IEEE P802.11
Wireless LANs

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| LB 205 Comment Resolution for Section 24.3.8 and other Clause 24 sections |
| Date: 2014-11-03 |
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Abstract

This submission proposes resolutions for comments in Clause 24 of TGah Draft 3.0 with the following CIDs:

* Section 24.3.8
	+ 5145, 5149, 5150, 5154, 5158, 5499, 5500
* Section 24.1.1
	+ 5136, 5137, 5353, 5421
* Section 24.3.10
	+ 5503, 5504, 5505, 5506,
* Section 24.3.2
	+ 5143, 5422, 5493, 5494, 5495, 5496, 5497, 5498

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

***Editing instructions formatted like this are intended to be copied into the TGah Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGah Editor: Editing instructions preceded by “TGah Editor” are instructions to the TGah editor to modify existing material in the TGah draft. As a result of adopting the changes, the TGah editor will execute the instructions rather than copy them to the TGah Draft.***

## Comment Resolutions for 24.3.8

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 5145 | 443.31 | 24.3.8.3.3 | The first "S1G\_SHORT" shouldn't it be S1G\_1M? | As in comment | Accept |
| 5149 | 426.12 | 24.3.8.2.1.4 | On Figure 24-9, the left constellation plot is missing the label "SIG-1" | Add label "SIG-1" | Accept |
| 5150 | 435.44 | 24.3.8.2.2.1.4 | On Figure 24-15, the left constellation plot is missing the label "SIG-A1" | Add label "S1G-A1" | Accept |
| 5154 | 437.47 | 24.3.8.2.2.2.4 | In 24.3.8.2.2.2.4 SIG-B definition, it does not mention how the 8-bit CRC is calculated | Add text to indicate that the 8-bit CRC is calculated the same way as the VHT-SIG-A's 8-bit CRC (i.e. same generator polynomial) | Revise.As per comment, please see editing instructions in 11-14-1465r0 |
| 5158 | 446.21 | 24.3.8.3.4 | Definition for p\_n in Equation 24-41 says to insert pilots based on values defined in 22.3.10.10, but 1MHz pilots are newly defined for 11ah. Any references to 1MHz pilot values should reference the new values for 1MHz defined in 24.3.9.10 | Correct the definition for p\_n to get values from section 24.3.9.10 | ReviseAs per comment, please see editing instructions in 11-14-1465r0 |
| 5499 | 436.6 | 24.3.8.2 | add D-STF definition | add D-STF definition | Reject.The section for D-STF definition for S1G\_LONG preambles is already given in 24.3.8.2.2.2.2. |
| 5500 | 436.47 | 24.3.8.2 | add D-LTF definition | add D-LTF definition | RejectThe section for D-LTF definition for S1G\_LONG is already given in 24.3.8.2.2.2.3. |

**TGah Editor: Please modify the following editorial fix to Table 24-10 in section 24.3.8.2.1.3**

The pilot tones of each LTF symbol are multiplied by the first column of the *PHTLTF* matrix. The multiplication of the pilot tones in the LTF symbols by the first column of the *PHTLTF* matrix instead of the whole *PHTLTF* matrix is to allow receivers to track phase and frequency offset during MIMO channel estimation using the LTF. The number of LTF symbols, *NLTF*, is a function of the total number of space-time streams *NSTS* as shown in Table 24-10 (Number of LTFs required for different numbers of space time streams). As a result, the LTF field consists of one, two, or four symbols that are necessary for the demodulation of the Data field in the PPDU or for channel estimation in an NDP.

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| * Number of LTFs required for different numbers of space time streams
 |
| *NSTS* |  |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 4 |

**TGah Editor: Please modify the following text to the section below to resolve CID 5154 for section 24.3.8.2.2.2.4**

* SIG-B definition

If the SU/MU indication subfield in SIG-A field is set to 0 (SU), then SIG-B field is one symbol that is identical to the first D-LTF field (D-LTF1). In this case, the time domain representation of the SIG-B field at transmit chain  shall be as specified in Equation (24-27) with *n=0*.

If the SU/MU indication subfield in SIG-A field is set to 1 (MU), then SIG-B field is one symbol and contains 26 bits in a 2 MHz PPDU, 27 bits in a 4 MHz PPDU and 29 bits in 8 MHz and 16 MHz PPDUs for each user. The fields in the SIG-B field are listed in Table 24-16 (Fields in the SIG-B field for MU PPDU).

