IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Control frames rate selection | | | | |
| Date: 2011-11-02 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Simone Merlin | Qualcomm Inc | 5775 Morehouse Dr  San Diego, CA 92109 | 8588451243 | [smerlin@qualcomm.com](mailto:smerlin@qualcomm.com) |

Abstract

Resolution for LB178 CIDs 3080, 3081, 3082, 3083

Comments

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 3080 | 73.28 | 9.7.5.1 | "9.7.5.1 General rules for rate selection for control frames. The following rules determine whether a control frame is carried in an HT PPDU or non-HT PPDU: a) A control frame shall be carried in an HT PPDU when the control frame meets any of the following conditions: 1) The control frame contains an L-SIG duration value (see 9.22.5 (L-SIG TXOP protection)), or 2) The control frame is sent using an STBC frame." account for VHT rate | Remove point 2): STBC can be used only with HT and VHT so that specification is implicit | COEX | Agree in Principle |
| 3081 | 73.44 | 9.7.5.4 | 9.7.5.4 Rate selection for control frames that are not control response frames. A frame that is carried in an HT PPDU shall be transmitted by the STA using an MCS supported by the receiver STA, as reported in the Supported MCS field in the HT Capabilities(#11223) element in management frames transmitted by that STA. When the supported rate set of the receiving STA or STAs is not known, the transmitting STA shall transmit using an MCS in the BSSBasicMCSSet parameter. Add same fro VHT | Add same normative text for VHT PPDUs, referring to VHT capabilities | COEX | Agree in Principle |
| 3082 | 73.61 | 9.7.5.5.2 | Section 9.7.5.5.2 Selection of a rate or MCS. Does not include rules for VHT | adapt rules to VHT by changing the references to "HT" with a reference to "HT or VHT", when applicable | COEX | Agree in Principle |
| 3083 | 73.61 | 9.7.5.5.3 | 9.7.5.5.3 Control response frame MCS computation(11n). Does not include rules for VHT | Add similar rules for VHT rates, when applicable. | COEX | Agree in Principle |

**Instructions to the Editor**

***The following text indicates amendments to REVmb D11.0***

**9.7.6 Rate selection for control frames**

**9.7.6.1 General rules for rate selection for control frames**

Control frames carried in an A-MPDU shall be sent at a rate selected from the rules defined in 9.7.5.6.

NOTE—The rules defined in 9.7.6.2 through 9.7.6.5 apply only to control frames not carried in an A-MPDU.

The following rules determine whether a control frame is carried in an HT, VHT or non-HT PPDU:

a) A control frame shall be carried in an HT PPDU when the control frame meets any of the following

conditions:

1) The control frame contains an L-SIG duration value (see 9.23.5), or

2) The control frame is sent using an STBC frame.

b) A control response frame shall be carried in an HT PPDU when the control frame is a response to a

frame that meets any of the following conditions:

1) The frame eliciting the response included an HT variant of the HT Control field with the TRQ field equal to 1

and the NDP Announcement subfield equal to 0, and this responder set the Implicit Transmit

Beamforming Receiving Capable field to 1 in its last transmitted HT Capabilities element; or

2) The frame eliciting the response was an RTS frame carried in an HT PPDU; or

3) The frame eliciting the response was an STBC frame, and the Dual CTS Protection field was

equal to 1 in the last HT Operation element received from its AP or transmitted by the STA (see

9.3.2.7).

c) A control frame may be carried in an HT PPDU when the control frame meets any of the following

conditions:

1) The control frame contains an HT Control field with the MRQ subfield equal to 1, or

2) The control frame contains an HT Control field with the TRQ field equal to 1.

d) a control frame that is not a control response frame may be carried in a VHT PPDU when the control frame includes an HT control field  (rules for control response frames are in clause 9.7.6.5)

e) Otherwise, the control frame shall be carried in a non-HT PPDU

NOTE—In these cases, requirements specified in 9.27, 9.28.2, and 9.29 further constrain the choice of non-HT, HT

or VHT PPDU.

Selection of channel width is defined in 9.7.6.6.

A control response frame is a control frame that is transmitted as a response to the reception of a frame a SIFS

time after the PPDU containing the frame that elicited the response, e.g. a CTS in response to an RTS

reception, an ACK in response to a DATA reception, a BlockAck in response to a BlockAckReq reception. In

some situations, the transmission of a control frame is not a control response transmission, such as when a CTS

is used to initiate a TXOP.

**9.7.5.2 Rate selection for control frames that initiate a TXOP(11n)**

**9.7.6.3 Rate selection for CF\_End frames**

If not operating during the 40 MHz phase of PCO, a STA that transmits a CF-End frame that is not at the end of

a TXOP that was obtained through the use of the dual CTS mechanism shall transmit the frame using a rate in

BSSBasicRateSet or from the mandatory rate set of the attached PHY if the BSSBasicRateSet is empty.

