IEEE P802.11  
Wireless LANs

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| IEEE 802.11 TGax  January 2016 Atlanta PHY Ad Hoc Meeting Minutes | | | | |
| Date: 2016-01-21 | | | | |
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Abstract

TGax meeting minutes for the IEEE 802.11 Atlanta PHY ad hoc session, January, 2016.

**IEEE 802.11 Task Group ax PHY Ad Hoc**

**January 2016 Atlanta Meeting**

**Monday, Jan. 18th, 2016, PM2 TGax Session**

1. **Meeting called to order by Bo Sun (ZTE)** 
   1. The agenda is contained in 11-15/1385r0 which is on the server.
2. **Administrative Items**
   1. Chair reminded the IEEE 802 and IEEE 802.11 Policy and Procedure.
   2. Chair also reminded to do attendance.
3. **Set and approve agenda**
4. **Presentations**

**4.1**

**11-16-0030-01-00ax-maximum-tone-grouping-size-for-802-11ax-feedback-with-mu-mimo**

**Kome Oteri** (InterDigital Inc.) presented.

**Discussions:**

Sriram: We have a similar contribution but with slightly different conclusions.

Kome: We do have a couple of strawpolls. Can we run our straw poll?

Chair: We will go through Sriram’s contribution, and then have the straw poll.

**SP #1:**

**Do you agree to add the following to Section 7.3 of the Tgax SFD ?**

* 802.11ax spec shall support Ng = 4 and 16 for sounding feedback with SU/MU-MIMO-OFDM(A).
* NOTE—The tone grouping factor, Ng is defined with respect to data tones of the HE PPDU.

**SP Result: 36Y/0N/15A; SP passed.**

**SP #2:**

**Discussions:**

Mingyue: The tradeoff of using Ng=8 is not good.

**Do you agree to add the following to Section 7.3 of the Tgax SFD ?**

* 802.11ax spec shall support *Ng = 2 and 8* for sounding feedback with SU/MU-MIMO-OFDM(A).
* *NOTE*—*The tone grouping factor, Ng is defined with respect to data tones of the HE PPDU.*

**SP Result: 6Y/17N/19A; SP failed**

**4.2**

**11-16-0088-00-00ax-ng-for-compressed-beamforming-feedback**

Sriram Venkateswaran (Broadcom) Presented

**Discussions:**

**SP #1:**

**Skipped since it is same as SP#1 in 11-16-0030r1**

**SP #2:**

**Do you support adding to the TG Specification Framework:**

In the MU Exclusive Beamforming Report for the delta SNR, the locations of the feedback tones shall be identical to the tone locations of the compressed V matrices fed back

**SP Result: 34Y/0N/11A; SP passed**

**4.3**

**11-16-0033-00-00ax-1x-he-ltf-for-ulmumimo**

Hongyuan Zhang (Marvell) Presented

**Discussions:**

**SP #1:**

**Do you agree to add the following text in SFD?**

* + **11ax allows 1xLTF as an optional mode in the following cases:**
    - **SU, with GI = 0.8us only**
    - **Full-BW UL-MUMIMO, with GI=1.6us only?**
    - **Full BW DL-MUMIMO, with GI=0.8us TBD**

**SP Result: 38Y/0N/10A; SP passed**

**4.4**

**11-16-0034-00-00ax-beamforming-with-he-ltf-compression**

Hongyuan Zhang (Marvell) Presented

**Discussions:**

Sigard: Interpolation at the receiver?

Hongyuan: yes.

**SP #1:**

**Discussions:**

Sigard: Does the TX have to do it?

Hongyuan: yes. Tx has to maintain the smoothness.

* **Do you agree to add the following text in SFD?**
  + When 1x/2x HE-LTF is transmitted, it is recommended that the spatial mapping matrix applied to HE-STF and beyond is chosen such that it preserves the smoothness of the physical channel, achieved by limiting the variation of each element’s real and imaginary values in the spatial mapping matrix across successive tones.

**SP Result: 35Y/0N/10A; SP passed**

**4.5**

**11-16-0036-00-00ax-crc-generation-for-he-sig**

**Yakun Sun** (Marvell) Presented

**Discussions:**

Daewon: if you just truncate the 8-bit CRC, the performance should not be better than the best polynomial.

Yakun: Our simulations show the performance is good enough.

Daewon: did you check the 1 bit or 2bits error cases?

Yakun: we did not.

