IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| BRP for channel aggregation | | | | |
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Abstract

This document proposes the specification text for BRP for channel aggregation.

**9.4.2.130 DMG Beam Refinement element**

*Change Figure 9-512 as follows*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B7 | B8 B15 | B16 | B17 | B18 | B19 | B20 | B21 B26 | B27 B28 | B29 B33 |
|  | Element ID | Length | Initiator | TX-train-response | RX-train-response | TX-TRN-OK | TXSS-FBCK-REQ | BS-FBCK | BS-FBCK Antenna ID | FBCK-REQ |
| Bits: | 8 | 8 | 1 | 1 | 1 | 1 | 1 | 6 | 2 | 5 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B34 B51 | B52 | B53 | B54 B55 | B56 B60 | B61 |
|  | FBCK-TYPE | MID Extension | Capability Request | Reserved | BS-FBCK MSB | BS-FBCK Antenna ID MSB |
| Bits: | 18 | 1 | 1 | 2 | 5 | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B62 B65 | B66 | B67 | B68 |
|  | Number of Measurements MSB | EDMG Extension Flag | EDMG Channel Measurement Present | Short SSW Packet Used |
| Bits: | 4 | 1 | 1 | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | B69 | B70 | B71 |
|  | DBF  FBCK  REQ | Aggregation Requested | Aggregation Present |
| Bits: | 1 | 1 | 1 |

*Insert the following paragraph before the 8th paragraph*

The size in bits of the BS-FBCK field depends on the value of the EDMG Extension Flag field. If the EDMG Extension Flag field is set to 1, the BS-FBCK MSB field is prepended to the BS-FBCK field to form a single BS-FBCK field of size 10 bits. Otherwise, the BS-FBCK MSB field is reserved and the BS-FBCK field remains with 6 bits in length.

*Change the 8th paragraph as follows*

If the EDMG Extension Flag field is set to 0, T~~t~~he BS-FBCK field indicates the index of the TRN-T field that was received with the best quality in the last received BRP-TX PPDU, where the first TRN-T field in the PPDU is defined as having an index equal to 1. ~~If the last received PPDU was not a BRP-TX PPDU, this field is set to 0.~~ If the EDMG Extension Flag field is set to 1, the BS-FBCK field indicates the AWV feedback ID of the TRN subfields transmitted with the same AWV that were received with the best quality in the last received EDMG BRP-TX packet or EDMG BRP-RX/TX packet as defined in 30.9.2.2.5. If the EDMG Extension Flag field is set to 1 and the last received EDMG BRP-TX packet or EDMG BRP-RX/TX packet was transmitted using channel aggregation, the BS-FBCK field indicates the AWV feedback ID of the TRN subfields transmitted with the same AWV that were received with the best quality in channel which includes the primary channel. If the last received PPDU was not a BRP-TX PPDU, an EDMG BRP-TX packet or an EDMG BRP-RX/TX packet, this field is set to 0. The determination of best quality is implementation dependent.

The Aggregation Requested field is set to 1 to indicate the TRN field is transmitted over a 2.16+2.16 GHz or 4.32+4.32 GHz channel and request the channel measurement feedback per channel in case of channel aggregation. Set to 0 otherwise. This field is reserved when the EDMG Extension Flag field is set to 0.

The Aggregation Present field is set to 1 to indicate that the channel measurement feedback per channel in case of channel aggregation is present. Set to 0 otherwise. This field is reserved when the EDMG Extension Flag field is set to 0.