If operating during the 40 MHz phase of PCO, a STA that transmits a CF-End frame that is not at the end of a

TXOP that was obtained through the use of the dual CTS mechanism shall transmit the frame using an MCS

from the BSSBasicMCSSet parameter.

A STA that transmits a CF-End frame at the end of a TXOP that was obtained by a non-AP STA through the

use of the dual CTS mechanism shall transmit the CF-End frame with the same value for the TXVECTOR

parameter STBC, TXVECTOR parameter MCS (if present), and TXVECTOR parameter RATE as was used

for the transmission of the matching control frame at the beginning of the TXOP. The matching control frame

is defined as follows:

— For the first CF-End transmitted in the TXOP, the matching control frame is the first RTS

transmitted in the TXOP.

— For the second CF-End transmitted in the TXOP, the matching control frame is the first CTS that

follows the first RTS transmitted in the TXOP.

— For the third CF-End transmitted in the TXOP, the matching control frame is the second CTS that

follows the first RTS transmitted in the TXOP.

A STA that transmits a CF-End frame at the end of a TXOP that was obtained by an AP through the use of the

dual CTS mechanism shall transmit the CF-End frame with the same value for the TXVECTOR parameter

STBC, TXVECTOR parameter MCS (if present), and TXVECTOR parameter RATE as was used for the

transmission of the matching control frame at the beginning of the TXOP. The matching control frame is

defined as follows:

— For the first CF-End transmitted in the TXOP, the matching control frame is the first CTS-to-self

transmitted in the TXOP.

— For the second CF-End transmitted in the TXOP, the matching control frame is the first RTS

transmitted in the TXOP.

**9.7.6.4 Rate selection for control frames that are not control response frames**

This subclause describes the rate selection rules for control frames that are not control response frames, are not

the frame that initiates a TXOP, are not the frame that terminates a TXOP, and are not carried in an A-MPDU.

A frame other than a BlockAckReq or BlockAck that is carried in a non-HT PPDU shall be transmitted by the

STA using a rate no higher than the highest rate in the BSSBasicRateSet parameter that is less than or equal to

the rate or non-HT reference rate (see 9.7.9) of the previously transmitted frame that was directed to the same

receiving STA. If no rate in the BSSBasicRateSet parameter meets these conditions, the control frame shall be

transmitted at a rate no higher than the highest mandatory rate of the attached PHY that is less than or equal to

the rate or non-HT reference rate (see 9.7.9) of the previously transmitted frame that was directed to the same

receiving STA.

A BlockAckReq or BlockAck that is carried in a non-HT PPDU shall be transmitted by the STA using a rate

supported by the receiver STA, as reported in the Supported Rates element and/or Extended Supported Rates

element in frames transmitted by that STA. When the supported rate set of the receiving STA or STAs is not

known, the transmitting STA shall transmit using a rate from the BSSBasicRateSet parameter or from the

mandatory rate set of the attached PHY if the BSSBasicRateSet is empty.

A frame that is carried in an HT PPDU shall be transmitted by the STA using an MCS supported by the

receiver STA, as reported in the Supported MCS field in the HT Capabilities element in management frames

transmitted most recently received from that STA. A frame that is carried in an VHT PPDU shall be transmitted by the STA using an MCS supported by the receiver STA, as reported in the VHT Supported MCS field in the VHT Capabilities element most recently received from that STA. When the supported rate set of the receiving STA or STAs is not known, the transmitting STA shall transmit using an MCS in the BSSBasicMCSSet parameter.

9.7.6.5 Rate selection for control response frames

9.7.6.5.1 Introduction

Subclauses 9.7.6.5.2 through 9.7.6.5.5 describe the rate selection rules for control response frames that are not

carried in an A-MPDU.

9.7.6.5.2 Selection of a rate or MCS

To allow the transmitting STA to calculate the contents of the Duration/ID field, a STA responding to a

received frame transmits its control response frame at a primary rate, or at an alternate rate, or at an MCS, as

specified by the following rules:

— If a CTS or ACK control response 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 9.7.9) of the previous frame. If no rate in the BSSBasicRateSet parameter meets

these conditions, the primary rate is defined to be the highest mandatory rate of the attached PHY

that is less than or equal to the rate (or non-HT reference rate; see 9.7.9) of the previous frame. The

STA may select an alternate rate according to the rules in 9.7.6.5.4. The STA shall transmit the

non-HT PPDU CTS or ACK control response frame at either the primary rate or the alternate rate, if

one exists.