**SP #1:**

* **Do you support to add the following in the current SFD:**
  + The CRC bits of HE-SIG-A and each coding group of HE-SIG-B are generated as 4 LSB of HT CRC generator output?

**SP Result: 38Y/3N/10A; SP passed**

**4.6**

**11-16-0037-01-00ax-continuous-puncturing-for-he-sigb-encoding**

**Yakun Sun** (Marvell) Presented

**Discussions:**

Daewon: My contribution #104 is related to the straw poll. I just ask if I can present after this presentation.

Chair: you can present after this straw poll.

**SP #1:**

* **Do you support to add the following to the current SFD:** 
  + SIGB bits for each SIGB content channel are continuously encoded with 1 BCC encoder?
* **SP Result: 36Y/0N/14A; SP passed**

**4.7**

**11-16-0104-00-00ax-rate-matching-for-he-sig-b**

Daewon (Newracom) Presented

**Discussions:**

Yakun: In some cases, your padding method loses efficiency.

Daewon: I would say if you want to high efficiency, we should remove all the tail bits.

**SP #1:**

**Do you agree to add the following text to SFD?**

* When MCS 2, 4, or 6 is configured for HE-SIGB, up to 2 (zero valued) filler bits are added after each tail bits of HE-SIG-B encoding block (i.e. common field and STA-specific information field) such that length of an encoding block (including the filler bits) is multiple of 3.
* When MCS 5 is configured for HE-SIGB, up to 1 (zero valued) filler bits are added after each tail bits of HE-SIG-B encoding block (i.e. common field and STA-specific information field) such that length of an encoding block (including the filler bits) is multiple of 2.

**SP Result: 6Y/22N/17A; SP failed**

**Tuesday, Jan.19th, 2016, AM2**

1. **Meeting called to order by Bo Sun (ZTE)** 
   1. The agenda is contained in 11-15/1385r1 which is on the server.
2. **Administrative Items**
   1. Chair reminded the IEEE 802 and IEEE 802.11 Policy and Procedure.
   2. Chair also reminded to do attendance.
3. **Presentations**

7.1

**11-16-0038-00-00ax-sequence-for-1x-ltf**

Daewon (Newracom) Presented

**Discussions:**

Le: The index is not divided by 4

Daewon: These are typos.

No Straw poll.

7.2

**11-16-0052-00-00ax-remaining-he-ltf-sequence-design**

Le (Huawei) Presented

**Discussions:**

Yakun: The index is not divided by 4

Daewon: These are typos.

**SP #1:**

* **Do you agree**
  + 4x HE-LTF160MHz(-1012:1:1012) =[ 4x LTF80MHz\_primary , zeros(1,23), 4x LTF80MHz\_secondary ]
    - 4x LTF80MHz\_primary = [L-LTF80M, 0, R-LTF80M] as agreed for 80MHz 4x HE-LTF;
    - 4x LTF80MHz\_secondary = [L-LTF80M, 0, (-1)\* R-LTF80M]
  + 4x HE-LTF80+80MHz = [4x LTF80MHz\_primary , 4x LTF80MHz\_secondary]

**SP Result: 35Y/0N/14A; SP passed**

**SP #2:**

* **Do you agree**
  + 2x HE-LTF160MHz(-1012:2:1012) = [ 2x LTF80MHz\_primary , zeros(1,11), 2x LTF80MHz\_secondary ]
    - 2x LTF80MHz\_primary  as agreed for 80MHz 2x HE-LTF  
      = [{1st 242-RU}, {2nd 242-RU}, {central 26-RU}, {3rd 242-RU}, {4th 242-RU}];
    - 2x LTF80MHz\_secondary   
      = [{1st 242-RU}, (-1)\*{2nd 242-RU}, {central 26-RU}, {3rd 242-RU}, (-1)\*{4th 242-RU} ];
  + 2x HE-LTF80+80MHz= [2x LTF80MHz\_primary , 2x LTF80MHz\_secondary]

**SP Result: 38Y/0N/16A; SP passed**

**SP #3:**

* Do you agree to use the 20/40/80/160/80+80MHz 1x HE-LTF sequences in slide 21-24?

**SP Result: 35Y/2N/15A; SP passed**

7.3

**11-16-0039-01-00ax-ru-allocation-in-sig-b**

Daewon (Newracom) Presented

Arjun: Your proposal requires STAs to successfully decode both content channels.

Daewon: If the STA does not know which channel its contents is on, the STA must decode both content channels.

