IEEE P802.11
Wireless LANs

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| IEEE 802.11 TGaxMay 2015 Berlin PHY Ad Hoc Meeting Minutes |
| Date: 2015-05-15 |
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Abstract

TGax meeting minutes from the IEEE 802.11 Vancouver PHY Ad hoc session, May, 2015.

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

**May 2015 Vancouver Meeting**

**Monday, May 11th, 2015, PM1 TGax Session (13:30-13:30)**

1. **Meeting called to order by Yakun Sun (Marvell) at 13:30.**
	1. The agenda is contained in 11-15/0640r0 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**
	1. Proposed agenda for Monday PM1:
		1. Call Meeting to order
		2. IEEE 802 and 802.11 IPR Policy and procedure.
		3. Presentations follow the order of DCN.
		4. Recess
	2. Chair asked for approval of the proposed agenda. – Agenda approved.
4. **Presentation**
	1. **11-15-0550-01-00ax-l-preamble-issues-for-ul-ofdma**

Katsuo Yunoki (KDDI) presented 15/0550r1.

**Discussions:**

Wookbong (LGE): STA can get sync by measuring DL trigger frame for UL OFDMA transmission, so there should be no extra requirements for sync.

Yunoki: not sure the sync can meet the requirements

Hongyuan (Marvell): In slide 6, actually the delay will not cause problem to STF correlation and sync.

Junghoon (Huawei): In slide 11, is there any consideration on OBSS detection.

Yunoki: Legacy STAs should not be able to identify it.

**SP1:**

Do you agree to modify the current sentence in Spec Framework Document as follows?

- An HE PPDU shall include the legacy preamble (L-STF, L-LTF and L-SIG), duplicated on each 20 MHz, for backward compatibility with legacy devices, except the case of narrower bandwidth (<20MHz) transmission for UL-OFDMA.

**Discussion:**

Wookbong (LGE): Based on above comment, still feel there’s no need to change the SFD..

**SP Result:**

**2Y/28N/15A**

**SP2:**

Do you agree to add the following text into Spec Framework Document?

PPDU header for UL-OFDMA transmission shall be defined for narrower bandwidth (<20MHz).

**Discussion:**

None

**SP Result:**

**1Y/13N/(Many)A**

* 1. **11-15-0553-00-00ax-enhancing-performance-of-hybrid-arq-with-linear-constellation-precoding**

No one reply to the chair’s call to present this contribution and this item was skipped over.

* 1. **11-15-0569-01-00ax-performance-of-1x-2x-and-4x-he-ltf**

Kome (InterDigital) presented 11-15/0569r1

**Discussion:**

Hongyuan (Marvell): Simulation result with power boosts seems worse than other company’s simulation because the using of channel-B and the positioning of the LTFs and proper interpolation.
Kome: LTF positioning and interpolation do impact the result as we saw in our studies. For outer tones, we used both linear and spline interpolation to improve the performance.

Hongyuan (Marvell): why is the UL-MU-MIMO performance better than the SISO performance?

Kome: We use 1x1 for the SISO while we use 8 Rx antennas for the 4 user UL-MU-MIMO performance.

Jiayin (Huawei): How does power boosting affect the results? Shouldn’t the energy be normalized?
Kome: We normalize the power in the LTF for the baseline. Power boosting is an additional assumption based on the results we saw that is up for discussion.
Ron (BroadCom): The results confirm our decision in the last meeting to eliminate the 1x case and minimize the options.
Kome: The key is that we now have actual data to make a more informed decision on whether to keep the option.
Jianhan (MTK): slide 7, MTK’s simulation was about 6 db better. When doing boosting, is power amplifier distortion (PAD) also included?
Kome: We did see some difference between our results and the reference 349 (MCS 9) vs MCS7. However, one key assumption is we run the simulation in 20 MHz while the simulation in 349 was run in 80 MHz. We could meet afterwards to align results. We do not model PAD at this time.

**SP:**

**Do you agree to add to the TG Specification Framework?**

* 3.2.y HE-LTF symbol duration of 3.2us excluding GI
	+ Equivalent to modulating every 4th tone in an OFDM symbol of 12.8 µs excluding GI, and then removing the last three quarters of the OFDM symbol in the time domain
	+ The energy transmitted per HE-LTF symbol may be boosted to compensate for the reduction in HE-LTF length

**Discussion:**

**None**

**SP Result:**

**2Y/24N/19A**

* 1. **11-15-0572-00-00ax-phy-inefficiency-of-256-fft-per-20mhz**

Heejung Yun (Newracom) presented 11-15/0572r0.