— If a BlockAck frame is sent as an immediate response to either an implicit BlockAck request or to a

BlockAckReq frame that was carried in an HT or VHT PPDU and the BlockAck 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 9.7.9) of the previous frame. If no rate

in the BSSBasicRateSet parameter meets these conditions, the primary rate is defined to be the

highest mandatory rate of the attached PHY that is less than or equal to the rate (or non-HT

reference rate; see 9.7.9) of the previous frame. The STA may select an alternate rate according to

the rules in 9.7.6.5.4. The STA shall transmit the non-HT PPDU BlockAck control response frame

at either the primary rate or the alternate rate, if one exists.

— If a Basic BlockAck frame is sent as an immediate response to a BlockAckReq frame that was

carried in a non-HT PPDU and the Basic BlockAck frame is carried in a non-HT PPDU, the primary

rate is defined to be the same rate and modulation class as the BlockAckReq frame, and the STA

shall transmit the Basic BlockAck frame at the primary rate.

— If a Compressed BlockAck frame is sent as an immediate response to a BlockAckReq frame that

was carried in a non-HT PPDU and the Compressed BlockAck 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 9.7.9) of the previous frame. If no rate in the

BSSBasicRateSet parameter meets these conditions, the primary rate is defined to be the highest

mandatory rate of the attached PHY that is less than or equal to the rate (or non-HT reference rate;

see 9.7.9) of the previous frame. The STA may select an alternate rate according to the rules in

9.7.6.5.4. The STA shall transmit the non-HT PPDU Compressed BlockAck control response frame

at either the primary rate or the alternate rate, if one exists.

— If the control response frame is carried in an HT or VHT PPDU, then it is transmitted at an MCS as

determined by the procedure defined in 9.7.6.5.3.

The modulation class of the control response frame shall be selected according to the following rules:

— If the received frame is of a modulation class other than HT or VHT and the control response frame is carried

in a non-HT PPDU, the control response frame shall be transmitted using the same modulation class

as 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.

— If the received frame is of the modulation class HT or VHT and the control response frame is carried in a

non-HT PPDU, the control response frame shall be transmitted using one of the ERP-OFDM or

OFDM modulation classes.

— If the control response frame is carried in an HT PPDU, the modulation class shall be HT.

-- If the control response frame is carried in an VHT PPDU, the modulation class shall be VHT.

The selection of the value for the channel width (CH\_BANDWIDTH parameter of the TXVECTOR) of the

response transmission is defined in 9.7.6.6.

9.7.6.5.3 Control response frame MCS computation

If a control response frame is to be transmitted within an HT or VHT PPDU, the channel width (CH\_BANDWIDTH

parameter of the TXVECTOR) shall be selected first according to 9.7.6.6, and then the MCS shall be selected

from a set of MCSs called the CandidateMCSSet as described in this subclause.

If the frame eliciting the response was transmitted by an HT STA that is not a VHT STA, the Rx Supported MCS Set is determined from the

supported MCS Set field in the HT Capabilities element most recently received from the STA, as follows:

— If a bit in the Rx MCS Bitmask subfield is equal to 0, the corresponding MCS is not supported.

— If a bit in the Rx MCS Bitmask subfield is equal to 1 and the integer part of the data rate (expressed

in megabits per second) of the corresponding MCS is less than or equal to the rate represented by the

Rx Highest Supported Data Rate subfield, then the MCS is supported by the STA on receive. If the

Rx Highest Supported Data Rate subfield is equal to 0 and a bit in the Rx MCS Bitmask is equal to

1, then the corresponding MCS is supported by the STA on receive.

If the frame eliciting the response was transmitted by a VHT STA, the Rx Supported MCS Set is determined from the Supported MCS Set field in the VHT Capabilities element and the

supported MCS Set field in the HT Capabilities element most recently received from the STA.

The CandidateMCSSet is determined using the following rules:

— If the frame eliciting the response was an STBC frame and the Dual CTS Protection bit is equal to 1,

the CandidateMCSSet shall contain only the basic STBC MCS.

— If the frame eliciting the response had an L-SIG duration value (see 9.23.5) and initiates a TXOP, the

CandidateMCSSet is the MCS Set consisting of the intersection of the Rx Supported MCS Set of the

STA that sent the frame that is eliciting the response and the set of MCSs that the responding STA is

capable of transmitting.

— If none of the above conditions is true, the CandidateMCSSet is the combination of the BSSBasicMCSSet and the VHTBSSBasicMCSSet parameters. If

the combined parameter is empty, the CandidateMCSSet shall consist of

-- the set of mandatory HT PHY MCSs, if the STA eliciting the response is an HT STA that is not a VHT STA;

-- the set of mandatory HT and VHT PHY MCSs, if the STA eliciting the response is an VHT STA.