**SP #1:**

**Do you agree with not to support dynamic split (not precluding equal split) of MU-MIMO STA specific information for 2x996 RU (i.e. 160MHz MU-MIMO).**

**SP Result: 8Y/6N/many A; SP failed**

**SP #2:**

**Do you agree with support equal split and no split (all STA information in one SIG-B channel) of MU-MIMO STA specific information for 2x996 RU (i.e. 160MHz MU-MIMO).**

**SP Result: 9Y/0N/many A; SP failed**

**SP #3:**

**Do you agree to include the following text to SFD?**

* At least 1 state is reserved in the 8 bit RU allocation subfield of the HE-SIG-B common field for ‘no STA-specific information field assigned by the RU allocation subfield’.
  + Details TBD

**SP Result: 21Y/1N/19A; SP passed**

7.4

**11-16-0040-00-00ax-issues-with-compressed-sig-b-mode**

Yujin Noh (Newracom) Presented

**Discussions:**

**SP #1:**

**Do you agree to include the following text to TGax SFD:**

* In MU PPDU, the SIG-A shall indicate the number of STAs when compressed SIG-B mode is indicated (i.e. full bandwidth MU-MIMO indicated).
  + Details TBD

**SP Result: 13Y/0N/31A; SP passed**

7.5

**11-16-0041-01-00ax-link-adaptation-for-he-wlan**

Yujin Noh (Newracom) Presented

**Discussions:**

Bin: How does the receiver knows the percentage of PER?

Daewon: The assumption is that you can measure the channel quality.

Hongyuan: The accuracy of the estimated per-tone SNR may be large than the link adation.

Daewon: If you have a better method, we are willing to accept.

**SP #1**

**Do you agree to include the following text to TGax SFD:**

* HE link adaptation shall define a fixed reference payload size as MPDU length of Y octets in specification.
  + “Y” is TBD.

**SP Result: 10Y/5N/26A; SP failed**

**Tuesday, Jan 19th, 2016, PM1**

1. **Meeting called to order by Bo Sun (ZTE)** 
   1. The agenda is contained in 11-15/1385r2 which is on the server.
2. **Administrative Items**
   1. Chair reminded the IEEE 802 and IEEE 802.11 Policy and Procedure.
   2. Chair also reminded to do attendance.
3. **Presentations**

**10.1**

**11-16-0044-00-00ax-mcs-levels-and-tx-evm-requirement-for-1024-qam**

Eunsung (LGE) Presented

**SP #1:**

* **Do you agree to add the following new MCS levels as an optional feature to the 11ax SFD:**
  + MCS10: 1024 QAM with 3/4 code rate
  + MCS11: 1024 QAM with 5/6 code rate

**SP Result: 23Y/1N/10A; SP passed**

**SP #2:**

* **Do you agree to add the following text to the 11ax SFD:**
  + TX EVM requirement of -35dB is used for MCS 10 and 11

**SP Result: 24Y/2N/11A; SP passed**

**10.2**

**11-16-0046-00-00ax-content-for-the-extra-tones-in-lsig-and-rlsig**

Jiayin Zhang (Huawei) Presented

**SP #1:**

**Do you support to add to the SFD**

* + The content of 4 extra tones [-28,-27,27,28] of L-SIG and RL-SIG in 20MHz HE PPDU is [-1,-1,-1,1]

**SP Result: 32Y/0N/11A; SP passed**

**10.3**

**11-16-0047-00-00ax-discussion-on-the-he-extended-range-su-ppdu**

Jiayin Zhang (Huawei) Presented

**Discussions:**

Sigurd: Will you see the performance difference of extend preamble?

Jiayin: Without extend preamble; data portion will be the bottleneck.

Daewon: What we need to enhance the data portion?

Jiayin: For example, beamforming can be used to improve the data portion performance.

Daewon: I do not think the power boost is good for beamforming?

Jiayin: It depends on how you do beamforming.

**SP #1:**

**Discussions:**

Daewon: I will prefer to not making this mandatory.

Sigurd: I think more simulation results needed.

* **Do you support to modify the SFD as the red text**

There are only three pre-HE-STF preamble formats defined:

* + - SU format (mandatory) / Trigger based UL
    - MU format (mandatory)
    - Extended range SU format (mandatory)

**SP Result: 32Y/9N/10A; SP passed**

**SP #2:**

* **Do you support to add to SFD**
  + The HE Extended Range SU PPDU is transmitted only on the primary 20MHz.

**SP Result: 38Y/0N/17A; SP passed**

**SP #3:**

* **Do you support to add to SFD**
  + The HE Extended Range SU PPDU can only be transmitted with MCS0, MCS1, MCS2 and only with 1 spatial stream.