**Discussion:**

None

**SP**

**Do you agree to add the following to the TGax specification framework document:**

* + x.y.z HE shall include mechanisms to keep the MAC/PHY padding overhead to be similar to VHT transmissions for the same payload size.

**Discussion:**

Jianhan (MTK): suggest to change the SP similar to “include mechanism to enhance the MAC/PHY padding efficiency for 4x symbol duration.”

Hongyuan (Marvell): agree with Jianhan. And the SP content is unclear, e.g. what’s the meaning of “similar”? We need a solution for such SP.

Jiayin (Heuawei): The SP is not clear without a solution.

Daewon (Newracom): It’s a general guideline direction SP, we don’t limit specific solution but prefer to collect opinions.

Hongyuan: Guideline is not suitable for SFD words.

Robert (Intel): Prefer some discussion on potential solutions before put something into the SFD.

**The presenter decided to defer the SP.**

* 1. **11-15-0574-00-00ax-sig-structure-for-ul-ppdu**

Young Hoon Kwon (Newracom) presented the contribution.

**Discussion:**

Wookbong (LGE): slide 11, when and how Partial band transmission happens?

Young (Newracom): when SST is implemented.

Robert (Intel): why not use MCS0 with full bandwidth?

Young: Partial band transmission can focus TX power on good sub-bands.

Junghoon (Huawei): How does the STA decide which sub-channels are better than others?

Young: by measuring the DL frame, e.g. beacon frames.

**SP1:**

* **Do you agree to add to the TG Specific Framework:**
	+ 3.y.z UL MU PPDU shall not include HE-SIG-B field if it is sent as an immediate response to a Trigger frame sent by an AP.

**Discussion:**

None

**SP Result:**

**25Y/1N/39A**

**SP2:**

* **Do you agree to add to the TG Specific Framework:**
	+ 3.y.z UL SU PPDU shall not include HE-SIG-B field.

**Discussion:**

Wookbong (LGE): we don’t have much on SU PPDU.

Ron (BroadCom): the requirements for HE-SIG-B design in SU PPDU is not clear yet, prefer discuss HE-SIG-A first

**The presenter decided to defer the SP.**

* 1. **11-15-0575-00-00ax-preamble-structure-in-802-11ax**

Yujin Noh (Newracom) presented the contribution.

**Discussion:**

None

**SP1**

* **Do you agree to add the following sentence to the TG SFD:**

-3.y.x. HE-SIG-A field in HE PPDU shall be fixed number of OFDM symbols, the number of OFDM symbols is TBD.

**Discussion:**

Jin Soo (LGE): in the contribution, option 2 and 3 don’t show worse performance, why SP2 prefer option 1?

Yujin: option 2 and 3 lead to more overhead.

John (WILUS): slide 6, additional STF/LTF is assumed to be used?

Yujin: depending on implementation, additional STF/LTF could be included or not.

Jiayin (Huawei): slide 4, what information will use the additional bits is not defined. SIG-A is assumed to use MCS0, any simulation comparison among using different MCSs?

Daewon (Newracom): the assumption is based on using 64 FFT for SIG-A design.

Robert (Intel): How to code SIG-B across channels, in case the SIG-B part and data part of one specific user are in different channel? There’s performance concern.

Wookbong (LGE): prefer to see performance comparison among different SIG-B coding schemes.

Sameer (QC): Prefer to discuss the SIG-A/B efficiency after the content information bits are decided.

**SP Result:**

**31Y/21N/12A**

**SP2**

* **Do you agree to add the following sentence to the TG SFD:**

-3.y.x. HE-SIG-B field in DL HE PPDU is a single encoded information mapped to the entire bandwidth.

**Discussion:**

Peter (Huawei): slide 7, how to expect STA to know how many sub-band it should check?

Yujun: it’s not considered in the contribution and simulation.

**SP Result:**

**27Y/16N/28A**

**SP3**

* **Do you agree to add the following sentence to the TG SFD:**
	+ **3.y.x. HE shall support only two types of HE-SIG, such as HE-SIG-A and HE-SIG-B.**

**Discussion**

Jiayin (Huawei): Not clear about the clue for other type of HE-SIG other than HE-SIG-A and HE-SIG-B.

Sameer (Qualcomm): The SFD should not say something like “not to do something”.

