IEEE P802.11
Wireless LANs

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| Proposed Resolution for CID 1265 and 1266 |
| Date: 2018-08-02 |
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Abstract

This document provides a proposed resolution for CID 1265 and 1266 from 802.11 letter ballot 232.

r1 – As discussed in the TGmd Adhoc (31 July – 2 August 2018) the following modifications were made:

1. In 4.3.13 the reference (at the end) to 11.3 was removed.
2. It was decided to retain the “mandatory” or “optional” language, the proposed changes removing “mandatory” or “optional” were removed

This contribution provides a resolution for 802.11 letter ballot 232 CID 1265 and 1266 [1], summarized below:

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| **Clause Number (C)** | **Page(C)** | **Line (C)** | **Type of Comment** | **Part of No Vote** | **Comment** | **Proposed Change** |
| 4.3.14.1 | 215 | 48 | G | Y | Section 4 should not contain statements as to which features are mandatory and optional. Both the 802.11 style document (11-09/1034) and the IEEE-SA style guide state that informative clause should not include normative statements. Characterizing a feature as mandatory or optional is a normative statement. Reference: 11-09/1034 - "Clause 4 provides a general description of the wireless system. It should be written in declarative, not normative, language." | remove the listing of mandatory and optional features and replace it with a description of the features of an S1G STA. It would also be useful to add the purpose or advantage of the feature or set of features. |
| 4.3.15. | 217 | 12 | G | Y | Section 4 should not contain statements as to which features are mandatory and optional. Both the 802.11 style document (11-09/1034) and the IEEE-SA style guide state that informative clause should not include normative statements. Characterizing a feature as mandatory or optional is a normative statement. Reference: 11-09/1034 - "Clause 4 provides a general description of the wireless system. It should be written in declarative, not normative, language." | remove the listing of mandatory and optional features and replace it with a description of the features of an VHT STA. It would also be useful to add the purpose or advantage of the feature or set of features. |

**Proposed resolution: CID 1266: Revise**

1. Provide additional text to describe the purpose and/or advantage of the features.

**In addition:**
2. Clean up the Section 4 phrasing to be consistent for the 4.3.13 HT STA, 4.314 S1G STA, 4.3.15 VHT STA, and 4.3.16 TVWS STA.
3. Clean up the some of the grammar and phrasing.

A detailed redline proposal for all additions and modification follows. The page and line number in Draft P802.11REVmd D1.0 [2] (**page.line**) proceeds each of the changed sections, followed by the redlined text.

Add a new resolution – which will be a revise.

***215.1***

*Modify section 4.3.13 as follows:*

* High-throughput (HT) STA

An HT STA provides PHY and MAC features that can support a throughput of 100 Mb/s and greater, as measured at the MAC data service access point (SAP). An HT STA supports HT features as identified in Clause 10 (MAC sublayer functional description(#107)) and Clause 19 (High-throughput (HT) PHY specification). An HT STA operating in the 5 GHz band supports transmission and reception of frames that are compliant with mandatory PHY specifications as defined in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification). An HT STA operating in the 2.4 GHz band supports transmission and reception of frames that are compliant with mandatory PHY specifications as defined in Clause 16 (High rate direct sequence spread spectrum (HR/DSSS) PHY -specification) and Clause 18 (Extended Rate PHY (ERP) specification). An HT STA is also a QoS STA. The HT features are available to HT STAs associated with an HT AP. A subset of the HT features is available for use between two HT STAs that are members of the same IBSS. Similarly, a subset of the HT features is available for use between two HT STAs that have established mesh peering.

An HT STA has PHY features consisting of the modulation and coding scheme (MCS) set described in 19.3.5 (Modulation and coding scheme (MCS)) and physical layer (PHY) protocol data unit (PPDU) formats described in 19.1.4 (PPDU formats). Some PHY features that distinguish an HT STA from a non-HT STA are: *multiple input, multiple output (MIMO)* operation; spatial multiplexing (SM); spatial mapping (including transmit beamforming); space-time block coding (STBC); low-density parity check (LDPC) encoding; and antenna selection (ASEL). The allowed PPDU formats are non-HT format, HT-mixed format, and HT-greenfield format (see 19.1.4 (PPDU formats)). The PPDUs can be transmitted with 20 MHz bandwidth and might be transmitted with 40 MHz bandwidth.

