IEEE P802.11
Wireless LANs

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| All STA CR MCS Negotiation |
| Date: 2020-06-08 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Matthew Fischer | Broadcom |  |  | Matthew.fischer@broadcom.com |
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Abstract

Proposed language to expand use of Control Response MCS Negotiation from S1G to all STA types.

The proposed changes are with reference to TGmd D3.0 SA1 LB CID 4156.

Changes are referenced to TGmd D3.2.

**REVISION NOTES:**

**R0**:

Initial

**R1**:

Update to D3.1

Include CID

Add discussion section to address questions from review of R0

**R2**:

Changed an instance of TGax to TGmd

Update doc references

**R3**:

Remove 64-QAM ½ from the reference table, as there is no use of this combination in the draft

Update doc references

**R4**:

Update to D3.2

Update doc references

**R5**:

Fix abstract Draft reference value and some other doc numbering/date issues

Removed BPSK ¾ from the table, as it is not that useful

Update doc references

**R6**:

Added material to the discussion section

Update doc references

**R7**:

10.6.6.5.3 – created a new paragraph to minimize impact of changes to baseline S1G behavioural description, baseline paragraph now addresses only S1G behaviour, new paragraph is modified to account for non-S1G STA behaviour

10.6.6.5.5 MCS for asymmetric Block Ack operation – these changes are removed, as there is no interest in extending this feature to non-S1G STAs

Changed PPDU to PPDU or PSDU (well, more complicated than that TXVECTOR is PSDU, RXVECTOR is PPDU)

Changed instances of MCS Negotiation Support field to subfield

Some upper/lower case issues addressed regarding field names and functions

Extended Cap IE bit setting modified to account for backwards compatibility

Add the qualifier of “with dot11MCSNegotiation equal to true” to “a STA shall transmit the MCS Negotiation Response frame after receiving the MCS Neg REQ frame”

Update doc references

**R8**:

9.6.27.2 change last new sentence to a NOTE

Update doc references

**R9**:

9.4.2.26 – spelling error fixed

10.6.6.5.3 – paragraph allows modification of MCS or VHT-MCS, but not NSS, so remove metions that seem to imply that NSS might be modifiable

10.6.6.5.3 –few articles added

10.6.6.5.6 –few articles added

106.6.5.6 – changed the sense of the TX CR MCS Neg Req frame sentence from “shall not unless” to “may if”, which then allows the removal of the subsequent sentence which used “may”

Change MCSDifference to MCS Difference – one is the parameter in the SAP and the other is the field in the frame

Update doc references

**END OF REVISION NOTES**

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 TGmd Draft. This introduction is not part of the adopted material.

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

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

**CIDs**

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| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution (Proposed)** |
| 4156 | Fischer, Matthew | 10.6.6.5.3 | 1784.00 | The Control Response MCS negotiation text is confusing and needs rework and corrections and should be extended to cover PHY types beyond S1G. | Make changes to clarify the behavior. See, for example, 11-19-1562 | Revise – TGmd editor to make changes shown in 11-19-1562r9 to clarify the behaviour by for example, creating an MCS Reference Index that allows comparisons of the base paraemters of the eliciting frame MCS and the usually limited set of responding frame MCS choices and which adds an extended capability support bit to indicate support for the mechanism. |

**Discussion:**

Questions were raised during the review of r0 regarding NSS and CCK response considerations and whether there needs to be something in the table or in the instructions that relates to the varying possible NSS values of the soliciting frame and or whether CCK can be used in order to meet the MCS difference.

**NSS discussion**

With regard to NSS, the NSS is accounted for in generating the candidate MCS set, see the existing baseline text:

**10.6.6.5.3 Control response frame MCS computation**

**b)**

**2)**

Determine the highest number of spatial streams (*NSS*) value of the MCSs in the CandidateMCSSet that is less than or equal to the *NSS* value of the MCS of the received frame. Eliminate all MCSs from the CandidateMCSSet that have an *NSS* value that is not equal to this *NSS* value. The mapping from MCS to *NSS* is dependent on the attached PHY. For the HT PHY, see 19.5 (Parameters for HT-MCSs).