**The presenter decided not to do the SP.**

1. **The chair announced the end of PHY ad hoc session.**

**Tuesday, May 12th, 2015, PM1 TGax Session (13:30-13:30)**

1. **Meeting called to order by Yakun Sun (Marvell) at 13:30.**

The agenda is contained in 11-15/0640r1 which is on the server.

1. **Administrative Items**

Chair reminded the IEEE 802 and IEEE 802.11 Policy and Procedure.

Chair also reminded to do attendance on-line registration.

1. **Set and approve agenda**

Proposed agenda for Monday PM1:

Call Meeting to order

IEEE 802 and 802.11 IPR Policy and procedure.

Presentations follow the order of DCN.

Recess

Chair asked for approval of the proposed agenda. – Agenda approved.

1. **Presentation**
	1. **11-15-0577-00-00ax-pilot-design-for-11ax**

Daewon Lee (Newracom) presented 15/0577r0.

**Discussions:**

Hongyuan (Marvell): The pilot tone performance is regardless of odd or even position. MU PPDU may have different design.

Daewon: agree on the first comment.

Wookbong (LGE): For OFDMA, the pilot design would be different.

Daewon: No matter MU OFDMA transmission or SU OFDM transmission, the pilot design should be the same.

Qinghua (Intel): The proposal is for DL or UL?

Daewon: mainly for DL. UL may have different design.

Qinghua: prefer to see the simulation result to evaluate the performance of the design used in OFDMA transmission.

**SP1:(r1)**

* **Do you agree to adopt the following statement in SFD?**
	+ 3.y.z. Number of pilot tones in a LTF symbol, regardless of LTF symbol durations excluding GI, shall be identical to number of pilot tones in a data OFDM symbol for DL HE PPDU.

**Discussion:**

Hongyuan: The SP seems too early to run. Lots of details and possibility are not discussed yet. Prefer more time to evaluate the performance. With pilot tone more than sampling tone, it can achieve better channel estimation performance.

Bin (Qualcomm): No reasonable justice can be setup based on the proposal itself. It needs more simulation result to evaluate the performance.

Daewon: the design is to follow 11ac’s design as much as possible.

**SP Result:**

**26Y/11N/36A**

* 1. **11-15-0579-00-00ax-preamble-design-and-autodetection**

Hongyuan Zhang (Marvell) presented 15/0579r0.

**Discussions:**

Sigurd (Quantenna): in slide 21, is the simulation follow 11ac rule?

Hongyuan: yes.

Newracom: MCS0 for the R-LSIG is also defined? Using one symbol only for auto-detection seems complicated.

Hongyuan: MCS used for R-LSIG is still TBD.

Kome (InterDigital): how to do rotation to detect the 2nd symbol

Hongyuan: Receiver must decode the 1st symbol before detect the 2nd symbol.

Daewon: Based on history lesson, any consideration about the extensibility of auto-detection design?

Hongyuan: It’s hard to predict the future, but still some schemes can be used for specific case.

**SP1:**

**Do you support having a 4us symbol repeating the L-SIG content, in the 11ax preamble right after the legacy section?**

* + **This symbol shall be modulated by BPSK and rate ½ BCC.**

**Discussion:**

None

**SP Result:**

**49Y/32N/13A**

**SP2:**

* **Do you agree that in an HE PPDU, both the first and second OFDM symbols immediately following the L-SIG shall use BPSK modulation.**
	+ **NOTE–This is to spoof all legacy (11a/n/ac) devices to treat an HE PPDU as a non-HT PPDU.**

**Discussion:**

None

**SP Result:**

**60Y/25N/19A**

* 1. **11-15-0580-00-00ax-11ax-coding-discussion**

Hongyuan Zhang (Marvell) presented 15/0580r0.

**Discussions:**

Sigurd (Quantenna): Low MCS is still used with wide bandwidth, so BCC is used any way.

Hongyuan: In HW design, LDPC can be the only choice in future and the swap-out should start now.

Daewon (Newracom): In current design, 80MHz still use BCC.

Hongyuan: To optimize 80MHz implementation, prefer LDPC over BCC.

Daewon: LDPC needs more decoding time which may cause extra challenge to the design. It needs more check.

Hongyuan: Padding delay could be one issue. But all vendors are working on this direction.

George (ST): During the BCC/LDPC discussion, padding delay is not the only issue. LDPC could be worse when packet and padding are small.