An HT STA has MAC features that include frame aggregation, some block ack features, power save multi-poll (PSMP) operation, reverse direction (RD), and protection mechanisms supporting coexistence with non-HT STAs.

**215.35**

*Modify section 4.3.14 as follows:*

* Sub 1 GHz (S1G) STA(11ah)
* Overview

An S1G STA operates in frequency bands below 1 GHz excluding the TV White Space bands.

An S1G STA supports S1G features identified in Clause 9 (Frame formats), Clause 10 (MAC sublayer functional description(#107)), Clause 11 (MLME), Clause 12 (Security), and Clause 23 (Sub 1 GHz (S1G) PHY specification(11ah)).

The main PHY features in an S1G STA are the following:

* Mandatory support for 1 MHz and 2 MHz channel width
* Mandatory support for of S1G\_1M, S1G\_SHORT PPDU
* Mandatory support for S1G\_LONG PPDU if ≥ 4 MHz channel width is supported
* Mandatory support for detection and decode of SIG-A field of the S1G\_LONG preamble
* Mandatory support for single spatial stream S1G-MCS 0 to S1G-MCS 2 and S1G-MCS 10 (for 1 MHz PPDU only)
* Mandatory support for single spatial stream S1G-MCS 3 to S1G-MCS 7 for an S1G AP
* Mandatory support for binary convolutional coding
* Mandatory support for normal guard interval
1. Mandatory support for fixed pilots
* Optional support for 2, 3 and 4 spatial streams (transmit and receive)
* Optional support for S1G\_LONG PPDU if only 2 MHz channel width is supported
* Optional support for beamforming sounding (by sending an S1G NDP frame)
* Optional support for compressed beamforming feedback
* Optional support for STBC, LDPC (transmit and receive)
* Optional support for S1G MU PPDUs (transmit and receive)
* Optional support for 4 MHz, 8 MHz, or 16 MHz channel width
* Optional support for S1G-MCSs 8 and 9 (transmit and receive)
* Optional support for short guard interval
* Optional support for traveling pilots

The main MAC features supported for S1G STA are the following:

* Mandatory support for NDP Ack, NDP BlockAck, and NDP CTS frames; mandatory support for the reception of NDP Probe Request frame for S1G AP; optional support for other NDP CMAC frames
* Mandatory support for the reception of PV1 MPDUs but optional support for the transmission of PV1 MPDUs
* Mandatory support for the second virtual carrier sensing - RID
* Mandatory support for the hierarchical structure of TIM element by an S1G AP
1. Mandatory support for extended BSS max idle periods and extended listen intervals with USF
* Optional support for RAW
* Optional support for (Ed)relay
* Optional support for grouping of non-AP STAs and group AID
* Optional support for TWT
* Optional support for BDT
* Optional support for sectorization
* Optional support for non-TIM STA operation
* Optional support for asymmetric block ack operation, fragment block ack operation
* Optional support for page slicing, dynamic AID assignment for an S1G AP
* Optional support for authentication control
* Optional support for SST
* Optional support for rescheduling STA’s doze/awake cycle
* Optional support for either a sensor STA or a non-sensor STA
* Optional support for an EL STA

NOTE—Some NDP CMAC frames are mandatory under certain conditions as indicated in B.4.4.2 (MAC frames).

Most S1G features help either reduce a STA’s energy consumption or increase the usable range between an AP and a non-AP STA.

An S1G STA is a non-mesh STA, and a QoS STA that does not support HCCA.

