IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| D1 Comment Resolution, brianh, part 2 | | | | |
| Date: 2011-07-19 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
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##### Baseline is 11ac D1.0. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

PHY CIDs addressed: 2923, 2355, 2356, 2357, 2207, 2359, 2360, 2052, 3391, 2305, 2306, 2362, 2605, 2745, 2365, 3600, 2691, 2358 [18]

Changes in D1: a) Created new PLCP section for 2357, b) change text for 2207 and 2359 already available for CID 2358, c) Changes for 2305 and 2306 rearranged and condensed (as crafted during presentation of D0), d) changed RSSI maximum to 255 to align with PMD output.

##### PHY

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 2923 | Loc, Peter | 106.00 | 22.1.1 | Capabilities to Transmit or Receive LDPC should be separated to allow devices that are designed to mostly transmit and receive few packets or vice versa, to benefit from the coding gain of LDPC without having to implement LDPC on both transmit and receiver | Change "(transmit and receive)" to "(transmit or receive or both)". Change the reserved bit B28 of the VHT Capabilities Info Field to "Tx LDBC " and change the "LDPC Coding Capability" to "Rx LDPC" | **Decline. The desired ability is available without a new capability bit. See 11/954r1** | PHY |

**Discussion**: The VHT Capabilities IE includes the following field

“LDPC Coding Capability: Indicates support for **receiving** LDPC coded packets. Set to 0 if not supported. Set to 1 if supported”

Thus the RX side is well defined.

Further, a STA is free to TX or not to TX LDPC if it so chooses/is capable, and no separate capability advertisement is required for interop. So far so good: we can support TX-LDPC-only, RX-LDPC-only, and TX-and-RX-LDPC.

Finally, the PHY para is an overview of modes defined in the PHY clause, and does not include any normative language around LDPC; although LDPC is just noted as optional on TX and RX. Since 2, 3, 4 ,... 8 SS are each independently optional yet are rendered as one line iterm, therefore such coupling does not imply both LDPC TX and RX must both be implemented or not. Really this language is used to indicate that LDPC is never mandatory, and so the language does not preclude the full range of implementations enabled by the VHT Capabilities IE.

“The VHT PHY data subcarriers are modulated using binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 16-quadrature amplitude modulation (16-QAM), 64-QAM and 256-QAM. Forward error correction (FEC) coding (convolutional or LDPC) is used with a coding rate of 1/2, 2/3, 3/4, or 5/6.

…

Optional features for a VHT STA are:

- 2 or more spatial streams (transmit and receive)

- LDPC (transmit and receive)”

Finally, this arrangement is identical to 11n.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2355 | Hart, Brian | 111.04 | 22.2.2 | Increase the allowed levels of TXPWR\_LEVEL to reflect industry practice - e.g. 64 levels | As in comment | **Accept in principle. Add extra MIB variable to support this. See 11/954r1.** | PHY |

**Discussion:** More power levels are required, e.g. to span -5 dBm to 32 dBm in 1 dB steps, and traditionally these have been defined via 8 MIB variables (that are little used). Since ASN.1 is very inexpressive, defining another 30 or so power levels by default requires another 30 MIB variables. That is crazy, so play some games with the OCTET STRING type. Clause 22.4.2 doesn’t have the dot11PHYTxPowerTable, so add that too. Align the new MIB variable with the old MIB variable to the extent possible.

**Change:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| TXPWR\_LEVEL | FORMAT is VHT | The allowed values for the TXPWR\_LEVEL parameter are in the range from 1 to numberOfOctets(dot11TxPowerLevelExtended)/2. This parameter is used to indicate which of the available transmit outpout power levels defined in dot11TxPowerLevelExtended shall be used for the current transmission. | Y | N |
| Otherwise | See corresponding entry in Table 19-1 | | |

**22.4.2 PHY MIB**

**Table 22-23—VHT PHY MIB attributes**

|  |  |  |
| --- | --- | --- |
| **dot11PHYOperationTable** | | |
| **…** |  |  |
| **dot11PHYTxPowerTable** | | |
| dot11TxPowerLevelExtended | Implementation dependent | Static |
| dot11CurrentTxPowerLevelExtended | Implementation dependent | Static |

