IEEE P802.11
Wireless LANs

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| [3.1.4 MIMO Channel Access] |
| Date: 2016-12-12 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Ou Yang | Intel |  |  | ou.yang@intel.com |
| Carlos Cordeiro | Intel |  |  |  |

Abstract

[This document proposes specification text for subclause 3.1.4 of the SFD describing MIMO channel access rules.]

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| Ou Yang | Intel |  |  | ou.yang@intel.com |
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Abstract

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Discussion

This proposal has the following assumptions on terminologies.

1. An EDMG STA is a DMG STA by default.
2. An EDMG network is a DMG network by default.

Based on the above assumption, the following motion “An EDMG STA that supports DL MU-MIMO shall support the same BlockACK mechanism used by a VHT STA that also supports DL MU-MIMO.” is covered in 10.24 [3].

10.36.11EDMG MIMO Channel Access

An EDMG STA should transmit a Grant frame to a peer EDMG STA to indicate the intent to transmit a MIMO PPDU to the peer STA. In the transmitted Grant frame, the value of the Allocation Duration field plus the Duration field of the Grant frame indicates the time offset from the PHY-TXEND.indication primitive of the Grant frame transmission when the EDMG STA intends to initiate access to the channel to transmit to the peer EDMG STA. For the transmitted Grant frame, the TXVECTOR parameter CONTROL\_TRAILER shall be set to Present and the parameter CT\_TYPE shall be set to Grant. Among other things, the control trailer indicates whether the upcoming MIMO transmission is SU-MIMO or MU-MIMO and corresponding antenna configuration.

An EDMG STA that receives a Grant frame with a control trailer indicating a MIMO transmission to itself shall configure its antennas according to the settings included in the control trailer of the received Grant frame within a time period of the Allocation Duration field plus the Duration field of the received Grant frame after the PHY-TXEND.indication primitive of the Grant frame transmission.

An EDMG STA may transmit an RTS frame or a DMG CTS-to-self frame to one or more peer EDMG STAs prior to an SU-MIMO or an MU-MIMO transmission. For the transmitted RTS frame, the TXVECTOR parameter CONTROL\_TRAILER shall be set to Present and the parameter CT\_TYPE shall be set to RTS. For the transmitted DMG CTS-to-self frame, the TXVECTOR parameter CONTROL\_TRAILER shall be set to Present and the parameter CT\_TYPE shall be set to DMG CTS-to-self. Among other things, the control trailer of the RTS and the DMG CTS-to-self frame indicates whether the following MIMO transmission is SU-MIMO or MU-MIMO and corresponding antenna configuration.

The intended receiver of such an RTS frame or a DMG CTS-to-self frame with a control trailer may transmit a frame (e.g., a DMG CTS frame or an ACK frame) in response to the received RTS or DMG CTS-to-self with a control trailer.

When reverse direction is supported in EDMG DL MU-MIMO, the channel access rules for the RD responder are defined in 10.28.4 (Rules for RD responder) and 10.28.5 (Reverse direction for EDMG DL MU-MIMO).

**29.3.8 Control trailer**

If the TXVECTOR parameter CONTROL\_TRAILER is set to Present for a non-EDMG control mode PPDU, a control trailer shall be inserted in the PPDU immediately following the Data field of the PPDU. The control trailer is one LDPC codeword with 18 data octets and 21 parity octets. The control trailer is added after the Data field of a non-EDMG control mode PPDU, using and continuing the control mode modulation and encoding. The scrambler is used to generate the control trailer and its initial state is the final state of the scrambler from the Data field of the PPDU.

To indicate the presence of a control trailer in a non-EDMG control mode PPDU, the Scrambler Initialization field in the L-Header shall be set as indicated in Table 6 and the value of the Training Length field in the L-Header shall be set to a value greater than or equal to 2. If the value of the Training Length field is equal to 2, the control trailer takes the place of the AGC and TRN fields following the Data field. If the value of the Training Length field is greater than 2, the AGC and TRN fields are appended after the control trailer.

The format of the control trailer depends on the value of the TXVECTOR parameter CT\_TYPE. Table 23 defines the control trailer format when the CT\_TYPE parameter is equal to CTS\_DTS. Table 24 defines the control trailer format when the CT\_TYPE parameter is equal to GRANT\_RTS\_CTS2self.