Later, the response frame is transmitted using an MCS that is selected according to the phrase or various similar versions of this phrase:

the highest rate in the BSSBasicRateSet parameter that is less than or equal to the rate (or non-HT reference rate; see 10.6.11 (Non-HT basic rate calculation)) of the previous frame

Find the highest indexed MCS from the CandidateMCSSet. The index of this MCS is the index of the MCS that is the primary MCS for the response transmission

it shall transmit the control response frame using either the primary MCS or the alternate MCS

I.e. for VHT and HT response frames, the construction of the candidate set includes instructions regarding NSS and therefore, NSS is already accounted for.

Readers should note that the case of VHT and HT response frames is somewhat rare, as in most cases the response frame will be transmitted using non-HT format, where NSS is immaterial, hence the existence in the baseline of the table which only includes coding and constellation. The following is the baseline text for the case of a non-HT format response frame:

**10.6.6.5.2 Selection of a rate or MCS**

carried in a non-HT PPDU, the primary rate is defined to be the highest rate in the BSSBasicRateSet parameter that is less than or equal to the rate (or non-HT reference rate; see 10.6.11 (Non-HT basic rate calculation)) of the previous frame

The BSSBasicRateSet contains only NSS=1 values and the baseline calculation of the non-HT reference rate only examines the coding and rate portions of the eliciting frame.

In either case, it should be noted that the candidate set or the BSSBasicRateSet from which to choose the primary MCS to be used for a control response transmission might not include a contiguous set of MCSs so that the instructions regarding MCS negotiation might not be satisfiable. That is, if the candidate MCS set contains gaps, then a desire to have an MCS difference of 2 might not be possible, as the set might contain, for example, only MCS values that are a difference of 1 and 3 from the soliciting MCS.

Therefore, the MCS difference instructions should be written to state that the MCS difference is a minimum difference, which is, in fact, how the baseline is worded.

Negotiated MCS is computed as the highest MCS *less than or equal to* the MCS that is MCSDifference lower than the primary MCS

**CCK discussion**

Regarding CCK used as a response frame format, see:

**10.6.6.5.2 Selection of a rate or MCS**

The modulation class of the (#1456)PSDU containing the control response frame shall be selected according to the following rules:

— If the PSDU containing the received frame is of a modulation class other than HT(11ah), VHT, or S1G and the control response frame is carried in a non-HT PPDU, the control response frame shall be transmitted in a PSDU using the same modulation class as the PSDU containing the received frame. In addition, the control response frame shall be sent using the same value for the TXVECTOR parameter PREAMBLE\_TYPE as the received frame.

Because of this rule, there should never be a CCK response to a non-CCK soliciting frame.

And the rate selection for CCK response to a CCK eliciting frame is goverened by the general rule:

If a CTS or Ack frame is carried in a non-HT PPDU, the primary rate is defined to be the highest rate in the BSSBasicRateSet parameter that is less than or equal to the rate (or non-HT reference rate; see 10.6.11 (Non-HT basic rate calculation)) of the previous frame.

So the only question is whether the MCS negotiation value of MCSDifference applies to a CCK soliciting frame or not. And that question is answered by the fact that all of the rules that exist in 10.6.6.5.3 where the MCSDifference is applied refer to formats other than CCK, leaving the response choice for CCK as effectively unmodified by the MCSDifference function.

**OTHER POSSIBLE MODIFICATIONS discussion ONE**

During presentation and review and subsequent exchanges, some points have been raised as follows with the responses to each point provided following the point:

1. how does the responder know the power difference

existing elements power constraint, power capability, transmit power envelope

1. TX power curve vs MCS is variable

See 11-17-0112, which suggested a tx power per MCS element, which was considered too much information

1. channel model variation can affect best response MCS choice

so long as the transmitter follows the current channel in its forward MCS choice, assuming some reciprocity, the responder, in transmitting its response with a delta MCS, will follow the same channel variation that was determined by the transmitter

1. forward frame size variation can affect best response MCS choice

Again, the transmitter is free to send frames of different sizes at different MCSs and the responder would follow its lead

1. impairments at transmitter and responder affect the best response MCS

the transmitter should know its own impairments and adjust forward MCS appropriately, the responder will suggest an MCS difference based on its own knowledge of its impairments

1. responder needs to be dynamically guessing at the best response MCS, but the negotiation yields a single delta value

dynamic parameters should be accounted for in the forward direction as indicated above

1. analysis suggested to determine if the mechanism is better than simply MCS down for forward frames

the difference in sending the short response frame at a lower MCS as compared to sending the longer forward data frame at a lower MCS is clear