**C.3 MIB Detail**

Dot11PhyTxPowerEntry ::=

SEQUENCE {

dot11NumberSupportedPowerLevelsImplemented Unsigned32,

dot11TxPowerLevel1 Unsigned32,

dot11TxPowerLevel2 Unsigned32,

dot11TxPowerLevel3 Unsigned32,

dot11TxPowerLevel4 Unsigned32,

dot11TxPowerLevel5 Unsigned32,

dot11TxPowerLevel6 Unsigned32,

dot11TxPowerLevel7 Unsigned32,

dot11TxPowerLevel8 Unsigned32,

dot11CurrentTxPowerLevel Unsigned32.

dot11TxPowerLevelExtended OCTET STRING,

dot11CurrentExtendedTxPowerLevel Unsigned32

}

dot11CurrentTxPowerLevel OBJECT-TYPE

SYNTAX Unsigned32 (1..8)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a status variable.

It is written by the PHY.

Set to min(N,8) where N is an index into dot11TxPowerLevel<N> or dot11TxPowerLevelExtended and identifies the transmit power level currently being used to transmit data. Some PHYs also

use this value to determine the receiver sensitivity requirements for

CCA."

::= { dot11PhyTxPowerEntry 10 }

dot11TxPowerLevelExtended OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(2..256))

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

It must have an even number of octets. It is organized as a variable length list of octet pairs, where each octet pair defines a big-endian 16-bit integer. The N-th integer represents the N-th transmit output power, in units of 250 microWatts. The values dot11TxPowerLevel1 to dot11TxPowerLevel<min(8, dot11NumberSupportedPowerLevelsImplemented)> inclusive, when converted from units of milliWatts to 250 microWatts, shall appear in order as the first to min(8, dot11NumberSupportedPowerLevelsImplemented)-th integers in this variable."

::= { dot11PhyTxPowerEntry 11 }

dot11CurrentTxPowerLevelExtended OBJECT-TYPE

SYNTAX Unsigned32 (1..128)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a status variable.

It is written by the PHY.

The N-th integer within dot11TxPowerLevelExtended that identifies the transmit output power currently being used to transmit data. "

::= { dot11PhyTxPowerEntry 12 }

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2356 | Hart, Brian | 111.12 | 22.2.2 | "RSSI maximum" is always used, never defined, anywhere. What value does it bring? | RSSI is an "unsigned integer" | **Agree in principle. Commenter is correct. See 11/954r1** | PHY |

**Discussion:** The PMD outputs 0 to 255, which is penty for RSSI and widely used by sniffers in the industry.

**Change:**

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

The allowed values for the RSSI parameter are in the range from

0 through 255 inclusive. This parameter is a measure by the PHY of the power observed at the antennas used to receive the current PPDU. RSSI shall be measured during the reception of

the PLCP preamble. In HT-mixed format, the reported RSSI shall be measured during the reception of the HT-LTFs. In VHT format, the reported RSSI shall be measured during the reception of the VHT-LTFs. RSSI is intended to be used in a relative manner, and it shall be a monotonically increasing function of the received power.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2357 | Hart, Brian | 111.14 | 22.2.2 | Normative statements in an interface are a trifle odd - should have its own section. (But this would apply equally to the SERVICE definition) | We should move this but feel free to ignore this. | **Accept in principle. Move VHT normative language to RX procedure, and unchanged clause 19 for everything else.** | PHY |

**Discussion:** Agreed that normative statements do not belong in an interface description, and this language is not well harmonized with the language in the RX procedure. Since we don’t want to change clause 19 too much, split this RXVECTOR row into “VHT” and “Otherwise”, so we only need to address the VHT issue. Move this VHT normative language to a) a new PLCP section that converts PMD\_RSSI/RSSI into RXVECTOR/RSSI or b) the PMD interface or c) both, as appropriate.