**9.4.2.136 Channel Measurement Feedback element**

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Size | | Meaning |
| Element ID | 8 bits | |  |
| Length | 8 bits | |  |
| SNR | SNR1 | 8 bits | SNR as measured in the first TRN-T field or at the first sector from which SSW frame or Short SSW packet is received, or at the channel indicated by the first SISO ID subset |
| SNR2 | 8 bits | SNR as measured in the second TRN-T field or at the second sector from which SSW frame or Short SSW packet is received, or at the channel indicated by the second SISO ID subset |
| . . . |  |  |
| SNRNmeas | 8 bits | SNR as measured in the second TRN-T field or at the second sector from which SSW frame or Short SSW packet is received, or at the channel indicated by the second SISO ID subset |
| Channel Measurement | Channel Measurement 1 | *Ntaps×*16 bits | Channel measurement for the first TRN-T field or for the channel indicated by the first SISO ID subset |
| Channel Measurement 2 | *Ntaps×*16 bits | Channel measurement for the first TRN-T field or for the channel indicated by the second SISO ID subset |
| . . . |  |  |
| Channel Measurement Nmeas | *Ntaps×*16 bits | Channel measurement for the Nmeas TRN-T field or for the channel indicated by the Nmeas SISO ID subset |
| Tap Delay | Relative Delay Tap #1 | 8 bits | The delay of Tap #1 in units of TC relative to the path with the shortest delay detected. |
| Relative Delay Tap #2 | 8 bits | The delay of Tap #2 in units of TC relative to the path with the shortest delay detected. |
| . . . |  |  |
| Relative Delay Tap #Ntaps | 8 bits | The delay of Tap #Ntaps in units of TC relative to the path with the shortest delay detected. |
| Sector ID Order | Sector ID1 | 6 bits | Sector ID for SNR1 being obtained, or sector ID of the first detected beam. |
| Antenna ID1 | 2 bits | Antenna ID corresponding to sector ID1. |
| Sector ID1 | 6 bits | Sector ID for SNR2 being obtained, or sector ID of the second detected beam. |
| Antenna ID1 | 2 bits | Antenna ID corresponding to sector ID2. |
| . . . |  |  |
| Sector IDNmeas or sector IDNbeam | 6 bits | Sector ID for SNRNmeas being obtained, or sector ID of the detected beam Nbeam. |
| Antenna IDNmeas or Antenna IDNbeam | 2 bits | Antenna ID corresponding to sector IDNmeas or sector IDNbeam. |
| Additional SNR | SNR1 | 8 bits | SNR as measured in the first TRN-T field or at the channel indicated by the first SISO ID subset |
| SNR2 | 8 bits | SNR as measured in the first TRN-T field or at the channel indicated by the first SISO ID subset |
| . . . |  |  |
| SNRNmeas | 8 bits | SNR as measured in the Nmeas TRN-T field or at the channel indicated by the Nmeas SISO ID subset |
| Additional Channel Measurement | Channel Measurement 1 | *Ntaps×*16 bits | Channel measurement for the first TRN-T field or for the channel indicated by the first SISO ID subset |
| Channel Measurement 2 | *Ntaps×*16 bits | Channel measurement for the first TRN-T field or for the channel indicated by the second SISO ID subset |
| . . . |  |  |
| Channel Measurement Nmeas | *Ntaps×*16 bits | Channel measurement for the Nmeas TRN-T field or for the channel indicated by the Nmeas SISO ID subset |

If both the Aggregation Present field and the EDMG Extension Flag field in the accompanying DMG Beam Refinement element are set to 1 or if the Aggregation Present field in the accompanying MIMO Feedback Control element is set to 1, the SNR and Channel Measurement fields are for a channel which includes the primary channel in case of channel aggregation. Otherwise the SNR and Channel Measurement fields are for a channel which the measurement is taken.

If both the Aggregation Present field and the EDMG Extension Flag field in the accompanying DMG Beam Refinement element are set to 1 or if the Aggregation Present field in the accompanying MIMO Feedback Control element is set to 1, the Additional SNR and Additional Channel Measurement fields are for a channel which does not include the primary channel in case of channel aggregation. Otherwise the Additional SNR and Additional Channel Measurement fields are not present.

