IEEE P802.11  
Wireless LANs

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| 802.11 TGac WG Letter Ballot LB190  Proposed resolution on CID 7103 | | | | |
| Date: 2013-01-10 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Youhan Kim | Qualcomm | 1700 Technology Drive  San Jose, CA 95110 |  | [youhank@qca.qualcomm.com](mailto:youhank@qca.qualcomm.com) |
| Sameer Vermani | Qualcomm |  |  | [svverman@qti.qualcomm.com](mailto:svverman@qti.qualcomm.com) |
| Allert Van Zelst | Qualcomm |  |  | [allert@qualcomm.com](mailto:allert@qualcomm.com) |
| Hongyuan Zhang | Marvell |  |  | [hongyuan@marvell.com](mailto:hongyuan@marvell.com) |
| Vinko Erceg | Broadcom |  |  | [verceg@broadcom.com](mailto:verceg@broadcom.com) |

##### Comments are based on 11ac D4.0. Proposed resolutions are based on 11ac D4.2 (as indicated in each resolution). Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

Following CID is covered in this document (total 1):

PHY: 7103

History:

R0: Initial revision

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 7103 | 251.12 | 22.3.8.2.3 | AP already has channel feedback when transmitting MU PPDUs. Hence, there is no need to support STBC in an MU transmission. | In Figure 22-16, split the STBC field between SU and MU, and make it reserved for MU. Also, make similar changes in Table 22-12. Remove m\_STBC from 22.3.10.5.5 as well. |

**Discussion:**

Context (D4.0 P251):



11ac D4.0 allows MU PPDUs to be encoded using STBC, provided that all users in the MU PPDUs use STBC. Note that STBC provides transmit antenna diversity without requiring channel knowledge at the transmitter. However, APs already have channel knowledge to perform MU precoding. In addition, since STBC requires twice the number of space-time streams than transmissions without STBC, the use of STBC in an MU transmission actually reduces the number of extra transmit dimensions with which the transmitter can precode to aid the MU receivers.

For example, consider an MU AP with four TX antennas. If the AP were to transmit an MU PPDU to two STAs without using STBC and with one spatial stream to each STA, then the AP has two extra TX antennas with which it can reduce interference between the two STAs. However, if the AP were to transmit an MU PPDU to the same two STAs with one spatial stream to each STA, but now using STBC, then the total number of space-time streams is four. Hence the AP is not able to reduce interference between the two STAs as effectively, and thus degrading the link quality. In essence, selecting Nss eigenmodes provides more gain than selecting Nsts = 2 \* Nss eigenmodes and using STBC on top of that.

The following figures compare achievable total PHY rate (summed over all STAs in the MU PPDU) in MU transmissions with and without STBC under the following scenario:

* VHT40
* AP transmits to two STA
* Both STAs have two RX antennas
* 1 spatial stream to each STA
* Equal pathloss from the AP to the two STAs
* Ch. D
* MMSE MU precoding
* Precoding error due to
  + Channel estimation error at the client STAs  
    = RSSI – RX noise floor
    - RSSI = TX power – path loss, where TX power = 24 dBm
    - RX noise floor = -90 dBm
  + Channel aging = -25 dBc

|  |  |
| --- | --- |
| **AP has four TX antennas** | **AP has eight TX antennas** |
|  |  |

As expected, the MU transmissions using STBC performs worse than MU transmissions not using STBC. In essence, there seems to be no cases in which MU transmissions using STBC with Nsts,u = N performs better than MU transmissions not using STBC with Nsts,u = N/2. Hence, it would be prudent to disallow STBC encoded MU transmissions.

**Proposed Resolution:**

REVISED. See proposed text change under CID 7103 in 11-13/0054r0 which disallows STBC encoding for MU PPDUs.

**Proposed Text Changes:**

**9.15 STBC operation**

***Change D4.2 P144L25 as follows:***

Only a VHT STA that sets the Tx STBC subfield to 1 in the VHT Capabilities element may transmit VHT SU PPDUs with a TXVECTOR parameter STBC set to a nonzero value to a VHT STA from which the value of the Rx STBC field of the VHT Capabilities element is nonzero.

**22.3.3 Transmitter block diagram**

***Remove the STBC block twice from Figure 22-10 on D4.2 P229L6***

**22.3.8.2.3 VHT-SIG-A definition**

***Change D4.2 Table 22-12, P254L12 as follows:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of VHT-SIG-A** | **Bit** | **Field** | **Number of bits** | **Description** |
| VHT-SIG-A1 | B3 | STBC | 1 | For a VHT SU PPDU:  Set to 1 if space time  block coding is used and set to 0 otherwise.  For a VHT MU PPDU:  Set to 0. |

**22.3.10.5.5 Encoding process for VHT MU PPDUs**

***Change D4.2 P271L6 as follows:***

 (22-64)

where

APEP\_LENGTH*u* is the TXVECTOR parameter APEP\_LENGTH for user *u*

**22.3.10.9.4 Space-time block coding**

***Change subscript ‘u’ throughout subclause 22.3.10.9.4 to ‘0’ as VHT SU PPDUs has only one user, thus u=0. For example, dk,1,2m,u should be changed to dk,1,2m,0.***

***Change D4.2 P284L42 as follows:***

This subclause defines a set of optional robust transmission techniques that are applicable only when using STBC coding for VHT SU PPDUs. In this case, *NSS,*0 spatial streams are mapped to *NSTS,*0 space-time streams. These techniques are based on STBC. When the VHT-SIG-A STBC field is 1, a symbol operation shall occur between the constellation mapper and the spatial mapper as defined in this subclause. STBC shall not be applied in a VHT MU PPDU. Hence, the user subscript *u* is 0 in this subclause.

If STBC is applied, the stream of complex numbers,

***Change D4.2 Table 22-20 legend on P285L5 as follows:***

Table 22-20—Constellation mapper output to spatial mapper input for STBC

***Change D4.2 P285L64 as follows:***

NOTE—When STBC is applied, an odd number of space time streams is not allowed, and *NSTS,*0 =2*Nss,*0.

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