**SP1:**

**Do you support having a 4us symbol repeating the L-SIG content, in the 11ax preamble right after the legacy section?**

* + **This symbol shall be modulated by BPSK and rate ½ BCC.**

**Discussion:**

None

**SP Result:**

**66Y/33N/11A**

* 1. **11-15-0584-00-00ax-considerations-on-ltf-sequence-design**

Sungho Moon (Newracom) presented 15/0584r0.

**Discussions:**

None

**SP1 (r1):**

* **Do you agree the following sentence to be adopted in SFD?**
	+ **3.y.z. A STA shall transmit HE LTF only in the allocated subbands in UL OFDMA.**

**Discussion:**

Hongyuan: the logic behind the proposal is too obvious to write into SFD.

Robert: clarify that the allocated subbands are those subbands allocated for the STA.

**The presenter decided to skip the SP**

**SP2:**

* **Do you agree the following sentences to be adopted in SFD?**
	+ **3.y.z. A HE LTF sequence for 40, 80, and 160MHz shall be made from concatenations of the HE LTF sequence for 20MHz with phase rotations and filling of missing tones.**
		- **Detailed phase rotations and filling of missing tones are TBD.**

**Discussion:**

Ron (BCM): is slide 8 the baseline of the SP?

Sungho: Yes.

Bin: is the concatenation referring to frequency domain concatenations or time domain concatenations?

Sungho: Frequency domain.

LG: is it for DL or UL and OFDMA case?

Sungho: it’s for both DL and UL, and OFDMA.

**SP Result:**

**26Y/16N/36A**

**SP3:**

* **Do you agree the following sentences to be adopted in SFD?**
	+ **3.y.z. A HE 2xLTF shall reuse the 4xLTF sequence defined for the half-sized subband**
		- **TBD for 2xLTF sequences for the smallest subband and the center band**
	+ ***Note: 2xLTF and 4xLTF stand for HE LTFs which have symbol durations of 6.4us and 12.8 µs, respectively, excluding GI***

**Discussion:**

None

**SP Result:**

**26Y/22N/23A**

* 1. **11-15-0572-01-00ax-phy-inefficiency-of-256-fft-per-20mhz**

Heejung Yun (Newracom) presented 11-15/0572r1.

**SP(changed as in r1, but not uploaded when running SP)**

**Do you support the concept**

* + HE shall include mechanisms to enhance the MAC/PHY padding efficiency for OFDM transmission using symbol duration of 12.8 usec.

**Discussion:**

Hongyuan: Need to clarify the comparison target when mention enhancing the efficiency.

Robert: What’s the baseline of the padding efficiency? The SP is not clear.

**SP Result**

21Y/32N/19A

**Wednesday, May 13th, 2015, PM1 TGax Session (13:30-13:30)**

1. **Meeting called to order by Yakun Sun (Marvell) at 13:30.**

The agenda is contained in 11-15/0640r2 which is on the server.

1. **Administrative Items**

Chair reminded the IEEE 802 and IEEE 802.11 Policy and Procedure.

Chair also reminded to do attendance on-line registration.

1. **Set and approve agenda**

Proposed agenda for Monday PM1:

Call Meeting to order

IEEE 802 and 802.11 IPR Policy and procedure.

Presentations follow the order of DCN.

Recess

Chair asked for approval of the proposed agenda. – Agenda approved.

1. **Presentation**
	1. **11-15-0553-01-00ax-enhancing-performance-of-hybrid-arq-with-linear-constellation-precoding**

Muhammad Mehboob Fareed (King Abdullah University of Science and Technology) presented 15/0553r1.

**Discussions:**

MediaTek: is it considered to embed with 802.11 framework?

Muhammad: it’s just report to the group for attention.

MediaTek: HARQ implementation in 802.11 for retransmission still has lots of issues. Why not implement it to the first transmission.

Muhammad: Not for the first transmission.

Zender (I2R): is NACK necessary for the scheme?

Muhammad: Yes, NACK similar signal is expected.

Ray (InterDigital): NACK is not necessary.

Bin (Qualcomm): How to design the metrics?

Muhammad: Using existing recording history to setup the metrics.

Bin: how much gain can get from this scheme? Is there any performance comparison among different coding scheme?

Muhammad: Not yet, but we can do it.

Young Hoon (Newracom): How to combine two transmissions since the MAC headers of the content are different? Maybe can leave the MAC header alone.