9.4.2.253 EDMG Channel Measurement Feedback element

1. —EDMG Channel Measurement Feedback element format

|  |  |  |  |
| --- | --- | --- | --- |
| Field | | Size | Meaning |
| Element ID | | 8 bits | Defined in 9.4.2.1 |
| Length | | 8 bits | Defined in 9.4.2.1 |
| Element ID Extension | | 8 bits | Defined in 9.4.2.1 |
| EDMG Sector ID Order | Sector ID1/CDOWN1/AWV Feedback ID1 | 11 bits |  |
| TX Antenna ID1 | 3 bits |  |
| RX Antenna ID1 | 3 bits |  |
| Sector ID2/CDOWN2/AWV Feedback ID2 | 11 bits |  |
| TX Antenna ID2 | 3 bits |  |
| RX Antenna ID2 | 3 bits |  |
| … | … |  |
| Sector IDNmeas/CDOWNNmeas/AWV Feedback IDNmeas | 11 bits |  |
| TX Antenna IDNmeas | 3 bits |  |
| RX Antenna IDNmeas | 3 bits |  |
| BRP CDOWN | BRP CDOWN1 | 6 bits |  |
| BRP CDOWN2 | 6 bits |  |
| … | … |  |
| BRP CDOWNNmeas | 6 bits |  |
| Tap Delay | Relative Delay Tap #1 | 12 bits | The delay of tap #1 in units of TC/NCB relative to the path with the shortest delay detected, where NCB is the integer number of contiguous 2.16 GHz channels over which the measurement was taken. |
| Relative Delay Tap #2 | 12 bits | The delay of tap #2 in units of TC/NCB relative to the path with the shortest delay detected, where NCB is the integer number of contiguous 2.16 GHz channels over which the measurement was taken. |
| … | … |  |
| Relative Delay Tap #Ntaps | 12 bits | The delay of tap #Ntaps in units of TC/NCB relative to the path with the shortest delay detected, where NCB is the integer number of contiguous 2.16 GHz channels over which the measurement was taken. |
| Additional EDMG Sector ID Order | Sector ID1/CDOWN1/AWV Feedback ID1 | 11 bits |  |
| TX Antenna ID1 | 3 bits |  |
| RX Antenna ID1 | 3 bits |  |
| Sector ID2/CDOWN2/AWV Feedback ID2 | 11 bits |  |
| TX Antenna ID2 | 3 bits |  |
| RX Antenna ID2 | 3 bits |  |
| … | … |  |
| Sector IDNmeas/CDOWNNmeas/AWV Feedback IDNmeas | 11 bits |  |
| TX Antenna IDNmeas | 3 bits |  |
| RX Antenna IDNmeas | 3 bits |  |
| Additional BRP CDOWN | BRP CDOWN1 | 6 bits |  |
| BRP CDOWN2 | 6 bits |  |
| … | … |  |
| BRP CDOWNNmeas | 6 bits |  |
| Additional Tap Delay | Relative Delay Tap #1 | 12 bits |  |
| Relative Delay Tap #2 | 12 bits |  |
| … | … |  |
| Relative Delay Tap #Ntaps | 12 bits |  |

If both the Aggregation Present field and the EDMG Extension Flag field in the accompanying DMG Beam Refinement element are set to 1 or if the Aggregation Present field in the accompanying MIMO Feedback Control element is set to 1, the EDMG Sector ID Order, BRP CDOWN and Tap Delay fields are for a channel which includes the primary channel in case of channel aggregation. Otherwise the EDMG Sector ID Order, BRP CDOWN and Tap Delay fields are for a channel which the measurement is taken.

If both the Aggregation Present field and the EDMG Extension Flag field in the accompanying DMG Beam Refinement element are set to 1 or if the Aggregation Present field in the accompanying MIMO Feedback Control element is set to 1, the Additional EDMG Sector ID Order, Additional BRP CDOWN and Additional Tap Delay fields are for a channel which does not include the primary channel in case of channel aggregation. Otherwise the Additional EDMG Sector ID Order, Additional BRP CDOWN and Additional Tap Delay fields are not present.

9.4.2.259 MIMO Setup Control element

1. —MIMO Setup Control element format

|  |  |  |
| --- | --- | --- |
| Field | Size (bits) | Meaning |
| Element ID | 8 |  |
| Length | 8 |  |
| Element ID Extension | 8 |  |
| SU/MU | 1 | Sets to 1 to indicate SU-MIMO beamforming and sets to 0 to indicate MU-MIMO beamforming. |
| EDMG Group ID | 8 | Indicates the EDMG Group ID of target MU group. This field is reserved when the SU/MU field is set to 1. |
| Group User Mask | 32 |  |
| DL/UL MU-MIMO Phase | 1 | Set to 1 to indicate downlink MIMO phase and sets to 0 to indicate uplink MIMO phase. This field is reserved when the SU/MU field is set to 1. |
| L-TX-RX | 8 | Indicates the requested number of consecutive TRN-Units in which the same AWV is used in the transmission of the last M TRN subfields of each TRN-Unit. This field is reserved when the SU/MU field is set to 0. |
| Requested EDMG TRN-Unit M | 4 | The value of this field plus one indicates the requested number of TRN subfields in a TRN-Unit transmitted with the same AWV following a possible AWV change. This field is reserved when the SU/MU field is set to 0. |
| Link Type | 1 | Sets to 1 to indicate initiator link and set to 0 otherwise. This field shall be set to 1 when the SU/MU field is set to 0. |
| MIMO FBCK-REQ | 10~~9~~ | Indicates channel measurement feedback requested for the link specified by the Link Type field. |
| Reserved | 7 |  |

The MIMO FBCK-REQ field is defined in Figure 49.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel Measurement Requested | Number of Taps Requested | Number of TX Sector Combinations Requested | Aggregation Requested |
| Bits: | 1 | 2 | 6 | 1 |

1. — MIMO FBCK-REQ field format

The Aggregation Requested field is set to 1 to indicate the TRN field is transmitted over a 2.16+2.16 GHz or 4.32+4.32 GHz channel and request the channel measurement feedback per channel in case of channel aggregation as part of MIMO BF feedback. Set to 0 otherwise.

