IEEE P802.11
Wireless LANs

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| Resolutions to 32.3.10 Transmit specification |
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Abstract

This submission shows

* Resolutions for comments from TGbd draft 1.0
* 8 CIDs: 1088, 1322, 1586, 1587, 1677, 1089, 1588 and 1589

Revisions:

* Rev 0: Initial version of the document.

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1088 | 77.29 | Mask should be based on PPDU BW instead of channel spacing. | "Change to ""For 10 MHz PPDU and 20MHz PPDU, the transmit spectrum masks are defined in 17.3.9.3 (Transmit spectrum mask)." | Revised.Since it seems to be out of scope here to change the termonology which is widely used through Clause 17, it would be better to remove confusing text unless it does not lead to confusion.TGbd Editor: make changes according to this document 11-20-1948-00-00bd Resolutions to 32.3.10 Transmit specification.  |
| 1322 | 77.24 | NOTE 2 is not necessary because there are no figures related to spectral mask in this amendment. | Remove NOTE 2. | Accepted |

***Discussion***

The commentor is technically correct to use PPDU BW instead of channel spacing (named channel width in other amendments). The transmitting PPDU BW is indicated with Bandwidth field in SIG field while channel width is used to indicate maximum operating PPDU BW.

However, when it comes to 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification), in terms of terminology, the channel spacing is used to mean PPDU BW.

For example, terminology “10 MHz channel spacing” is used for 10 MHz transmission as below



***To TGbd Editor:*** ***P77L17*** *update the description as below.*

***------------- Begin Text Changes ---------------***

**32.3.10.1 Transmit spectrum mask**

The transmit spectrum mask by regulatory domain is defined in Annex D and Annex E.

NOTE 1—In the presence of additional regulatory restrictions, the device has to meet both the regulatory requirements

and the mask defined in this subclause.

~~NOTE 2—Transmit spectral mask figures in this subclause are not drawn to scale.~~

NOTE 3—For rules regarding TX center frequency leakage levels, see Clause 32.3.10.4.2 (Transmit center frequency

leakage). The spectral mask requirements in this subclause do not apply to the RF LO.

~~For operation using 10 MHz channel spacing and 20MHz channel spacing, the~~ The transmit spectrum masks are defined in 17.3.9.3 (Transmit spectrum mask).

***------------- End Text Changes ------------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1586 | 78.30 | The subclause numbers shown in this paragraph should be changed to 32.3.10.4.2, 32.3.10.4.3, and 32.3.10.4.4, respectively. | As in the comment. | Accepted |
| 1677 | 78.30 | References for the transmit modulation accuracy specifications are made to the VHT subclauses 21.3.17.4.2, 21.3.17.4.3, and 21.3.17.4.4 although 32.310.4.2, 32.3.10.4.3, and 32.3.10.4.4 contain the NGV specific specifications | Replace the reference to VHT subclauses 21.3.17.4.2, 21.3.17.4.3, and 21.3.17.4.4 with references to NGV subclauses 32.310.4.2, 32.3.10.4.3, and 32.3.10.4.4 . | Accepted |

***To TGbd Editor:*** ***P78L27*** *update the description as below*

***------------- Begin Text Changes ---------------***

**32.3.10.4.1 Introduction to modulation accuracy tests**

Transmit modulation accuracy specifications are described in ~~21.3.17.4.2~~ 32.3.10.4.2 (Transmit center frequency leakage) and ~~21.3.17.4.3~~ 32.3.10.4.3 (Transmitter constellation error). The test method is described in ~~21.3.17.4.4~~ 32.3.10.4.4 (Transmitter modulation accuracy (EVM) test).

***------------- End Text Changes ------------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1587 | 78.24 | The statement "Each output port of the transmitting STA shall be connected through a cable to one input port of the Device Under Test." coped from 32.3.11 Receiver specifications (P80L17) should be included in the Modulation accuracy tests in 32.3.10.4. The test procedure that involves channel estimation and equalization (such as step f and g, P79L30) should be removed. | As in the comment. | Revised.TGbd Editor: make changes according to this document 11-20-1948-00-00bd Resolutions to 32.3.10 Transmit specification. |

***Discussion on CID1587***

For the first comment, the comment fails to explain why the text in 32.3.11 (Receiver specification) should be reused in Transmit specification. Looking at the 11bd D1.0, there are two sentences with barely different description as below and there is nothing wrong with it technically.