1. unconditional rejection of MCS negotiation by the transmitter of the forward frames leaves the responder with no solution

this could be modified, it is not clear whether there is a burden on an AP that has many associations to determine a different response MCS per RA, but it feels like there should not be an extra burden since the AP needs to do a lookup for each RA anyway for forward MCS retrieval and other reasons

1. consideration of complications and potential additional functionality needed for future amendments

unclear what additional features exist in for example, 11ax or 11be that would need consideration

See: 11-20-0678-02-000m-some-thoughts-on-control-response-mcs-negotiation

**OTHER POSSIBLE MODIFICATIONS discussion TWO**

Another possible solution is to change the use of "shall" to "may" within 10.6.6.5 Rate selection for control response frames, specifically surrounding language that dictates the use of a fixed single response MCS based on the forward MCS.

Note that the only reason for the MCS negotiation mechanism at all in S1G or anywhere else, is to allow the transmitter to fill in a DUR value that is potentially accurate based on the expected response frame duration.

**Proposed Changes to TGmd D3.2:**

**9.4.2.26 Extended Capabilities element**

***TGmd editor: within TGmd D3.2, add another row to Table 9-153 – Extended Capabilities field as shown:***

**Table 9-153—Extended Capabilities field**

|  |  |  |
| --- | --- | --- |
| **Bit** | **Information** | **Notes** |
| <ANA> | MCS Negotiation Support | A STA sets the MCS Negotiation Support field to 1 when dot11MCSNegotiationActivated is true and dot11S1GOptionImplemented is false and sets it to 0 otherwise. |

**6.3.114.2.2 Semantics of the service primitive**

***TGmd editor: within TGmd D3.2, in 6.3.114.2.2 Semantics of the service primitive, within the unnamed table within the subclause, change the text in the Description column of the row that contains “MCSDifference” in the Name column, as shown:***

The nominal minimum difference between the MCS Reference Index value of the primary MCS and the MCS Reference Index value of the MCS that is preferred for use by the STA to transmit control response frames as described in 10.6.6.5.6 (Control response MCS negotiation(11ah)) and 10.6.6.5.3 (Control response frame MCS computation).

**6.3.114.4.2 Semantics of the service primitive**

***TGmd editor: within TGmd D3.2, in 6.3.114.4.2 Semantics of the service primitive, within the unnamed table within the subclause, change the text in the Description column of the row that contains “MCSDifference” in the Name column, as shown:***

The nominal minimum difference between the MCS Reference Index value of the primary MCS and the MCS Reference Index value of the MCS that is preferred for use by the STA to transmit control response frame as described in 10.6.6.5.6 (Control response MCS negotiation(11ah)) and 10.6.6.5.3 (Control response frame MCS computation).

***TGmd editor: within TGmd D3.2, in 9.6.27.2 Control Response MCS Negotiation Request frame format, change the text as shown:***

**9.6.27.2 Control Response MCS Negotiation Request frame format**

The MCS Difference field is 1 octet and is set to an unsigned value that represents the nominal minimum difference between the MCS Reference Index value of the primary MCS and the MCS Reference Index value of the MCS that is preferred for use by the STA to transmit control response frames as described in 10.6.6.5.6 (Control response MCS negotiation(11ah)) and 10.6.6.5.3 (Control response frame MCS computation).

NOTE - The value is a nominal minimum difference because for some values of primary MCS, there is no MCS with a lower MCS Reference Index value that satisfies the minimum difference condition.

***TGmd editor: within TGmd D3.2, in 10.6.6.5.3 Control response frame MCS computation, change the text as shown:***

**10.6.6.5.3 Control response frame MCS computation**

If the responding STA is an S1G STA, then once the primary <S1G-MCS, NSS> tuple has been selected, the STA may select an alternate MCS according to 10.6.6.5.4 (Selection of an alternate rate or MCS for a control response frame). If the STA has not negotiated the control response MCS negotiation as described in 10.6.6.5.6 (Control response MCS negotiation(11ah)) or has received a Reject indication in the Control Response MCS Negotiation Response frame, then it shall transmit the control response frame using either the primary MCS or the alternate MCS, if one exists. If the STA has received an Accept indication in the Control Response MCS Negotiation Response frame from a responding STA, then it shall transmit the control response frame to the responding STA using the negotiated MCS or alternative MCS provided that the duration of the frame at the alternate MCS is the same as the duration of the frame at the negotiated MCS, if one exists. The negotiated MCS is computed as the highest MCS less than or equal to the MCS that is MCSDifference lower than the primary MCS if one exists, or the MCS 10 otherwise.

