IEEE P802.11  
Wireless LANs

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| Proposed Resolution for CID 1265 and 1266 | | | | |
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Abstract

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

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:**

1. Remove the “mandatory” and “optional” statements from Section 4, replacing them with statements that the features are “supported” or “may be supported”.
2. Provide additional text to describe the purpose and/or advantage of the features.   
     
   **In addition:**
3. 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.
4. 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.

***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(see 11.3 (STA authentication and association) for details).

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

A 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:

* Support of 1 MHz and 2 MHz channel width
* Support of S1G\_1M, S1G\_SHORT PPDU
* Support of S1G\_LONG PPDU if ≥ 4 MHz channel width is supported
* Support of detection and decode of SIG-A field of the S1G\_LONG preamble
* Support of single spatial stream S1G-MCS 0 to S1G-MCS 2 and S1G-MCS 10 (for 1 MHz PPDU only)
* Support of single spatial stream S1G-MCS 3 to S1G-MCS 7 for an S1G AP
* Support of binary convolutional coding
* Support of normal guard interval
* Support of fixed pilots

An S1G STA may also:

* Support 2, 3 and 4 spatial streams (transmit and receive)
* Support S1G\_LONG PPDU if only 2 MHz channel width is supported
* Support beamforming sounding (by sending an S1G NDP frame)
* Support compressed beamforming feedback
* Support STBC, LDPC (transmit and receive)
* Support S1G MU PPDUs (transmit and receive)
* Support 4 MHz, 8 MHz, or 16 MHz channel width
* Support S1G-MCSs 8 and 9 (transmit and receive)
* Support short guard interval
* Support traveling pilots

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

* Support for NDP Ack, NDP BlockAck, and NDP CTS frames; support for the reception of NDP Probe Request frame for S1G AP; and may also support other NDP CMAC frames
* Support of the reception of PV1 MPDUs and may support the transmission of PV1 MPDUs
* Support of second virtual carrier sensing - RID
* Support of the hierarchical structure of the TIM element transmitted by an S1G AP
* Support of extended BSS max idle periods and extended listen intervals with USF

An S1G STA may also:

* Support RAW
* Support (Ed)relay
* Support grouping of non-AP STAs and group AID
* Support TWT
* Support BDT
* Support sectorization
* Support non-TIM STA operation
* Support asymmetric block ack operation, fragment block ack operation
* Support page slicing, dynamic AID assignment for an S1G AP
* Support authentication control
* Support SST
* Support rescheduling STA’s doze/awake cycle
* Support either a sensor STA or a non-sensor STA
* Support an EL STA

NOTE—Some NDP CMAC frames are supported 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:

* Support of 40 MHz and 80 MHz channel widths
* Support of VHT single-user (SU) PPDUs

A VHT STA may also:

* Support 160 MHz and 80+80 MHz channel widths
* Support VHT sounding protocol to support beamforming
* Support VHT multi-user (MU) PPDUs
* Support VHT-MCSs 8 and 9

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

* Support of the A-MPDU padding of a VHT PPDU
* Support of S-MPDU(11ah)
* Support of 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

A VHT STA may also:

* Support MPDUs of up to 11 454 octets
* Support A-MPDU pre-end-of-frame (pre-EOF) padding (see 9.7.1 (A-MPDU format)) of up to 1 048 575 octets
* Support 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 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 features of a VHT STA except for HT-mixed format PPDUs and 20 MHz, 40 MHz, and 80 MHz channel widths, 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:

* Support of TVHT\_W channel width.

A TVHT STA may also:

* Support TVHT\_W+W channel width.
* Support TVHT\_2W channel width.
* Support TVHT\_4W channel width.
* Support 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)