IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Remove TBDs in PHY Transmit Spec. | | | | |
| Date: 2016-11-07 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Yujin Noh | Newracom |  |  | yujin.noh at newracom.com |
| Namsik Ryu | Newracom |  |  | namsik4085at newracom.com |
| Bin Tian | Qualcomm | 5775 Morehouse Dr. San Diego, CA, USA |  | btian@qti.qualcomm.com |
| Lin Yang | Qualcomm | 5775 Morehouse Dr. San Diego, CA, USA |  | linyang@qti.qualcomm.com |
| Ilan Sutskover | Intel |  |  | ilan.sutskover@intel.com |
| Ran Leviev | Intel |  |  | ran.leviev@intel.com |
| Shahar Gross | Intel |  |  | shahar.gross@intel.com |
| Hongyuan Zhang | Marvell | 5488 Marvell Lane, |  |  |
| Ron Porat | Broadcom |  |  | rporat at broadcom.com |

Abstract

This submission shows the text proposal removing TBDs left and editorial changes on 26.3.16 (Transmit specification)

The proposed changes are based on 11ax D0.5.

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

***Editing instructions formatted like this are intended to be copied into the TGax 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.***

**Changes to Section 26.3.16.1 Transmit spectral mask**

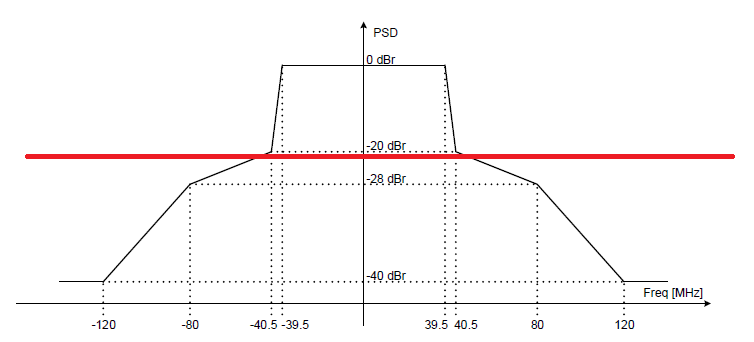
**Discussion**

Figure 26-38 is the mask of 80MHz PPDU instead of 160MHz PPDU

***To TGax editor:*** ***P291L27*** *replace the Figure 26-38 with the proposed changes below.*

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





**Figure 26-38—Example transmit spectral mask for a 160 MHz mask PPDU**

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

**Changes to Section 26.3.16.2 Spectral flatness**

**Discussion**

Signal phase doesn't matter to the spectral flatness testing so it can be removed in the test procedure. However if intended to keep it, the term needs to be changed from “timing drift error” to "sampling offset drift" to be consistent with the EVM testing proceure.

***To TGax editor:*** ***P293L4*** *replace the text with the proposed changes below.*

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

(#2351)Spectral flatness measurements shall be conducted using BPSK modulated HE PPDUs. Demodulate the HE PPDUs according to the following (or equivalent) procedure:

1. Start of PPDU shall be detected.
2. Transition from L-STF to L-LTF shall be detected and fine timing shall be established.
3. Coarse and fine frequency offsets shall be estimated.
4. Symbols in a PPDU shall be manipulated to account for both frequency error and sampling offset drift.
5. For each HE-LTF symbol, transform the symbol into subcarrier received values, estimate the phase from the pilot subcarriers, and compensate the subcarrier values according to the estimated phase.
6. For each of the data OFDM symbols: transform the symbol into subcarrier received values

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

**Changes to Section 26.3.16.4.3 Transmitter constellation error**

**Discussion**

Texts corresponding to HE MU PPDU with preambling puncturing is removed for future study.

For HE Trigger-based PPDU, in order to control the interference to other RUs, tighten the occupied one EVM for lower MCSs.

* The EVM of MCS0 and MCS1 are set to -13dB as the same as MCS2.
* For other MCSs, apply the same limits of EVM per MCS as in full BW EVM.
* BPSK + DCM is kept at the same as MCS0.
* Other DCM+MCS combinations can be mapped to non-DCM+MCS with the same data rates.

To enable AP managing interference by power control, consider additaional EVM requirement for HE Trigger-based PPDU.

***To TGax editor:*** ***P294L45*** *replace the text and the table with the proposed changes below.*

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

The relative constellation RMS error, calculated by first averaging over subcarriers, frequency segments, HE PPDUs, and spatial streams (see Equation (26-125)) shall not exceed a data-rate dependent value according to Table 26-42 (Allowed relative constellation error versus constellation size and coding rate). The number of spatial streams under test shall be equal to the number of utilized transmitting STA antenna (output) ports and also equal to the number of utilized testing instrumentation input ports. In the test, *NSS* = *NSTS* (no STBC) shall be used. Each output port of the transmitting STA shall be connected through a cable to one input port of the testing instrumentation. The requirements apply to 20 MHz, 40 MHz, 80 MHz, and 160 MHz contiguous transmissions as well as 80+80 MHz noncontiguous transmissions.