**SP:**

**Do you agree to add to the TG SFD:**

 **x.y.z The specification shall include an LCP-ARQ scheme to average the reliability of transmitted bits in *M*-QAM constellations with *M*>4 to improve the overall error rate.**

**Discussion:**

None

**SP Result:**

1Y/(Many)No

* 1. **11-15-0600-00-00ax-phy-non-uniform-constellations-for-1024qam**

Daniel Schneider (Sony Deutschland GmbH) presented 15/0600r0.

**Discussions:**

MediaTek: Any other optimization approach examined?

Zander (I2R): What portion may impact the constellation optimization design?

Daniel: Depending on target SNR and input data rate. Need to balance between reliability and data rate at given SNR.

Jianhan (MediaTek): Is perfect channel estimation used in the simulation?

Daniel: Yes.

Yakun: Is there any other fading channel simulation?

Daniel: Yes, but they got similar result as that using AWGN channel.

* 1. **11-15-0602-02-00ax-he-ltf-squence-for-ul-mu-mimo**

Qinghua Li (Intel) presented 15/0602r2.

**Discussions:**

Zendar (I2R): why not to design sequence from non-P-Metric?

Qinghua: to be consistent with 11n and 11ac. But open to other sequence design.

Zendar (I2R): any PAPR performance comparison between proposal LTF and original LTF?

Qinghua: the comparison is between LTF and data portion, not to the original legacy LTF. PAPR is a secondary judgment criteria.

Newracom: any simulation of operation without cyclic operation which is used to avoid timing offset?

Qinghua: no result without cyclic operation.

Newracom: any comparison with pre-coding per stream design?

Qinghua: the result is not presented but can share offline.

Newracom: there should be 8 LTF sequence in this scheme, please clarify the ratio between PAPR of the LTF and PAPR of data portion.

Intel: Agree that data PAPR is randomly distributed. The PAPR of data portion is the mean of CDF. That’s calculated on each sequence per user.

Hongyuan (Marvell): The simulation clearly shows the PAPR of LTF is less than PAPR of data portion. Beamforming may cause challenge to power control which is more important to UL MU-MIMO therefore it’s not suggested to use beamforming in UL MU-MIMO.

Minho (Newracom): slide 11, does it imply same design for UL and DL?

Qinghua: we prefer same design for UL and DL, but open to different DL/UL scheme.

Ray (InterDigital): Is per user UL power control considered? Any simulation result per that?

Qinghua: Per user UL power control is assumed in the simulation but there’s no simulation result for power control impact. Per user average power is the same in the simulation.

**SP (changed as in r3):**

* Do you agree to add to the TGax SFD :
* The HE-LTF sequences for UL MU-MIMO shall be generated as follows:
	+ For each stream, a common sequence shall be masked repeatedly in a piece-wise manner by a distinct row of the 8x8 P matrix. When the length of the LTF sequence is not divisible by 8, the last M elements of the LTF sequence (M being the remainder after the division of LTF length by 8) shall be masked by the first M elements of the P matrix row.

**Discussion:**

None

**SP Result:**

**57Y/21N/14A**

* 1. **11-15-0621-02-00ax-design-principles-for-he-preamble**

John Son (WILUS Institue) presented 15/0621r2.

**Discussions:**

None

**SP1:**

* Do you agree to add the following text into 11ax SFD ?

 3.2.z HE-SIG-B shall use a DFT period of 3.2us and subcarrier spacing of 312.5kHz.

**Discussion:**

None

**SP Result:**

**8Y/0N/(Many)A**

**SP2:**

* + Do you agree to add the following text into 11ax SFD ?

3.2.z For HE SU PPDU, HE-SIG-A field shall include common control information and user specific information.

**Discussion:**

Robert: Is it meaning separate design for SU?

John: Yes.

Robert: Prefer same design for SU and MU.

**SP Result:**

**5Y/12N/38A**

**SP3:**

* For transmission of HE-SIG-B field per 20MHz, which option do you prefer ?
	+ [C-1] HE-SIG-B duplicate per 20MHz
	+ [C-2] HE-SIG-B non-duplicated per 20MHz, individual information per 20MHz
	+ [C-3] HE-SIG-B encoding in the entire PPDU bandwidth
	+ [C-4] HE-SIG-B encoding in the entire PPDU bandwidth, prepended with dedicated STF/LTF in the entire PPDU bandwidth

**Discussion:**

People can vote multiple options.

**SP Result:**

**C-1: 0Y**

**C-2: 4Y**

**C-3: 5Y**

**C-4: 2Y**