9.4.2.261 MIMO Feedback Control element

1. —MIMO Feedback Control element format

|  |  |  |
| --- | --- | --- |
| Field | Size (bits) | Meaning |
| Element ID | 8 |  |
| Length | 8 |  |
| Element ID Extension | 8 |  |
| SU/MU | 1 | Sets to 1 to indicate SU-MIMO beamforming and sets to 0 to indicate MU-MIMO beamforming. |
| Link Type | 1 | Sets to 1 to indicate initiator link and sets to 0 otherwise. This field shall be set to 1 when the SU/MU field is set to 0. |
| MIMO FBCK-TYPE | 12~~11~~ |  |
| Reserved | 2~~3~~ |  |

The MIMO FBCK-TYPE field is defined in Figure 50.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Channel Measurement Present | Tap Delay Present | Number of Taps Present | Number of TX Sector Combinations Present | Precoder Information Present | Aggregation Present |
| Bits: | 1 | 1 | 2 | 6 | 1 | 1 |

1. — MIMO FBCK-TYPE field format

The Aggregation Present field is set to 1 to indicate that the channel measurement feedback per channel in case of channel aggregation is present. Set to 0 otherwise.

**10.38.9.2.3 SU-MIMO beamforming**

**10.38.9.2.3.3 MIMO phase**

In the SU-MIMO BF setup subphase, the initiator shall send a MIMO BF Setup frame with the SU/MU field set to 1 and the Link Type field set to 1 to the responder. In case of channel aggregation, the Aggregation Requested field in the MIMO BF Setup frame should set to 1. The TA field and the RA field of the MIMO BF Setup frame shall be set to the MAC addresses of the initiator and the responder, respectively.

The responder shall send a MIMO BF Setup frame with the SU/MU field set to 1 and the Link Type field set to 0 a SIFS following the reception of the MIMO BF Setup frame from the initiator. In case of channel aggregation, the Aggregation Requested field in the MIMO BF Setup frame should set to 1.

The initiator shall initiate the SU-MIMO BF feedback subphase a MBIFS following reception of an EDMG BRP-RX/TX packet with the BRP CDOWN field set to 0 from the responder. All frames transmitted during the SU-MIMO BF feedback subphase should be sent using the DMG control mode. In the SU-MIMO BF feedback subphase, the initiator shall send to the responder a MIMO BF Feedback frame with the SU/MU field set to 1 and the Link Type field set to 0. In case of channel aggregation, the Aggregation Present field in the MIMO BF Feedback frame should be set to 1. The TA field of the MIMO BF Feedback frame shall be set to the MAC address of the initiator and the RA field shall be set to the MAC address of the responder.

The responder shall send a MIMO BF Feedback frame to the initiator with the SU/MU field set to 1 and the Link Type field set to 1 a SIFS following reception of a MIMO BF Feedback frame from the initiator. In case of channel aggregation, the Aggregation Present field in the MIMO BF Feedback frame should be set to 1. The TA field of the MIMO BF Feedback shall be set to the MAC address of the responder and the RA field shall be set to the MAC address of the initiator.

**10.38.9.2.4 MU-MIMO beamforming**

**10.38.9.2.4.3 MIMO phase**

**10.38.9.2.4.3.2 Downlink MIMO phase**

In the MU-MIMO BF setup subphase, the initiator shall transmit one or more MIMO BF Setup frame with the SU/MU field set to 0 and the DL/UL MIMO Phase field set to 1 to each responder in the MU group. In case of channel aggregation, the Aggregation Requested field in each MIMO BF Setup frame should be set to 1. The initiator should transmit the minimum number of MIMO BF Setup frames to reach all responders in the MU group.

The initiator shall initiate the MU-MIMO BF feedback subphase a MBIFS following the transmission of the EDMG BRP RX-TX packet with the BRP CDOWN field set to 0. In the MU-MIMO BF feedback subphase, the initiator shall transmit a MIMO BF Poll frame with the Poll Type field set to 0 to poll each remaining responder to collect MU-MIMO BF feedback from the preceding MU-MIMO BF training subphase. The MIMO BF Poll frames should be sent using the DMG control mode. The TA field of each MIMO BF Poll frame shall be set to the BSSID of the initiator and the RA field shall be set to the MAC address of the corresponding responder. Each MIMO BF Poll frame carries the dialog token in the Dialog Token field that identifies the MU-MIMO BF training. Upon receiving a MIMO BF Poll frame for which a remaining responder is the addressed recipient, the responder shall transmit a MIMO BF Feedback frame with the SU/MU field set to 1 to the initiator. In case of channel aggregation, the Aggregation Present field in the MIMO BF Feedback frame should be set to 1. The RA field of the MIMO BF Feedback frame shall be set to the BSSID of the initiator and the TA field shall be set to the MAC address of the responder.