**Table 26-42—Allowed relative constellation error versus constellation size and coding rate**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Modulation | | Coding rate | Relative constellation error in HE SU PPDU, HE Extended SU PPDUHE SU, and HE MU PPDU (dB) | Relative constellation error in HE Trigger-based PPDU (dB) | Relative constellation error in HE Trigger-based PPDU when transmit power is less than or equal to the maximum power of MCS7 (dB) |
| Without DCM | With DCM |
| N/A | BPSK | 1/2 | –5 | -13 | -27 |
| BPSK | QPSK | 1/2 | –5 | -13 | -27 |
| QPSK | 16-QAM | 1/2 | –10 | -13 | -27 |
| QPSK | 16-QAM | 3/4 | –13 | -13 | -27 |
| 16-QAM | N/A | 1/2 | –16 | -16 | -27 |
| 16-QAM | N/A | 3/4 | –19 | -19 | -27 |
| 64-QAM | N/A | 2/3 | –22 | -22 | -27 |
| 64-QAM | N/A | 3/4 | –25 | -25 | -27 |
| 64-QAM | N/A | 5/6 | –27 | –27 | -27 |
| 256-QAM | N/A | 3/4 | –30 | –30 | -30 |
| 256-QAM | N/A | 5/6 | –32 | –32 | -32 |
| 1024-QAM | N/A | 3/4 | –35 | –35 | -35 |
| 1024-QAM | N/A | 5/6 | –35 | –35 | -35 |
| NOTE - The maximum power of MCS7 can be measured by setting the Target RSSI subfield as defined in Table 9-25g (Target RSSI subfield encoding) in the Trigger frame to 127 for the same data-carrying subcarriers which EVM test is conducted. | | | | | |

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

**Discussion**

* Texts corresponding to HE MU PPDU with preambling puncturing is removed for future study.
* The unused tone EVM is calculated as the linear average power of un-occupied subcarrier normalized to the linear average power per subcarrier of the occupied RU. To avoid frequency selective variations of the unused tone EVM, average over the unused tones on each unassigned RU26.

***To TGax editor:*** ***P296L47*** *replace the text and TBD with the proposed changes below.*

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

For HE trigger-based PPDU, additional transmit modulation accuracy test for the un-occupied subcarriers of the PPDU shall be performed. The transmit modulation accuracy of un-occupied subcarriers of the PPDU test shall be performed by instrumentation capable of converting the transmitted signals into a stream of complex samples at sampling rate greater than or equal to the bandwidth of the signal being transmitted; except that for noncontiguous transmissions, only the frequency segment with occupied subcarriers is tested. The transmit modulation accuracy of un-occupied subcarriers of the PPDU shall meet relative constellation error staircase mask for each modulation and code rates using the un-occupied subcarriers within the corresponding segment.

The instrument shall have sufficient accuracy in terms of I/Q branch amplitude and phase balance, DC offsets, phase noise, and analog to digital quantization noise. A possible embodiment of such a setup is converting the signals to a low IF frequency with a microwave synthesizer, sampling the signal with a digital oscilloscope and decomposing it digitally into quadrature components. The sampled signal shall be processed in a manner similar to an actual receiver, according to the following steps, or equivalent procedure:

1. Start of PPDU shall be detected.
2. Transition from L-STF to L-LTF shall be detected and fine timing shall be established.
3. Coarse and fine frequency offsets shall be estimated.
4. Symbols in a PPDU shall be derotated according to estimated frequency offset. Sampling offset drift shall be also compensated. Note that amplitude drift shall not be compensated by the testing instrument.
5. For each of the data OFDM symbols: transform the symbol into subcarrier received values, estimate the power of each subcarriers.
6. Compute the average un-occupied subcarrier error vector magnitude for each un-occupied RU26 and average across PPDUs of the RMS of all errors per PPDU as given by Equation (26-A).

 (26-A)

where

*Iu*(*if*, *is*, *iRU*) *Qu*(*if*, *is*, *iRU*) denotes un-equalized observed symbol point in the complex plane in un-occupied RU26 *iRU* and OFDM symbol *is* of frame *if*.

Ω*k* is a set of subcarriers for k-th RU26 as definded in Table 26-3, Table 26-4 and Table 26-5

*PS* is the average data subcarrier power of occupied RU under test and is given by  
 Equation (26-B)

 (26-B)

*Nf* is the number of tested frames

*NSYM* is the number of data OFDM symbols

*NST* is the number of data tones of the occupied RU



1. For all MCS, for an occupied RU bandwidth of *r* in units of RU26 as defined by Equation (26-C)

 (26-C)

the average un-occupied subcarrier error vector magnitude for each un-occupied RU26 as calculated in step e) shall meet the following staircase mask requirement in Equation (26-D):

 (26-D)

where

*m* defines the gap in the units of RU26 to the occupied RU from either side and is a positive integer with *m*=1 being the adjacent RU26.

The Used Tone ErrorRMS is the relative constellation error for HE trigger based PPDU defined in Table 26-42

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