**217.1**

*Modify section 4.3.15 as follows:*

* Very high throughput (VHT) STA

(#286)A VHT STA provides PHY and MAC features that can support a throughput of 1Gb/s and greater, as measured at the MAC data SAP. This additional throughput capability is based on the introduction of larger frequency bandwidth channels (up to 4 times larger than a HT STA), higher peak data rate MSCs (up to 33% faster than an HT STA), and the introduction of downlink multiple user multiple input multiple output (DL-MU-MIMO) for space division multiple access. A VHT STA supports VHT features as identified in Clause 10 and Clause 21. A VHT STA is also an HT STA and therefore supports HT features as identified in Clause 10 (MAC sublayer functional description), Clause 19 (High-throughput (HT) PHY specification), transmission and reception of frames that are compliant with mandatory PHY specifications as defined in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) and is a QoS STA, but does not operate in the 2.4 GHz band. The VHT features are available to VHT STAs associated with a VHT AP. A subset of the VHT features is available for use between two VHT STAs that are members of the same IBSS. A subset of the VHT features is available for use between two VHT STAs that have established mesh peering. A subset of the VHT features is available for use between two VHT STAs that have established a TDLS link.

The main PHY features in a VHT STA that are not present in an HT STA are the following:

* Mandatory support for 40 MHz and 80 MHz channel widths
1. Mandatory support for VHT single-user (SU) PPDUs
* Optional support for 160 MHz and 80+80 MHz channel widths
* Optional support for VHT sounding protocol to support beamforming
* Optional support for VHT multi-user (MU) PPDUs
* Optional support for VHT-MCSs 8 and 9

The main MAC features in a VHT STA that are not present in an HT STA are the following:

* Mandatory support for the A-MPDU padding of a VHT PPDU
* Mandatory support for S-MPDU(11ah)
1. Mandatory support for responding to a bandwidth indication (provided by the RXVECTOR parameters CH\_BANDWIDTH\_IN\_NON\_HT and DYN\_BANDWIDTH\_IN\_NON\_HT) in a non-HT and non-HT duplicate RTS frame
* Optional support for MPDUs of up to 11 454 octets
* Optional support for A-MPDU pre-end-of-frame (pre-EOF) padding (see 9.7.1 (A-MPDU format)) of up to 1 048 575 octets
* Optional support for VHT link adaptation

The support for VHT transmit beamforming sounding and VHT MU PPDUs in a VHT AP and more than one VHT STA within a VHT BSS enables the optional use of DL-MU-MIMO. With DL-MU-MIMO the AP can create up to four A-MPDUs, each carrying MPDUs destined for an associated MU beamformee capable STA. The AP uses group identifiers (GIDs) to signal potential recipient STAs. The AP transmits the A-MPDUs simultaneously in separate space-time streams such that each recipient STA is able to demodulate the space-time streams carrying its A-MPDU. The simultaneous transmission of A-MPDUs in a single VHT MU PPDU provides a means to increase aggregate throughput over that achieved by sending the A-MPDUs in separate SU PPDUs.

The use of certain HT features, such as reduced interframe space (RIFS), is not permitted for VHT STAs.

**218.59**

*Modify section 4.3.16 as follows:*

* Television very high throughput (TVHT) STA

A TVHT STA operates in television white spaces (TVWS) bands.

A TVHT STA supports all mandatory features of a VHT STA as mandatory features except for HT-mixed format PPDUs and 20 MHz, 40 MHz, and 80 MHz channel widths. A TVHT STA supports all optional features of a VHT STA as optional features except for HT-greenfield format PPDUs, 160 MHz or 80+80 MHz channel widths, and more than 4 spatial streams. A TVHT STA also supports Short GI..

The features and behaviors of VHT STAs specified in Clause 6 (Layer management), Clause 8 (PHY service specification), Clause 9 (Frame formats), Clause 10 (MAC sublayer functional description(#107)), Clause 11 (MLME), Clause 14 (MLME mesh procedures), and Annex G apply to TVHT STAs as well, unless stated otherwise.