**10.38.9.2.4.3.3 Uplink MIMO phase**

In the MU-MIMO BF setup subphase, the initiator shall transmit one or more MIMO BF Setup frame with the SU/MU field set to 0 and the DL/UL MU-MIMO Phase field set to 0 to each responder in the MU group. In case of channel aggregation, the Aggregation Requested field in each MIMO BF Setup frame should be set to 1. The initiator should transmit the minimum number of MIMO BF Setup frames to reach all responders in the MU group. The MIMO BF Setup frames should be sent using the DMG control mode or using a non-EDMG duplicate PPDU transmitted with the DMG Control modulation class. The TA field of the MIMO BF Setup frame shall be set to the BSSID of the initiator and the RA field shall be set to the broadcast address. The MIMO BF Setup frame shall indicate the EDMG group ID of the MU group in the EDMG Group ID field, each remaining responder in the Group User Mask field, and a unique dialog token in the Dialog Token field for identifying MU-MIMO BF training. A responder whose corresponding bit in the Group User Mask field of the received MIMO BF Setup frame is set to 0 can ignore the subsequent MU-MIMO BF training subphase.

The initiator shall initiate an MU-MIMO BF training subphase a MBIFS following the transmission of the MIMO BF Setup frame. In the MU-MIMO BF training subphase, the initiator shall transmit a MIMO BF Poll frame with the Poll Type field set to 1 to each remaining responder in the MU group. Each MIMO BF Poll frame should be sent using the DMG control mode or using a non-EDMG duplicate PPDU transmitted with the DMG Control modulation class. The TA field of each MIMO BF Poll frame shall be set to the BSSID of the initiator and the RA field shall be set to the MAC address of the corresponding responder.

**10.38.9.5 BRP transmit sector sweep (BRP TXSS)**

**10.38.9.5.1 General**

As defined in 30.9.2.2.2, the TRN field in EDMG BRP packets sent as part of BRP TXSS is transmitted over the entire channel bandwidth. Therefore, the BRP TXSS allows for transmit sector sweep over the entire channel bandwidth when the initiator and responder operate on a 4.32 GHz, 6.48 GHz, ~~or~~ 8.64 GHz, 2.16+2.16GHz, or 4.32+4.32GHz channel.

**10.38.9.5.3 BRP TXSS execution**

Both the BRP frame sent by the initiator to initiate the BRP TXSS and the BRP frame sent by the responder to confirm the BRP TXSS execution shall not include a TRN field. The initiator of the BRP TXSS sends a BRP frame with the BRP-TXSS field and the TXSS-INITIATOR field within the EDMG BRP Request element both set to one and the TXSS-PACKETS field set to indicate the number of EDMG BRP-TX packets necessary for the initiator to perform transmit training. In case of channel aggregation, the Aggregation Requested field in the DMG Beam Refinement element carried within the BRP frame sent by the initiator should be set to 1. To confirm the BRP TXSS execution, the responder shall respond with a BRP frame MBIFS interval after the reception of the BRP frame sent by the initiator with the BRP-TXSS field within the EDMG BRP Request element set to one, the TXSS-INITIATOR field set to zero, and the TXSS-REPEAT field set to indicate the number of requested repetitions of the EDMG BRP-TX packets sent by the initiator. In case of channel aggregation, the Aggregation Requested field in the DMG Beam Refinement element carried within the BRP frame sent by the responder should be set to 1.

**10.38.9.5.4 BRP TXSS feedback**

A BRP frame with feedback transmitted in a BRP TXSS shall have the SNR Present subfield within the FBCK-TYPE field set to 1, the Sector ID Order subfield set to 1, the EDMG Extension Flag set to 1 and the EDMG Channel Measurement Present set to 1. In case of channel aggregation, the Aggregation Present field in the DMG Beam Refinement element carried within the BRP frame with feedback should be set to 1. In the EDMG Sector ID Order subfield, the SISO IDs indicate the AWV IDs, TX antennas and RX Antennas of Sectors that were received in the last BRP TXSS. The SNRs subfield in the Channel Measurement Feedback field indicates the SNRs with which these sectors have been received. The BRP-CDOWN associated with each SISO ID indicate the value of the BRP-CDOWN of the packet in which the sector has been received.

**References:**

1. Draft P802.11ay\_D0.8

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**Straw Poll:**

* **Do you agree to include the texts described in 11-17-1674-00-00ay-BRP for channel aggregation?**