**Change:**

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RSSI | FORMAT IS VHT | The allowed values for the RSSI parameter are in the range from 0 through RSSI maximum. This parameter is a measure by the PHY of the power observed at the antennas used to receive the current PPDU during the reception of the VHT-LTFs. RSSI is intended to be used in a relative manner, and it is a monotonically increasing function of the received power. | N | Y |
| Otherwise | See corresponding entry in Table 19-1 | | |

***TGac editor – note addition of new section***

**22.3.19.6 RSSI**

The RSSI parameter returned in the RXVECTOR shall be calculated from the values of the RSSI parameter provided by the PMD\_RSSI.indication primitive during the reception of the VHT-LTFs such that RSSI parameter returned in the RXVECTOR shall be a monotonically increasing function of the received power.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2358 | Hart, Brian | 111.60 | 22.2.2 | "non-HT duplicate format" is a common expression here and elsewhere but formally it is FORMAT=OFDM, NON\_HT\_MODULATION (aka "subformat")=OFDM/NON\_HT\_DUP\_OFDM. | Correct, at least in the PHY clause. Search for "format". E.g. P114L42 or P188L16, P188L18, etc etc |  | PHY |

**Discussion:** Theproposed change gets unwieldy. And non-HT duplicate format is used extensively in the MAC clauses. Therefore audit usage of “format” and remove abuses and related concerns. Mostly minor corrections, but add “NON\_HT CBW40” to Table 22-2 (was missing; and we can’t use clause 19 due to the possibility of wider BSS bandwidths)

**Change:**

**Table 22-1—TXVECTOR and RXVECTOR parameters**

|  |  |  |
| --- | --- | --- |
| FORMAT |  | Determines the format of the PPDU.  Enumerated type:  NON\_HT indicates Clause 17 (Orthogonal frequency division  multiplexing (OFDM) PHY specification) or non-HT duplicated  PPDU format. In this case, the modulation is determined  by the NON\_HT\_MODULATION parameter.  HT\_MF indicates HT-mixed format.  HT\_GF indicates HT-greenfield format.  VHT indicates VHT format. |
| NON\_HT\_MODULATION | FORMAT is NON\_HT | On transmit: indicates the subformat of the transmitted non-HT  packet.  On receive: indicates the estimated subformat of the received  non-HT packet.  Enumerated type:  OFDM indicates Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) format  NON\_HT\_DUP\_OFDM indicates non-HT duplicated format |
| CH\_BANDWIDTH | FORMAT is NON\_HT | On transmit: indicates the channel width of the transmitted  packet.  On receive: indicates the estimated channel width of the received  packet.  Enumerated type:  CBW40, CBW80, CBW160 or CBW80+80 if NON\_HT\_MODULATION equals NON\_HT\_DUP\_OFDM  CBW20 if NON\_HT\_MODULATION equals OFDM |
| NOTE 1—In the “TXVECTOR” and “RXVECTOR” columns, the following apply:  Y = Present;  N = Not present;  O = Optional;  MU indicates that the parameter is present per user. Parameters specified to be present per user are conceptually  supplied as an array of values indexed by *u*, where *u* takes values 1 through NUM\_USERS-1.  NOTE 2—On reception, where valid, the CH\_BANDWIDTH\_IN\_NON\_HT parameter is likely to be a more reliable  indication of subformat and channel width than the NON\_HT\_MODULATION and CH\_BANDWIDTH parameters. | | |

**Table 22-2— PPDU format as a function of CH\_BANDWIDTH parameter**

|  |  |
| --- | --- |
| NON\_HT CBW40 | The STA transmits the packet in each of the two adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). If the VHT BSS BW is wider than 40  MHz, then the transmission shall use the primary 40 MHz channel. The one 20 MHz channel higher in frequency is rotated +90º relative to the 20 MHz channel lowest in frequency as defined in Equation (22-11). |
| NON\_HT CBW80 | The STA transmits the packet in each of four adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). If the VHT BSS BW is wider than 80 MHz, then the transmission shall use the primary 80 MHz channel. The three 20 MHz channels higher in frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (22\_12). |
| NON\_HT CBW160 | The STA transmits the packet in each of eight adjacent 20 MHz channels as defined in 22.3.10.12 (Non-HT duplicate transmission). The second, third, fourth, sixth, seventh, eighth 20 MHz channels in the order of increasing frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (22\_13). |
| NON\_HT CBW80+80 | The STA transmits the packet in each of two non-adjacent frequency segments, with each frequency segment consisting of four adjacent 20 MHz channels, as defined in 22.3.10.12 (Non-HT duplicate transmission). In each frequency segment, the three 20 MHz channels higher in frequency are rotated +180º relative to the 20 MHz channel lowest in frequency as defined in Equation (22\_12). |

**22.3.2 VHT PPDU format**

The VHT-SIG-A, VHT-STF, VHT-LTF, and VHT-SIG-B fields exist only in VHT packets. In a VHT NDP, the Data field is not present.