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| * Fields in the SIG-B field for MU PPDU
 |
| Field | Bit Allocation (number of bits) | Description |
| 2 MHz | 4 MHz | 8 MHz | 16 MHz |
| MCS | B0-B3 (4) | B0-B3 (4) | B0-B3 (4) | B0-B3 (4) | Per-user MCS in MU-MIMO |
| Reserved | B4-B11 (8) | B4-B12 (9) | B4-B14 (11) | B4-B14 (11) | All 1s |
| CRC | B12-B19 (8) | B13-B20 (8) | B15-B22 (8) | B15-B22 (8) |   |
| Tail | B20-B25 (6) | B21-B26 (6) | B23-B28 (6) | B23-B28 (6) | All 0s |
| Total # bits | 26 | 27 | 29 | 29 |   |

The 8-bit CRC is calculated according to the procedure described in 24.2.8.2.2.2.5 CRC calculation for S1G SIG-B field.

**TGah Editor: Please add the following section of text to the section below 24.3.8.2.2.2.4 to resolve CID 5154**

CRC calculation for S1G SIG-B field

The CRC protects the MCS and Reserved field bits of the SIG-B field. The value of the CRC field shall be the ones complement of

Where

 is the MCS and Reserved field appended and represented as a polynomial

Where

 *N* is 12, 13, 15, and 15 for 2 MHz, 4 MHz, 8MHz, and 16 MHz SIG-B fields, respectively

 is the *i-*th bit of the corresponding SIG-B field

 are the initialization values that are added to the first 8 bits of the SIG-B field is the CRC generating polynomial

The CRC field is transmitted with first.

Figure 20-8 in Section 20.3.9.4.4 CRC calculation for HT-SIG shows the operation of the CRC using the same generator polynomial. For SIG-B CRC operation specifically, the bits will be input serially from to

**TGah Editor: Please modify the following text to the section below to resolve CID 5158 for section 24.3.8.3.4**

The SIG field of S1G\_1M is composed of six OFDM symbols, SIG-1 ~ SIG-6, each containing 6 data bits, as shown in Table 24-18 (Fields in the SIG field of S1G\_1M PPDU). SIG-1 is transmitted first and SIG-6 is the last. The SIG field symbols shall be BCC encoded at rate, R = 1/2, and repeated two times for the encoded bits within each OFDM symbol, interleaved, mapped to a BPSK constellation, and have pilots inserted, following the steps for MCS10 transmission flow described in Clause 24.3.9 (Data field). The stream of 144 complex numbers generated by these steps (before pilot insertion) is divided into six groups of 24 complex numbers , , where  respectively. All the 144 complex numbers are BPSK modulated. The first 24 complex numbers form the first symbol of SIG field; and the second 24 complex numbers form the second symbol of SIG field, and so forth.

The time domain waveform for the SIG field in an S1G\_1M PPDU at transmit chain  shall be as specified in Equation (24-41).

* where

 is defined in 18.3.5.10 (OFDM modulation), and  for S1G\_1M is defined in 24.3.9.10 Pilot Subcarriers

 represents the cyclic shift for space-time stream *m* with a value given in Table 24-17 (Cyclic shift values of S1G\_1M PPDU)

 is defined in Table 24-4 (Timing-related constants)

 is defined in Table 24-4 (Timing-related constants)

 is defined in Table 24-6 (Frequently used parameters)

 is defined in Equation (20-27) in 20.3.9.4.6 (HT-LTF definition)

 has the value given in Tone scaling factor and guard interval duration values for PHY fieldsTable 24-7 (Tone scaling factor and guard interval duration values for PHY fields).

 is defined in Table 24.3.7 (Mathematical description of signals)

* 

where

 is defined in Equation (24-53)

* 

## Comment Resolutions for 24.1.1

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 5136 | 371.37 | 24.1.1 | Similar to the previous comment, it is only necessary to specify one mandatory channel width to maintain universal interoperability. Since the 1MHz channel is an oddball not clocked off all of the other bandwidths I suggest to remove it as a mandatory requirement for non-AP STAs. | Change to "2 MHz channel width" | Reject.Entire PHY design based on 1 and >=2MHz modes being interoperable. System would not function correctly and coexistence would not work if devices operating in >=2MHz do not support 1MHz mode. 1MHz frame structure and tone plans are completely separate of >=2MHz modes. |
| 5137 | 371.52 | 24.1.1 | Similar to the previous comment, it is only necessary to specify one mandatory channel width to maintain universal interoperability. Since the 1MHz channel is an oddball not clocked off all of the other bandwidths I suggest to remove it as a mandatory requirement for AP STAs. | Change to "2 MHz channel width" | Reject.Entire PHY design based on 1 and >=2MHz modes being interoperable. System would not function correctly and coexistence would not work if devices operating in >=2MHz do not support 1MHz mode. 1MHz frame structure and tone plans are completely separate of >=2MHz modes.  |
| 5353 | 371.1 | 24 | The instruction to the editor to insert this clause is totally missing. Add it immediately before clause 24. | As in comment. | Accept |
| 5421 | 371.26 | 24.1.1 | Change "clause 22" to "Clause 22".There are multiple similar typos. So please search throughout the whole Clause 24, and make changes wherever the initial of "Clause" or "Subclause" should be in capital case. | As in the comment. | Accept |

