sentence on page 40 line 57 as the following:***

~~If an MU-RTS frame requests a STA to send CTS responses in a non-HT or non-HT duplicate PPDU, the
RU Allocation subfield in the Per-User Info field addressed to the STA shall be set to a value indicating
either primary 20 MHz channel, primary 40 MHz channel, primary 80 MHz channel, 160 MHz channel, or
80+80 MHz channel. Other indications are TBD.~~(#2428)

***TGax editor: Modify the sentence on page 41 line 10, 11 as the following:***

If a HE STA receives an MU-RTS frame, the HE STA shall commence the transmission of a CTS response
at the SIFS time boundary after the end of a received PPDU when all the following conditions are met.

— The MU-RTS frame has one of the Per-User Info fields addressed to the STA.

— The UL MU CS condition described in 25.5.2.4 (UL MU CS mechanism) indicates the medium is
idle

— The RU Allocation subfield in the Per-User Info field addressed to the STA indicates the primary 20 MHz channel, primary 40 MHz channel, primary 80 MHz channel, 160 MHz channel, or 80+80 MHz channel.(#2428)

~~— Other transmission conditions TBD are met.~~(#693)

**Propose:**

Revised for CID 2603 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Add the sentence on page 22 line 42 as the following:***

**9.3.1.23.2 MU-RTS variant**
The MU-RTS frame format is a variant of Trigger frame format as shown in Figure 9-51a (Trigger frame).

NOTE 1 - The TA field value is the address of the STA transmitting the MU-RTS frame.

***TGax editor: Modify the sentence on page 16 line 47 as the following:***

When the CTS frame is a response to an MU-RTS frame, the value of the RA field of the CTS frame is set to the
address from the TA field of the MU-RTS frame ~~with the Individual/Group bit forced to the value 0~~.

**Propose:**

Revised for CID 13 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Modify the sentence on page 41 line 13 as the following:***

~~HE STAs may transmit~~The CTS responses to an MU-RTS frame shall be carried in a non-HT or a non-HT duplicate PPDU. ~~based on the request in MU-RTS frame. The method of request is TBD.~~

**Propose:**

Revised for CID 1727 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Modify the sentence on page 41 line 25 as the following:***

~~If the CTS sent in response to an MU-RTS frame is transmitted in a non-HT or non-HT duplicate PPDU,~~ ~~then t~~The CTS response shall be transmitted on the 20 MHz channels identified in the RU Allocation subfield of the Per-User Info field of the MU-RTS frame.

**Propose:**

Revised for CID 1644 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Modify the paragraph on page 40 line 51 as the following marked in red:***

The transmitter of an MU-RTS frame ~~An MU-RTS frame~~ shall not request a STA to send CTS responses in any 20 MHz channel that is not occupied by the ~~immediately preceding DL~~ PPDU that contains the MU-RTS frame.

In each 20 MHz channel occupied by the ~~immediately preceding DL~~ PPDU that contains the MU-RTS frame, the transmitter of the MU-RTS frame shall request ~~there is~~ at least one STA~~that is requested~~ to send a CTS responses on the 20 MHz channel.

**Propose:**

Revised for CID 160 per discussion and editing instructions in 11-16/0807r0.

***TGax editor: Add the sentence on page 40 line 62 as the following:***

After transmitting an MU-RTS frame, the STA shall wait for a CTSTimeout interval with a value of aSIFSTime +
aSlotTime + aRxPHYStartDelay. This interval begins when the MAC receives a PHY-TXEND.confirm
primitive. If a PHY-RXSTART.indication primitive does not occur during the CTSTimeout interval, the STA
shall conclude that the transmission of the MU-RTS frame has failed, and this STA shall invoke its backoff
procedure upon expiration of the CTSTimeout interval. If a PHY-RXSTART.indication primitive does occur
during the CTSTimeout interval, the STA shall wait for the corresponding PHY-RXEND.indication primitive
to determine whether the MU-RTS frame transmission was successful. The recognition of a valid CTS frame sent
by the recipient of the MU-RTS frame, corresponding to this PHY-RXEND.indication primitive, shall be
interpreted as successful response, permitting the frame exchange sequence to continue. The
recognition of anything else, including any other valid frame, shall be interpreted as failure of the MU-RTS frame
transmission.