The number of symbols in the VHT-LTF field, *NVHTLTF*, can be either 1, 2, 4, 6 or 8 and is determined by the

total number of space-time streams across all users being transmitted in the VHT PPDU (see Table 22-11

(Number of VHT-LTFs required for different numbers of space time streams)).

**22.3.10.9.4 Space-time block coding**

This subclause defines a set of optional robust transmission techniques that are applicable only when using STBC coding. In this case, *NSS,u* spatial streams for user *u* are mapped to *NSTS,u* space-time streams. These techniques are based on STBC. When the VHT-SIG-A STBC field is set to 1, a symbol operation shall occur between the constellation mapper and the spatial mapper as defined in this subclause.

**22.3.10.11.1 Transmission in VHT format**

For a non-contiguous 80+80 MHz transmission, each frequency segment shall follow the 80 MHz VHT subcarrier mapping as specified in Equations (22-85) and (22-43).

**Table 22-22—Conditions for CCA BUSY on the primary 20 MHz**

**Operating Channel Width Conditions**

20 MHz, 40 MHz, 80 MHz, 160 MHz or 80+80 MHz

The start of a 20 MHz NON\_HT format PPDU in the primary 20 MHz channel as defined in 17.3.10.6 (CCA requirements).

The start of an HT format PPDU under the conditions defined in 19.3.21.5 (CCA sensitivity).

The start of a 20 MHz VHT format PPDU in the primary 20 MHz channel at or above -82 dBm.

40 MHz, 80 MHz, 160 MHz or 80+80 MHz

The start of a 40 MHz non-HT duplicate or VHT format PPDU in the primary 40 MHz channel at or above -79 dBm.

The start of an HT format PPDU under the conditions defined in 19.3.21.5 (CCA sensitivity).

80 MHz, 160 MHz or 80+80 MHz

The start of an 80 MHz non-HT duplicate or VHT format PPDU in the primary 80 MHz channel at or above -76 dBm.

160 MHz or 80+80 MHz The start of a 160 MHz or 80+80 MHz non-HT duplicate or VHT format PPDU at or above -73 dBm.

**22.3.19.5.3 CCA sensitivity for signals not occupying the primary 20 MHz channel**

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary}) if the conditions for issuing PHY-CCA.indication(BUSY, {primary}) are not present and one of the following conditions are present in an otherwise

idle 40 MHz, 80 MHz, 160 MHz or 80+80 MHz operating channel width:

— Any signal within the secondary 20 MHz channel at or above -62 dBm.

— A 20 MHz NON\_HT, HT\_MF, HT\_GF or VHT format PPDU detected in the secondary 20 MHz channel at or above -72 dBm with >90% probability within a period aCCAMidTime (<25 μs).

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary40}) if the conditions for issuing PHYCCA.indication(BUSY, {primary}) and PHY-CCA.indication(BUSY, {secondary}) are not present and one

of the following conditions are present in an otherwise idle 80 MHz, 160 MHz or 80+80 MHz operating channel

width:

— Any signal within the secondary 40 MHz channel at or above -59 dBm.

— A 40 MHz non-HT duplicate, HT\_MF, HT\_GF or VHT format PPDU detected in the secondary 40 MHz channel at or above -72 dBm with >90% probability within a period aCCAMidTime (<25 μs).

— A 20 MHz NON\_HT, HT\_MF, HT\_GF or VHT format PPDU detected in any 20 MHz sub-channel of the secondary 40 MHz channel at or above -72 dBm with >90% probability within a period aCCAMidTime (<25 μs).

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary80}) if the conditions for PHY-CCA.indication(

BUSY, {primary}), PHY-CCA.indication(BUSY, {secondary}) and PHY-CCA.indication(BUSY,

{secondary40}) are not present and one of the following conditions are present in an otherwise idle 160 MHz

or 80+80 MHz operating channel width:

— Any signal within the secondary 80 MHz channel at or above -56 dBm.

— An 80 MHz non-HT duplicate or VHT format PPDU detected in the secondary 80 MHz channel at

or above -69 dBm with >90% probability within a period aCCAMidTime (<25 μs).

— A 40 MHz non-HT duplicate, HT\_MF, HT\_GF or VHT format PPDU detected in any 40 MHz

sub-channel of the secondary 80 MHz channel at or above -72 dBm with >90% probability within a

period aCCAMidTime (<25 μs).