For the second comment, the comment fails to explain why f) and g) should be deleted. Those are general procedures to be described for EVM test through other amendments. However, reviewing the f), it turned out that estimating channel response coefficient on midamble happens to be missed.





***To TGbd Editor:*** ***P79L30*** *update the description as below.*

***------------- Begin Text Changes ---------------***

1. Estimate the complex channel response coefficient for each of the subcarriers and each of the transmit streams. If midambles are present in the Data field of the PPDU, the channel response coefficients shall be based upon the most recently received midamble symbols.
2. For each of the data OFDM symbols: transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers, and compensate the subcarrier values according to the estimated phase, group the results from all of the receiver chains in each subcarrier to a vector, and multiply the vector by a zero-forcing equalization matrix generated from the estimated channel.
3. For each data-carrying subcarrier in each spatial stream, find the closest constellation point and compute the Euclidean distance from it. If midambles are present in the Data field of the PPDU, the midamble symbols shall not be used to compute the Euclidean distance.

***------------- End Text Changes ------------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1089 | 79.09 | EVM requirement is defined in Table 21-24 of VHT. However, VHT doesn't have the DCM modulation. Need to add the EVM requirement for DCM+BPSK | as in the comment | Revised.TGbd Editor: make changes according to this document 11-20-1948-00-00bd Resolutions to 32.3.10 Transmit specification. |

***To TGbd Editor:*** ***P79L09*** *update the description as below.*

***------------- Begin Text Changes ---------------***

In this case, transmit modulation accuracy of each segment shall meet the required value in Table ~~21-24~~ 32-xx

(Allowed relative constellation error versus constellation size and coding rate) using only the subcarriers

within the corresponding segment.

Table 34-xx—Allowed relative constellation error versus constellation size and coding rate

|  |  |  |
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| Modulation | Coding rate | Relative constellation error(dB) |
| BPSK with DCM | 1/2 | –5 |
| BPSK | 1/2 | –5 |
| QPSK | 1/2 | –10 |
| QPSK | 3/4 | –13 |
| 16-QAM | 1/2 | –16 |
| 16-QAM | 3/4 | –19 |
| 64-QAM | 2/3 | –22 |
| 64-QAM | 3/4 | –25 |
| 64-QAM | 5/6 | –27 |
| 256-QAM | 3/4 | –30 |
| 256-QAM | 5/6 | –32 |

***------------- End Text Changes ------------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1588 | 79.08 | There is no cncept of "segment" in NGV. Change "segment" to "channel width." | As in the comment. | RevisedEven though commentor’s point makes sense, this terminology “segment” has been widely used through 11bd draft 1.0 and other amendments. At this point, it would be better to add the definition of Number of frequency segments in Table 32-6 (Timing-related constants).TGbd Editor: make changes according to this document 11-20-1948-00-00bd Resolutions to 32.3.10 Transmit specification. |

***To TGbd Editor:*** ***P58L07*** *update the description as below.*

***------------- Begin Text Changes ---------------***

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| Table 32-6 Timing-related constants  |
| Parameter | CBW10 | CBW20 | Description |
| *NSD* | 52 | 108 | Number of complex data numbers per frequency segment |
| *NSP* | 4 | 6 | Number of pilot values per frequency segment |
| *NST* | 56 | 114 | Total number of subcarriers per frequency segment. See NOTE. |
| *NSR* | 28 | 58 | Highest data subcarrier index per frequency segment |
| *NSeg* | 1 | 1 | Number of frequency segments |
| *∆F* | 156.25 kHz | Subcarrier frequency spacing |

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***------------- End Text Changes ------------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 1589 | 79.13 | "... shall have sufficient accuracy ..." This is not verifiable. | Need to provide a verifiable requirement. | RejectedSince those values are out of scope in the spec, the spec does not need to specify required values to be verified.Instead, EVM is known for sufficient transmit modulation accuracy test to cover I/Q amplitude and phase blance, phase Noise, and quantization noise, etc in the transmitter. |

***Discussion on CID1589***

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The commentor suggests the spec needs to provide verifiable requirement for I/Q arm amplitude and phase balance, DC offsets, phase noise, and analog to digital quantization noise. Since those values are out of scope in the spec, the spec does not need to specify required values to be verified.

The spec already provides the required value to be met for EVM test in Table 34-xx. The values in this table are verifiable requirement for sufficient transmit modulation accuracy.