1. —Control trailer definition when CT\_TYPE is CTS\_DTS

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Number of bits** | **Start bit** | **Description** |
| Channel Aggregation | 1 | 1 | See Table 11 |
| BW | 8 | 2 | See Table 11 |
| Primary Channel Number | 3 | 10 | See Table 11 |
| SISO/MIMO | 1 | 13 | Set to 0 to indicate that the following transmission from this STA is performed in SISO. Set to 1 to indicate that the following transmission from this STA is performed in MIMO. |
| SU/MU MIMO | 1 | 14 | Set to 0 to indicate SU-MIMO, and set to 1 to indicate MU-MIMO. Reserved when SISO/MIMO is set to 0. |
| CTCS | 16 | 15 | Contains the CRC-16 computed over the content of the control trailer. This field is computed as defined in section 20.3.7 |
| Reserved | 114 | 31 | Set to 0 by the transmitter and ignored by the receiver. |

Table 24—Control trailer definition when CT\_TYPE is GRANT\_RTS\_CTS2self

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Number of bits** | **Start bit** | **Description** |
| Channel Aggregation | 1 | 0 | See Table 10 |
| BW | 8 | 1 | See Table 10 |
| Primary Channel Number | 3 | 9 | See Table 10 |
| SISO/MIMO | 1 | 12 | Set to 0 to indicate SISO, and set to 1 to indicate MIMO. |
| SU/MU MIMO | 1 | 13 | Set to 0 to indicate SU-MIMO, and set to 1 to indicate MU-MIMO. Reserved when SISO/MIMO is set to 0. |
| Number of SS | 3 | 14 | The value of this field plus one indicates the number of SSs transmitted to the EDMG STA that is the recipient of the control trailer. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS1 | 6 | 17 | This field indicates the sector that the transmitter of this control trailer uses for SS1. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS1 | 2 | 23 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS1. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS1 | 2 | 25 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS1. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS2 | 6 | 27 | This field indicates the sector that the transmitter of this control trailer uses for SS2. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS2 | 2 | 33 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS2. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS2 | 2 | 35 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS2. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS3 | 6 | 37 | This field indicates the sector that the transmitter of this control trailer uses for SS3. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS3 | 2 | 43 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS3. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS3 | 2 | 45 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS3. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS4 | 6 | 47 | This field indicates the sector that the transmitter of this control trailer uses for SS4. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS4 | 2 | 53 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS4. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS4 | 2 | 55 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS4. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS5 | 6 | 57 | This field indicates the sector that the transmitter of this control trailer uses for SS5. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS5 | 2 | 63 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS5. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS5 | 2 | 65 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS5. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS6 | 6 | 67 | This field indicates the sector that the recipient of this control trailer uses for SS6. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS6 | 2 | 73 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS6. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS6 | 2 | 75 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS6. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS7 | 6 | 77 | This field indicates the sector that the transmitter of this control trailer uses for SS7. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS7 | 2 | 83 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS7. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS7 | 2 | 85 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS7. Reserved if SISO/MIMO is set to 0. |
| TX Sector ID for SS8 | 6 | 87 | This field indicates the sector that the recipient of this control trailer uses for SS8. Reserved if SISO/MIMO is set to 0. |
| TX DMG antenna ID for SS8 | 2 | 93 | This field indicates the DMG antenna that the transmitter of this control trailer uses for SS8. Reserved if SISO/MIMO is set to 0. |
| RX DMG antenna ID for SS8 | 2 | 955 | This field indicates the DMG antenna that the recipient of this control trailer uses for SS8. Reserved if SISO/MIMO is set to 0. |
| CTCS | 16 | 97 | Contains the CRC-16 computed over the content of the control trailer. This field is computed as defined in section 20.3.7 |
| Reserved | 31 | 113 | Set to 0 by the transmitter and ignored by the receiver. |

9.4.2.250.5 Beamforming field

The Beamforming Capability field is defined in Figure 8.

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B4 | B5 | B6 B7 |
|  | Requested BRP SC Blocks | MU-MIMO Supported | Reserved |
| Bits: | 5 | 1 | 2 |

1. —Beamforming Capability field format

The Requested BRP SC Blocks field indicates the number of data SC blocks that the STA requests be included in a PPDU carrying a TRN field and transmitted to the STA. The value of this field ranges from 0 through aBRPminSCblocks inclusive.

The MU-MIMO Supported field is set to one to indicate that the STA supports the DL MU-MIMO protocol including the MU-MIMO beamforming protocol described in 10.38.6.6. The field is set to zero otherwise.

The SU-MIMO Supported field is set to one to indicate that the STA supports the SU-MIMO protocol including the SU-MIMO beamforming protocol described in 10.38.6.5. The field is set to zero otherwise.

The Grant required field is set to one to indicate a Grant frame is required setup MIMO configurations. The field is set to zero if a Grant frame is not necessary for MIMO configuration setup. The Grant required field is reserved if the MU-MIMO Supported and the SU-MIMO Supported field are set to 0.

**References:**

1. 11-15-1358-09-00ay-11ay-specification-framework-for-tgay.doc

2. IEEE P802.11-REVmc/D8.0, Aug 2016

3. Text to cover SFD 3.7 Block Acknowledgement v1.docx, Solomon Trainin, Dec 2016