— A 20 MHz NON\_HT, HT\_MF, HT\_GF or VHT format PPDU detected in any 20 MHz sub-channel

of the secondary 80 MHz channel at or above -72 dBm with >90% probability within a period

aCCAMidTime (<25 μs).

**22.3.21 PLCP receive procedure**

A typical PLCP receive procedure is shown in Figure 22-23 for VHT format. A typical state machine implementation of the receive PLCP is given in Figure 22-24. This receive procedure and state machine do not describe the operation of optional features, such as STBC. If the detected format indicates a NON\_HT format PPDU, refer to the receive procedure and state machine in Clause 17.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 2207 | Dehghan, Hossein | 111.63 | 22.2.2 | replace "CBW20 for all other non-HT formats" with "OFDM format" |  | **Accept in principle. See 11/954r1.** | PHY |
| 2359 | Hart, Brian | 111.63 | 22.2.2 | "all other non-HT formats" looks like an 11n hangover. Only NON\_HT\_MODULATION=OFDM is allowed here? | As in comment | **Accept in principle. See 11/954r1.** | PHY |

**Discussion**: Apply the change proposed in CID 2359 to both non-dup and dup NON\_HT subformats. This change is already available as part of CID 2358.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2360 | Hart, Brian | 112.04 | 22.2.2 | "indicates" yet this is dependent on whether it is valid or not | "When present and valid … always valid on TX, validity on RX is determined by MAC (ref)". Ditto CH\_BW\_IN\_NON\_HT | **Accept in principle. Qualification on validity is required, and presence needs greater granularity. See 11/954r1.** | PHY |

**Discussion**: DYN\_BANDWIDTH\_IN\_NON\_HT and CH\_BANDWIDTH\_IN\_NON\_HT are always present in the RXVECTOR, but they may be invalid and their validity is unknown at the PHY, so condition on validity for the RXVECTOR description. For the TXVECTOR, this is mandatory/optional/disallowed according to the frame that is being transmitted, which is hard to express in this interface without overcomplicating the interface. The most direct and clear method seems to indicate that, for TXVECTOR, status is Y/O/N and add a clarifying note that points the reader to the relevant MAC sections.

**Change:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DYN\_BANDWIDTH\_IN\_NON\_HT | FORMAT is NON\_HT | In TXVECTOR, if present, indicates whether the transmitter is capable of Static or Dynamic bandwidth operation.  In RXVECTOR, if valid, indicates whether the transmitter is capable of Static or Dynamic bandwidth operation Enumerated type: Static if the transmitter is capable of Static bandwidth operation Dynamic if the transmitter is capable of Dynamic bandwidth operation  Note: This is mandatory in TXVECTOR for certain control frames, optional for other control frames and disallowed for data and management frames. See 9.3.2.6a (VHT RTS procedure), 9.3.2.7 (CTS procedure), 9.7.4.0 (General) and 9.7.9. | Y/O/N | Y |
| Otherwise | Not present | N | N |
| CH\_BANDWIDTH\_IN\_NON\_HT | FORMAT is NON\_HT | In TXVECTOR, if present, indicates the channel width of the transmitted packet which is signalled via the scrambling sequence.  In RXVECTOR, if valid, indicates the channel width of the transmitted packet which is signalled via the scrambling sequence.  Enumerated type: CBW20, CBW40, CBW80, CBW160/80+80  Note: This is mandatory in TXVECTOR for certain control frames, optional for other control frames and disallowed for data and management frames. See 9.3.2.6a (VHT RTS procedure), 9.3.2.7 (CTS procedure), 9.7.4.0 (General) and 9.7.9. | Y/O/N | Y |
| Otherwise | Not present | N | N |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 2052 | Asai, Yusuke | 112.21 | 22.2.2 | CBW160 and CBW80+80 are individually defined and there is no definition of "CBW160/80+80". | Change "CBW160/80+80" to "CBW160, or CBW80+80". | **Agree. See 11/954r1** | PHY |
| 3391 | Rosdahl, Jon | 112.21 | 22.2.2 | Are CBW160 and CBW80+80 really intended to be merged in the enum here, unlike everywhere else? | Clarify | **Agree. See 11/954r1** | PHY |

