IEEE P802.11
Wireless LANs

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| Comment Resolution for LB 178 (D1.0): resolution for CIDs 2123 |
| Date: 19 October 2011 |
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Abstract

This document provides a resolution for CIDs 2180, 2558, 2789, 3134, 2123

## Comments

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| **CID** | **Clause** | **Page #** | **Comment** | **Proposed Changes** | **Proposed Resolution** |
| 2180 | 4 | 5.65 | There are no changes to clause 4 describing the new VHT features | Include them. | Accept |
| 2558 | 4 | 5.01 | There is no description at all of VHT in the General Description. | Write a general description of VHT for Clause 4. At least include a VHT-descriptive subclause after 11mb 4.10. | Accept |
| 2789 | 4.3 | 5.01 | general description on VHT STA is missiong | Add general description on VHT STA to "4.3 Componenets of the IEEE 802.11 architecture" | Accept |
| 3134 | 4 | 5.01 | should we add something in Clause 4 "General Description"? | add something in Clause 4 describing 11ac | Accept |
| 2123 | 9 | 70.01 | The MU-MIMO amendments are not so clear in the text and may provide confusion or at least diffrent interpretation  | Please illustrate the MU-MIMO amendments with adequate figures in the MAC description chapter. | P – Add VHT introduction to Clause 4 as in 11/1392 |

## Discussion

The 802.11ac amendment would benefit from some introductory text modelled on that added for 802.11n (reproduced below from REVmb D10.0). Additional notes:

1. Since a VHT STA is also an HT STA, this should be stated. And as a result only the additions to an HT STA that create the VHT STA need to be described.
2. Mention should be made of the single link and aggregate throughput enhancements VHT features provide. These are PAR requirements and, as such, should be called out.
3. The commenter for #2123 is looking for an introduction to the MU-MIMO features. Including figures illustrating MU-MIMO seems overkill since we don’t do this for other features. However, a paragraph describing MU-MIMO and its benefit would help.

**4.3.10 High-throughput (HT) station (STA)**

The IEEE 802.11 HT STA provides physical layer (PHY) and medium access control (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 9 (MAC sublayer functional description) and

Clause 20 (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 18 (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 17 (High Rate direct sequence spread spectrum (HR/DSSS) PHY

specification) and Clause 19 (Extended Rate PHY (ERP) specification). An HT STA is also a quality of

service (QoS) STA. The HT features are available to HT STAs associated with an HT access point (AP) in a

basic service set (BSS). A subset of the HT features is available for use between two HT STAs that are

members of the same independent basic service set (IBSS). Similarly, a subset of the HT features is

available for use between two HT STAs that have established mesh peering (see 8.4.2.58 (HT Capabilities

element) for details).

An HT STA has PHY features consisting of the modulation and coding scheme (MCS) set described in

20.3.5 (Modulation and coding scheme (MCS)) and physical layer convergence procedure (PLCP) protocol

data unit (PPDU) formats described in 20.1.4 (PPDU formats). Some PHY features that distinguish an HT

STA from a non-HT STA are referred to as 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. The PPDUs may be transmitted with 20 MHz

or 40 MHz bandwidth.

An HT STA has MAC features that include frame aggregation, some Block Ack features, power save multipoll

(PSMP) operation, reverse direction (RD), and protection mechanisms supporting coexistence with

non-HT STAs.

## Resolution

***Insert a new subclause 4.3.10a after 4.3.10 as follows:***

**4.3.10a Very High Throughput (VHT) station (STA)**

The IEEE 802.11 VHT STA operates in frequency bands below 6 GHz excluding the channels defined in the tables of E.1 (Country information and operating class) where the “Channel starting frequency” entry is either 2.407 or 2.414.

A VHT STA is an HT STA that, in addition to features supported as an HT STA, supports VHT features identified in Clause 8, Clause 9, Clause 10 and Clause 22. The main PHY features in a VHT STA that are not present in an HT STA are summarized as follows:

* mandatory support for 40 MHz and 80 MHz channel widths
* mandatory support for VHT format PPDUs
* optional support for 160 MHz and 80+80 MHz channel widths
* optional support for VHT transmit beamforming sounding (providing VHT compressed beamforming feedback)
* optional support for 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 summarized as follows:

* mandatory support for A-MPDU padding of VHT PPDUs
* mandatory support for VHT single MPDUs
* mandatory support for responding to BW indication in RTS
* optional support for MPDUs of up to 11 454 octets
* optional support for A-MPDUs pre-EOF padding of up to 1 048 575 octets
* optional support for VHT link adaptation

These VHT features, among other benefits, increase the maximum throughput achievable between two VHT STAs over that achievable using HT features alone. The VHT features are available to VHT

STAs associated with a VHT AP in a BSS. A subset of the VHT features is available for use between two VHT STAs that are members of the same IBSS. Similarly, a subset of the VHT features is available for use between two VHT STAs that have established mesh peering (8.4.2.xx (VHT Capabilities element)).

The support for VHT transmit beamforming sounding and MU PPDUs in a VHT AP and more than one VHT STA on a VHT BSS enables the use of MU-MIMO. With MU-MIMO, the AP can create up to 4 A-MPDUs each carrying MPDUs destined for an associated MU capable STA and transmit 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 MU PPDU increases aggregate throughput over that which would be achieved by sending the A-MPDUs in separate SU PPDUs.

The use of certain HT features, such as RIFS, is not permitted for STAs operating as VHT STAs.