If the responding STA is not an S1G STA, once the primary MCS or <VHT-MCS, NSS> tuple has been selected, the STA may select an alternate MCS or VHT-MCS according to 10.6.6.5.4 (Selection of an alternate rate or MCS for a control response frame). If the STA has not performed a control response MCS negotiation as described in 10.6.6.5.6 (Control response MCS negotiation) or has received a Reject indication in the Control Response MCS Negotiation Response frame, then it shall transmit the control response frame using either the primary MCS or the alternate MCS, if one exists. If the STA has received an Accept indication in the Control Response MCS Negotiation Response frame from a responding STA, then it shall transmit the control response frame to the responding STA using the negotiated MCS. The negotiated MCS is computed as the highest MCS in the CandidateMCSSet that is less than or equal to the MCS that has an MCS Reference Index value that is MCS Difference lower than the MCS Reference Index value of the primary MCS. If no MCS in the CandidateMCSSet has an MCS Reference Index value that is MCS Difference lower than the MCS Reference Index value of the primary MCS, then the negotiated MCS is equal to the MCS in the CandidateMCSSet with the lowest MCS Reference Index value. MCS Reference Index values are defined in Table XX-YY MCS Reference Indices.

NOTE - The values of MCS Reference Indices are independent of the values of the CH\_BANDWIDTH and FORMAT parameters of the TXVECTOR of the PSDU that is transmitted or the RXVECTOR of the PPDU that is received with the indicated modulation and coding rate values.

Table XX-YY MCS Reference Indices

|  |  |  |
| --- | --- | --- |
| **Modulation** | **Coding rate** | **MCS Reference Index** |
| BPSK | ½ | 0 |
| QPSK | ½ | 1 |
| QPSK | ¾ | 2 |
| 16-QAM | ½ | 3 |
| 16-QAM | ¾ | 4 |
| 64-QAM | 2/3 | 5 |
| 64-QAM | ¾ | 6 |
| 64-QAM | 5/6 | 7 |
| 256-QAM | ¾ | 8 |
| 256-QAM | 5/6 | 9 |

***TGmd editor: within TGmd D3.2, in 10.6.6.5.6 Control response MCS negotiation, change the text as shown:***

**10.6.6.5.6 Control response MCS negotiation(11ah)**

Control response MCS negotiation allows two STAs with power imbalance to send control response frames with a different MCSs from the primary MCS as defined by the rules in 10.6.6.5.3 (Control response frame MCS computation). A STA may initiate control response MCS negotiation by sending a Control Response MCS Request frame to another STA that supports control response MCS negotiation. After reception of a Control Response MCS Response frame that includes a command value of Accept, the STA that received the Control Response MCS Response frame sends control response frames with an MCS as defined in 10.6.6.5.3 (Control response frame MCS computation) to the STA from which it received the Control Response MCS Response frame.

An S1G STA with dot11MCSNegotiation equal to true shall set the MCS Negotiation Support field of the S1G Capabilities element to 1. An S1G STA with dot11MCSNegotiation equal to false shall set the MCS Negotiation Support field of the S1G Capabilities element to 0. An S1G STA shall set the MCS Negotiation Support field of the Extended Capabilities element to 0.

A non-S1G STA with dot11MCSNegotiation equal to true shall set the MCS Negotiation Support subfield of the Extended Capabilities element to 1. A non-S1G STA with dot11MCSNegotiation equal to false shall set the MCS Negotiation Support subfield of the Extended Capabilities element to 0.

A STA may transmit a Control Response MCS Negotiation Request frame to another STA if the MCS Negotiation Support subfield of either the S1G Capabilities element or the Extended Capabilities element received from that STA contained a value of 1 and dot11MCSNegotiation is true. The determination of the value placed in the MCS Difference field of the frame is beyond the scope of the standard.

A STA with dot11MCSNegotiation equal to true shall transmit a Control Response MCS Negotiation Response frame to a STA from which it has received a Control Response MCS Negotiation Request frame. The STA shall include a value that indicates either Accept or Reject in the Command field of the Response frame as defined in Table 9-516 (Command Values(11ah)).

**End of proposed changes.**