**SP Result: 37Y/0N/16A; SP passed**

**SP #4:**

**Discussions:**

Sigurd: Are you not compliant if you are not boosted?

Jiayin: Boost is a mandatory.

Jianhan: it is also transparent to the receiver.

* **Do you support to add to SFD**
  + HE-LTF/HE-STF power is boosted 3dB for BPSK and QPSK including DCM in the HE Extended Range SU PPDU preamble.

**SP Result: 40Y/6N/12A; SP passed**

**10.4**

**11-16-0045-01-00ax-flexible-wider-bandwidth-transmission**

John Son (WILUS) Presented

**Discussions:**

Hongyuan: You need some change on secondary CCA. Per 20MHz CCA, what is the level?

John: We do not have a specific level. Just a concept.

Hongyuan: should be occupied bandwidth.

**SP #1:**

* **Do you agree to add the following text into 11ax SFD?** 
  + 3.x.x The spec shall support occupied HE PPDU bandwidth options other than 20/40/80/160(80+80)MHz for HE MU PPDU format.

**SP Result: 22Y/17N/19A; SP failed**

**10.5**

**11-16-0053-00-00ax-requirements-for-ul-mu-transmissions**

Arjun (Qualcomm) presented.

**Discussions:**

Daewon: Are both categories are mandatory.

Arjun: No.

**SP #1:**

* **Do you agree to add the following text in SFD?**

There are two STA classes that support HE trigger-based PPDU with information exchanged as part of the device capability

Class A: STAs that are high capability devices and

Class B: STAs that are low capability devices

**SP Result: 40Y/2N/13A; SP passed**

**SP #2:**

* **Do you agree to add the following text in SFD?**
  + STAs that participate in HE trigger-based PPDU shall support per chain max(P-32,-10dBm) as the min Tx power, with P the max power the STA can transmit at the antenna connector of that chain using MCS0 while meeting the TX EVM and spectral mask requirements. A STA transmitting at and above the min power shall support the EVM requirements for TBD MCS (but at least MCS7)

**SP Result: 39Y/2N/17A; SP passed**

**SP #3:**

* Do you agree to add the following text in SFD?
  + STAs that participate in HE trigger-based PPDU shall support the following absolute Tx power requirements and the RSSI measurement accuracy requirements for the two device classes

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **11ax Minimum Requirements** | | **Comments** |
| **Class A devices** | **Class B devices** |
| Absolute Transmit Power accuracy | +/-3dB | +/-9dB | Accuracy of achieving a specified transmit power level |
| RSSI Measurement Accuracy | +/- 2 dB | +/- 5 dB | Difference between the actual RSSI and the measured RSSI  Requirements are valid from minimum RX to maximum RX input power |

**SP Result: 41Y/1N/14A; SP passed**

**SP #4:**

* **Do you agree to add the following text in SFD?**
  + STAs that participate in HE trigger-based PPDU shall pre-compensate for carrier frequency offset (CFO) error and timing drift.  After compensation, the absolute value of residual CFO error with respect to the corresponding Trigger frame shall not exceed 350Hz for data subcarriers when measured as the 10% point of CCDF of CFO errors in AWGN at a received power of -60dBm in the primary 20MHz. The residual CFO error measurement shall be made on the HE trigger-based PPDU packet after HE-SIGA.

**SP Result: 39Y/0N/17A; SP passed**

**SP #5:**

* Do you agree to add the following text in SFD?
  + STA that participate in HE Trigger based PPDU transmission shall have timing accuracy of **+/-0.4µs** relative to the Trigger frame. This requirement does not include round trip delay.

**SP Result: 39Y/0N/10A; SP passed**

**SP #6:**

* Do you agree to add the following text in SFD?
  + The following TX LO leakage requirements are supported for all transmission modes in 11ax:
    - The power measured at the location of the RF LO using resolution BW 78.125 kHz shall not exceed the maximum of –32 dB relative to the total transmit power and -20 dBm, or equivalently max(P-32,-20), where *P* is the transmit power per antenna in dBm. The transmit center frequency leakage is specified per antenna.

**SP Result: 38Y/0N/17A; SP passed**

**SP #7:**

* Do you agree to add the following text in SFD?
  + Transmit center frequency and the symbol clock frequency for all transmit antennas and frequency segments shall be derived from the same reference oscillator

**SP Result: 41Y/0N/10A; SP passed**