## Comment Resolutions for 24.3.10

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 5503 | 460.46 | 24.3.10.2 | The referring to clause 22.3.11.2 for the specification of beamforming feedback in S1G by simply stating it is the same as that used in VHT with all the VHTs replaced with S1Gs is very poor way to specify the requirements for S1G, in my view. The text from 22.3.11.2 with VHT replaced with S1G should be provided here, with any additional correction/additions/deletions required by S1G. | Provide appropriate text which defines the behavior of the Beamforming feedback matrix V in S1G. | Reject.S1G inherits many aspects of VHT and many other sections of S1G text use the same approach to avoid redundancy and concurrency issues when there are no system differences other than simple VHT🡪S1G terminology naming. |
| 5504 | 460.49 | 24.3.10 | This is not really a Note. A note is explanatory text that does not specify behavior. This note explains that compressed beamforming from clause 20.3.12.3.6 is used in S1G and hence is normative. Please correct the text so this is clear. | Correct the text so that this is a normative statement. | Revise.Agree in principle that the text should be written as a normative statement, not as a note.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5505 | 460.52 | 24.3.10 | The wording "are assumed" is not very clear. It should be clear in the specification that when the angle is not included in the feedback frame, then the angle is given below. There should be no assumption, it is the default if not provided in the feedback frame. Clarify text so that it is clear and there are no assumptions. | Change the sentence to read: "If the ¤ê angle is not included in the feedback frame then the ¤ê angle for a single column V matrix having elements with equal magnitude are defined as follows:" | Revise.Agree in principle that the phrasing “are assumed” is not clear, and should be defined normatively.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5506 | 460.25 | 24.3.10 | The feedback/training overhead of DL MU-MIMO is really huge, especially with the 10x down clocking. Is it practical to ever use this procedure. If not either improve the procedure to lower the overhead or remove the feature. | Evaluate if this clause is useful and correct or delete as appropriate. | Reject.No compelling reason to remove MU-MIMO feature in S1G for devices that choose to implement sounding procedure, since S1G devices can also be higher data rate non-sensor devices operating in higher bandwidth modes (e.g. 8, 16MHz).Additionally, beamforming feedback formats and sounding protocol are shared with SU-MIMO.Technique for reducing overhead and simplifying compressed feedback for Nx1 cases is described in 8.4.1.48.1, through use of Codebook Information Field parameter. |

**TGah Editor: Please modify the following text to the section below to resolve CIDs 5504, 5505 for section 24.3.10**

* SU-MIMO and DL-MU-MIMO Beamforming
* General

S1G SU-MIMO and DL-MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. The general description of SU-MIMO and DL-MU-MIMO beamforming is identical to its VHT counterparts as described in 22.3.11.1 (General) with VHT replaced by S1G.

In S1G operation, SU-MIMO allows beamforming up to 4 space-time streams, and DL-MU-MIMO beamforming allows up to 4 total number of space-time streams for all users each with up to 3 space-time streams.

S1G beamforming exchange is defined only for 2 MHz, 4 MHz, 8 MHz and 16 MHz.

* Beamforming Feedback Matrix V

The description of beamforming feedback matrix V in S1G band is identical to its VHT counterpart as described in 22.3.11.2 (Beamforming feedback matrix V) with VHT replaced by S1G.