**Change:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CH\_BANDWIDTH\_IN\_NON\_HT | FORMAT is NON\_HT | When present, indicates the channel width of the transmitted packet which is signalled via the scrambling sequence. Enumerated type: CBW20, CBW40, CBW80, CBW160, CBW80+80 | Y | Y |
| Otherwise | Not present | N | N |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2305 | Grandhi, Sudheer | 112.38 | 22.2.2 | The LENGTH Value is placed in the VHT-SIG-B Length field for all frames except the NDP frame. | Replace line with "This parameter is placed in the VHT-SIG-B Length field rounded up to a 4 octet boundary with the low order two bits removed except in the case of an NDP frame". | **Accept in principle. Reorder the language so the NDP/non-NDP choice happens first, then a TXVECTOr/RXVECTOR choice, then updated details of the parameters. See 11/954r1** | PHY |
| 2306 | Grandhi, Sudheer | 112.46 | 22.2.2 | The LENGTH Value is placed in the VHT-SIG-B Length field for all frames except the NDP frame. | Replace line with "In the RXVECTOR, this parameter is the value obtained from  the VHT-SIG-B Length field multiplied by 4 to represent a value in octets except in the case of an NDP frame." | **Accept in principle. Reorder the language so the NDP/non-NDP choice happens first, then a TXVECTOr/RXVECTOR choice, then updated details of the parameters. See 11/954r1** | PHY |

**Discussion**: Agree with the commenter. Also, reserve 0 to indicate NDP only. And correct the range of LENGTH, which is different for RXVECTOR Since the current language only points to its usage in VHT-SIG-B, also add that it is used to calculate the number of OFDM symbols, which is actually a much more important usage.

**Change:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LENGTH | FORMAT is VHT | If equal to zero, indicates a VHT NDP PPDU.  If greater than zero, in the TXVECTOR, indicates the number of octets in the range 1 to 1 048 575 in the A-MPDU pre-EOF padding (see 9.12.2 (A-MPDU length limit rules)) carried in the PSDU. This parameter is used to determine the number of OFDM symbols in the Data field and, after being rounded up to a 4 octet boundary with the low order two bits removed, is placed in the VHT-SIG-B Length field.  NOTE—The rounding up of the LENGTH parameter to a 4-octet word boundary may result in a LENGTH parameter that is larger than the PSDU\_LENGTH parameter.  If greater than zero, in the RXVECTOR, this parameter is the value obtained from the VHT-SIG-B Length field multiplied by 4.  . | MU | O |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2362 | Hart, Brian | 112.55 | 22.2.2 | With MU, the MAC is responsible for padding the MPDU appropriately so that all the users exactly fill the same number of OFDM symbols. This is likely to be an error prone procedure. | Add to TXSTATUS aparameter with allowed values SUCCESS/INVALID\_PARAMETERS to deal with this case, maybe in clause 7 and certainly somewhere in clause 22 | **Disagree. 11mb has removed these error conditions since a conformant implementation never makes mistakes. 11ac should not reintroduce this spec overhead.** | PHY |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2605 | Hunter, David | 113.30 | 22.2.2 | There doesn't seem to be a specifciation of what a "user" is. | Supply a specification of a "user", or at least a clear description that tells the implementer how to identify one. There don't seem to be MLME primitives that specify numbers of users, so how do the MAC and PHY determine those (1-4)? | **Accept in principle. Add a definition for STA and MIB variables to describe the PHY limitations to the MLME. See 11/954r1** | PHY |

**Discussion**: Add a definition for user = “STA”. The MAC-SAP (TXVECTOR) defines the number of users in the MU-MIMO PPDU, and the choice to select SU or MU or which kind of MU PPDU lies in the MLME sublayer, as per rate adaptation, so no additional MLME primitives are required. However, it is likely that PHY implementations only support certain MU-MIMO configurations, so add variables to express these constraints to the MLME. Traditionally these are MIB variables. Since MIB variables add mimimum practical value, only define the “Implemented” version of these, and assume a) they are available/“Activiated” at all times, but b) the MLME is smart enough to only use them when helpful.