MCS values from the CandidateMCSSet that cannot be transmitted with the selected CH\_BANDWIDTH

parameter value shall be eliminated from the CandidateMCSSet.

The choice of a response MCS is made as follows:

a) If the frame eliciting the response is within a non-HT PPDU,

1) Eliminate from the CandidateMCSSet all VHT MCSs and the MCSs that have a data rate greater than the data rate

of the received PPDU (the mapping of MCS to data rate is defined in 20.6).

2) 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.

3) If the CandidateMCSSet is empty, the primary MCS is the lowest indexed MCS of the

mandatory MCSs.

b) If the frame eliciting the response is within an HT PPDU,

1) Eliminate from the CandidateMCSSet all VHT MCSs and all MCSs that have an index that is higher than the indexof the MCS of the received frame.

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 20.6.

3) Find the highest indexed MCS of the CandidateMCSSet for which the modulation value of

each stream is less than or equal to the modulation value of each stream of the MCS of the

received frame and for which the coding rate value is less than or equal to the coding rate value

of the MCS from the received frame. The index of this MCS is the index of the MCS that is the

primary MCS for the response transmission. The mapping from MCS to modulation and coding

rate is dependent on the attached PHY. For the HT PHY, see 20.6. For the purpose of

comparing modulation values, the following sequence shows increasing modulation values:

BPSK, QPSK, 16-QAM, 64-QAM.

4) If no MCS meets the condition in step 3), remove each MCS from the CandidateMCSSet that

has the highest value of NSS in the CandidateMCSSet. If the resulting CandidateMCSSet is

empty, then set the CandidateMCSSet to the HT PHY mandatory MCSs. Repeat step 3) using

the modified CandidateMCSSet.

c) If the frame eliciting the response is within a VHT PPDU,

1) Eliminate from the CandidateMCSSet all MCSs that have a data rate that is higher than the data rate

of the MCS of the received frame.

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 20.6; for the VHT PHY,

see 22.5.

3) Find the highest rate MCS of the CandidateMCSSet for which the modulation value of

each stream is less than or equal to the modulation value of each stream of the MCS of the

received frame and for which the coding rate value is less than or equal to the coding rate value

of the MCS from the received frame. This MCS is the

primary MCS for the response transmission. The mapping from MCS to modulation and coding

rate is dependent on the attached PHY. For the HT PHY, see 20.6; for the VHT PHY, see 22.5 For the purpose of

comparing modulation values, the following sequence shows increasing modulation values:

BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM

4) If no MCS meets the condition in step 3), remove each MCS from the CandidateMCSSet that

has the highest value of NSS in the CandidateMCSSet. If the resulting CandidateMCSSet is

empty, then set the CandidateMCSSet to the VHT PHY mandatory MCSs. Repeat step 3) using

the modified CandidateMCSSet.

Once the primary MCS has been selected, the STA may select an alternate MCS according to 9.7.6.5.4. The

STA shall transmit the PPDU control response frame using either the primary MCS or the alternate MCS,

if one exists

9.7.6.5.4 Selection of an alternate rate or MCS for a control response frame

An alternate rate may be selected provided that all of the following conditions are met:

— The duration of frame at the alternate rate is the same as the duration of the frame at the primary rate

determined by 9.7.6.5.2.

— The alternate rate is in either the BSSBasicRateSet parameter or is a mandatory rate of the attached

PHY.

— The modulation class of the frame at the alternate rate is the same class as that of the primary rate

selected by 9.7.6.5.2.

An alternate MCS may be selected provided that both of the following conditions are met:

— The duration of the frame at the alternate MCS is the same as the duration of the frame at the primary

MCS.

— The alternate MCS is in the CandidateMCSSet that was generated according to the procedure of

9.7.6.5.3.

9.7.6.5.5 Control response frame TXVECTOR parameter restrictions

A STA shall not transmit a control response frame with TXVECTOR parameter GI\_TYPE set to SHORT\_GI

unless it is in response to a reception of a frame with the RXVECTOR parameter GI\_TYPE equal to

SHORT\_GI.

A STA shall not transmit a control response frame with TXVECTOR parameter FEC\_CODING set to

LDPC\_CODING unless it is in response to a reception of a frame with the RXVECTOR parameter

FEC\_CODING equal to LDPC\_CODING.

A STA shall not transmit a control response frame with the TXVECTOR parameter FORMAT set to HT\_GF

Pre-motion

Do you accept the resolution of CIDs 3080, 3081,3082,3083 as in document 11/1439r0?