Compressed beamforming feedback using 20.3.12.3.6 (Compressed beamforming feedback matrix) is the only beamforming feedback format defined for S1G operation. In certain cases when the ψ angle is not included in the feedback frame(e.g. for SU feedback with ), the ψ angles not included in the feedback report are given the values below, which correspond to a single column V matrix having elements with equal magnitude:

 

## Comment Resolutions for 24.3.2

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| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 5143 | 392.44 | 24.3.2 | The references to the figures in this subclause are broken. | Instruct the editor to fix the references of the figures in this subclause. | Revise.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5422 | 392.48 | 24.3.2 | The text is not complete.Same changes need to be made for P393Ln3 and P393Ln30. | Need to add the numbers for the referred Figure, and also remove the redundant text. | Revise.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5493 | 392.49 | 24.3.2 | These sentences are very unclear due to misplaced parentheses, redundant references, and missing figure indices. | Please make this readable. | Revise.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5494 | 393.4 | 24.3.2 | These sentences are very unclear due to misplaced parentheses, redundant references, and missing figure indices. | Please make this readable. | Revise.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5495 | 393.31 | 24.3.2 | These sentences are very unclear due to misplaced parentheses, redundant references, and missing figure indices. | Please make this readable. | Revise.Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID. |
| 5496 | 393.15 | 24.3.2 | Figure 24-2, the format has two portions a Omni Portion and a Data Portion, I don't understand this. Isn't the Data Portion really the Directional Portion. Why isn't it labeled as the Directional Portion? The phrase "data portion" is currently used in the .11 specification by Mesh, HT, and beamforming, but my understanding is that the phrase refers to only the data portion of the frame, not the data portion and additional fields.. | Correct the references throughout the text to the Data Portion and replacing it with the Directional Portion. | Reject.For S1G, the naming convention was decided as to not place any implied requirements for beamforming on the “Data Portion”, hence that name was chosen over “Directional Portion”. S1G is not required to interoperate with any previous .11 specifications and hence should be able to choose its own independent nomenclature. |
| 5497 | 394.5 | 24.3.2 | Should the D-STF/D-LTF be directional STF/LTF instead of STF/LTF for data? The term 'STF/LTF for data' sounds does not describe the training field well, as all training fields are to allow for the reception/demodulation of the frame and the data in the frame. | Change "Short Training Field for data" to be "Directional Short Training Field".Correct it if it should be directional STF/LTF, not data STF/LTF. | Revise.Will change to specify that it corresponds to the Data Portion. Please see editing instructions in document 11-14-1465r0 for detailed resolution of CID.  |
| 5498 | 395.5 | 24.3.2 | Suggest to add figures (with necessary changes such as changing 20 MHz to the appropriate bandwidth) in clause 22 here so that this clause is clear, complete, and independent. | Add figures (with necessary changes such as changing 20 MHz to the appropriate bandwidth) in clause 22 here for self completeness | Reject.This convention of borrowing figures from Clause 22 while highlighting minor terminology deltas is used throughout Clause 24 and is appropriate given the many inherited system/algorithmic aspects.  |

**TGah Editor: Please modify the following text to the section below to resolve CIDs 5504, 5505 for section 24.3.2**

* S1G PPDU format

Three formats are defined for the S1G PHY: S1G\_SHORT, S1G\_LONG, and S1G\_1M.

The general structure for S1G\_SHORT is shown in Figure 24-1 (S1G\_SHORT format). This format is used for SU transmission using 2 MHz, 4 MHz, 8 MHz and 16 MHz PPDUs.



* S1G\_SHORT format

The general structure for S1G\_LONG is shown in Figure 24-2 (S1G\_LONG format) This frame format can be used for MU and SU beamformed transmissions using 2 MHz, 4 MHz, 8 MHz and 16 MHz PPDUs.



* S1G\_LONG format(#3069)

The general structure for S1G\_1M is shown in Figure 24-3 (S1G\_1M format). . This frame format is used for S1G\_1M PPDU SU transmission.



* S1G\_1M format

The fields of the S1G PPDU formats are summarized in Table 24-3 (Fields of the S1G PPDU).

|  |
| --- |
| * Fields of the S1G PPDU
 |
| Field | Description |
| STF | Short Training field |
| LTF | Long Training field |
| SIG | SIGNAL field |
| SIG-A | Signal A field  |
| D-STF | Short Training field for the Data Portion  |
| D-LTF | Long Training field for the Data Portion  |
| SIG-B | Signal B field |
| Data | The Data field carries the PSDU(s) |
| GI | Guard interval |
| GI2 | Double guard interval |
| LTS | Long training symbol |

The SIG-A, D-STF, D-LTF, and SIG-B fields exist only in S1G\_LONG. In an S1G NDP, the Data field is not present (see 24.3.11 (S1G preamble format for NDPs). The number of symbols in the LTF field of S1G\_1M and S1G\_SHORT, or in the D-LTF field of S1G\_LONG, *NVHTLTF*, can be either 1, 2, or 4 and is determined by the total number of space-time streams across all users being transmitted in the S1G PPDU (see Table 24-10 (Number of LTFs required for different numbers of space time streams)).