**Change:**

**3.2 Definitions specific to IEEE 802.11**

user: STA, used in the context of single-user MIMO or MU-MIMO

**Table 22-23—VHT PHY MIB attributes**

|  |  |  |
| --- | --- | --- |
| **Managed Object** | **Default value/range** | **Operational Semantics** |
| **dot11PHYVHTTable** | | |
| dot11VHTMUMIMOMaxUsersImplemented | Implementation dependent | Static |
| dot11VHTMUMIMOMaxNSTSPerUserImplemented | Implementation dependent | Static |
| dot11VHTMUMIMOMaxNSTSTotalImplemented | Implementation dependent | Static |

**C.3 MIB Detail**

Dot11PhyVHTEntry ::=

SEQUENCE {

dot11VHTChannelWidthOptionImplemented INTEGER,

dot11CurrentChannelBandwidth INTEGER,

dot11CurrentChannelCenterFrequencyIndex1 Unsigned32,

dot11CurrentChannelCenterFrequencyIndex2 Unsigned32,

dot11VHTShortGIOptionIn80Implemented TruthValue,

dot11VHTShortGIOptionIn80Activated TruthValue,

dot11VHTShortGIOptionIn160and80p80Implemented TruthValue,

dot11VHTShortGIOptionIn160and80p80Activated TruthValue,

dot11VHTLDPCCodingOptionImplemented TruthValue,

dot11VHTLDPCCodingOptionActivated TruthValue,

dot11VHTTxSTBCOptionImplemented TruthValue,

dot11VHTTxSTBCOptionActivated TruthValue,

dot11VHTRxSTBCOptionImplemented TruthValue,

dot11VHTRxSTBCOptionActivated TruthValue,

dot11VHTMUMIMOMaxUsersImplemented INTEGER,

dot11VHTMUMIMOMaxNSTSPerUserImplemented INTEGER,

dot11VHTMUMIMOMaxNSTSTotalImplemented INTEGER}

dot11VHTMUMIMOMaxUsersImplemented OBJECT-TYPE

SYNTAX INTEGER

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of users to which this device is capable of transmitting within a MU-MIMO PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 13 }

dot11VHTMUMIMOMaxNSTSPerUserImplemented OBJECT-TYPE

SYNTAX INTEGER

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of space-time streams per user that this device is capable of transmitting within a MU-MIMO PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 14 }

dot11VHTMUMIMOMaxNSTSTotalImplemented OBJECT-TYPE

SYNTAX INTEGER

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum number of space-time streams for all users that this device is capable of transmitting within a MU-MIMO PPDU."

DEFVAL { 1 }

::= { dot11PhyVHTEntry 15 }

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 2745 | Kudo, Riichi | 114.39 | 22.2.2 | "1 through NUM\_USERS-1" is not correct. "0 through NUM\_USERS-1" is correct and this is corresponding to Table 22-5 and other parts of Clause 22. | As in comment. | **Accept. See 11/954r1** | PHY |
| 2365 | Hart, Brian | 114.40 | 22.2.2 | 1 through NUMUSERS-1 | 0 through NUMUSERS-1 | **Accept. See 11/954r1** | PHY |
| 3600 | Stephens, Adrian | 114.40 | 22.2.2 | "values 1 through NUM\_USERS-1."  Obviously we had a battle between the FORTRAN programmers and the C programmers, and they came to a compromize. Unfortunately, like writing alternating lines of a program in FORTRAN and C, the compromise does not work. | Take a straw poll as to whether we like FORTRAN ('77 was the last version I learned) or C (ANSI C). Then adjust upper or lower bound accordingly.  Those who are COBOL programmers won't understand this comment, and are advised to take it easy. | **Accept in principle. Right answer is 0..NUM\_USERS-1. See 11/954r1** | PHY |

**Discussion**.The math and usage elsewhere requires that the range be 0 to NUM\_USERS-1.

**Change:** See roll-up after next comment for changes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2691 | Kim, Youhan | 114.49 | 22.2.2 | Is it clear that a parameter with 'MU' in TXVECTOR or RXVECTOR should also be present for SU packets as well? For example, the FEC\_CODING (P110L32) should be resent for SU packets as well. |  | **Agree in principle: Clarify Note 1. See 11/954r1.** | PHY |

**Discussion:** Good point.

**Change:**

|  |
| --- |
| NOTE 1—In the “TXVECTOR” and “RXVECTOR” columns, the following apply:  Y = Present;  N = Not present;  O = Optional;  MU indicates that the parameter is present for one user if a single-user transmission and present per user if a multi-user transmision. Parameters specified to be present per user are conceptually supplied as an array of values indexed by u, where u takes values 0 through NUM\_USERS-1. |