For Clause 6 (Layer management), Clause 8 (PHY service specification), Clause 9 (Frame formats), Clause 10 (MAC sublayer functional description(#107)), Clause 11 (MLME), and Clause 14 (MLME mesh procedures), the following replacements are applied for TVHT STAs:

* “TVHT\_W/TVHT\_2W” replaces “20/40 MHz”.
* “TVHT\_W/TVHT\_2W/TVHT\_4W” replaces “20/40/80/160 MHz”.
* “TVHT\_W”, “TVHT\_2W”, and “TVHT\_4W” replace “20 MHz”, “40 MHz”, and “80 MHz,” respectively.
* “TVHT\_W” replaces “CBW20”.
* “TVHT\_2W” replaces “CBW40”.
* “TVHT\_4W” replaces “CBW80” and “CBW80+80”.
* “secondaryTVHT\_2W” replaces “secondary40”.
* “TVHT STA” replaces “VHT STA”.
* “TVHT AP” replaces “VHT AP”.
* “TVHT BSS” replaces “VHT BSS”.
* “TVHT-MCS” replaces “VHT-MCS”.
* “TVHT Operation” replaces “VHT Operation”.
* “dot11TVHTOptionImplemented” replaces “dot11VHTOptionImplemented”.
* “dot11TVHTControlFieldOptionImplemented” replaces both “dot11VHTControlFieldOption-Implemented” and “dot11HTControlFieldSupported”.
* “dot11TVHTShortGIOptionIn4WActivated” replaces “dot11VHTShortGIOptionIn80Activated”.
* “dot11TVHTSUBeamformerOptionImplemented” replaces “dot11VHTSUBeamformerOption-Implemented”.
* “dot11TVHTSUBeamformeeOptionImplemented” replaces “dot11VHTSUBeamformeeOption-Implemented”.
* “dot11TVHTMUBeamformerOptionImplemented” replaces “dot11VHTMUBeamformerOption-Implemented”.
* “dot11TVHTMUBeamformeeOptionImplemented” replaces “dot11VHTMUBeamformeeOption-Implemented”.
* “dot11TVHTTXOPPowerSaveOptionImplemented” replaces “dot11VHTTXOPPowerSaveOptionImplemented”.
* “dot11TVHTOBSSScanCount” replaces “dot11VHTOBSSScanCount”.
* “dot11TVHTExtendedNSSBWCapable” replaces “dot11VHTExtendedNSSBWCapable”.
* Reference to 9.4.1.49 (TVHT Compressed Beamforming Report field) replaces reference to 9.4.1.48 (VHT Compressed Beamforming Report field).
* Reference to 9.4.1.51 (TVHT MU Exclusive Beamforming Report field) replaces reference to 9.4.1.50 (MU Exclusive Beamforming Report field).
* Reference to 9.4.2.170 (TVHT Operation element) replaces reference to 9.4.2.157 (VHT Operation element).
* Reference to 11.41 (Basic TVHT BSS functionality) replaces reference to 11.38.1 (Basic VHT BSS functionality)
* Reference to Clause 22 (Television very high throughput (TVHT) PHY specification) and its subclauses replace reference to Clause 21 (Very high throughput (VHT) PHY specification) and its subclauses.

For Annex G, the following replacements are applied for TVHT STAs:

* “TVHT” replaces “VHT”.
* “tvht” replaces “vht”.

The main PHY features in a TVHT STA that are not present in a VHT STA are the following:

* Mandatory support for TVHT\_W channel width.
* Optional support for TVHT\_W+W channel width.
* Optional support for TVHT\_2W channel width.
* Optional support for TVHT\_4W channel width.
* Optional support for TVHT\_2W+2W channel width.

These TVHT features are available to TVHT STAs associated with a TVHT AP. A subset of the TVHT features is available for use between two TVHT STAs that are members of the same IBSS.

**References:**

1. **11-18-0611-04-000m-revmd-wg-ballot-comments**
2. **IEEE P802.11-REVmd™/D1.0, February 2018.** (Revision of IEEE Std 802.11TM-2016 as amended by IEEE Std 802.11aiTM-2016, and IEEE Std 802.11ahTM-2016)