IEEE P802.11  
Wireless LANs

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| D3.0 Bug Fixes | | | | |
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Abstract

This document proposes a fix to some bugs found in TGaz D3.0

**BUG #1**

The current draft allows sending Channel Measurement Feedback (CMF) element as part of the Fine Timing Measurement frame. However, this element cannot be interpreted without the FBCK-TYPE field which is part of the beam refinement element that is normally sent together with Channel Measurement Feedback element in a BRP frame. The feedback type has information about the number of measurements in the CMF and what fields are present. In order to send a CMF element without a BRP element we need to add a variant of the FBCK-TYPE element to the Fine Timing Measurement frame

***TGaz Editor: Add a Channel Measurement Feedback FBCK-TYPE to the Fine Timing Measurement Action field format (Figure 9-877, P68)***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Fine Timing Measurement Synchronization Information (optional | Ranging Parameters (optional) | Secure LTF Parameters (optional) | Channel Measurement Feedback Type  (optional) | Channel Measurement Feedback (optional) | Direction Measurement Results  (optional) | Multiple Best AWV ID  (optional) | Multiple AOD Feedback (optional) | LOS Likelihood (optional) |
| Octets | variable | variable | 13 | 2 | variable | 9 | variable | variable | 4 |

***TGaz Editor: Add the following text before P68L6 (9.6.7.33):***

The Channel Measurement Feedback Type field is present in the Fine Timing Measurement frame if the Channel Measurement Feedback field is present. It describes the content of the Channel Measurement Feedback element contained in that field. This field has the structure shown in Figure 1. The interpretation of each of the subfields is described in table 9-257 (FBCK-TYPE field description)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 B4 | B5 B14 | B15 |
|  | SNR Present | Channel Measurement Present | Tap Delay Present | Number of Taps Present | Number of Measurements | Reserved |
| bits: | 1 | 1 | 1 | 2 | 10 | 1 |

Figure 1- Channel Measurement Feedback Type format

***TGaz Editor Modify the text in P68L6-9***

The Channel Measurement Feedback field is present in the Fine Timing Measurement frame if the frame is sent after a LOS Assessment ACK PPDU and optionally in response to an ISTA to RSTA angle of departure TRN field on an ACK frame or as part of Ranging response. This field contains the Channel Measurement Feedback element (see 9.4.2.136).

***TGaz Editor: Modify the text at P120L4-13 as follows***

In a Direction Measurement FTM pair that agreed on I2R AOD, the ISTA shall add a TRN field to the Ack frames in the exchanges specified by the Direction Measurement Density by setting the TRN\_LEN to a non-zero value and PACKET\_TYPE to 1. The RSTA shall set the Best AWV Id field in the Fine Timing Measurement frames sent to the ISTA following these Ack frames to the AWV Id or the Best Sector Index of the TRN field (if the ACK was an EDMG/DMG PPDU respectively). If the RSTA has set the AOD Channel Measurement Feedback subfield to 1 in the DMG Direction Measurement Capabilities field, it shall also include a Channel Measurement Feedback Type field and a Channel Measurement Feedback field in the Fine Timing Measurement frames sent to the ISTA following the reception of the Ack frames with PACKET-TYPE equal to TRN-T-PACKET or EDMG-PACKET-TYPE equal to EDMG-TRN-T-PACKET and TRN-LEN greater than 0 or EDMG-TRN-LEN greater than 0.

**BUG #2**

FTM bursts that use the first path BF AWV are based on the assumption that an indication at the beginning of the burst will be sufficient to cause the whole FTM burst to run on first path AWV. The problem is that due to time needed for calculation, FTM exchanges in a burst may be separated by long periods, of the order of several milliseconds. Between the bursts, the ISTA may switch to another antenna pattern to receive data from the RSTA or from other STAs. When the RSTA initiates an FTM exchange the ISTA is unlikely to be receiving in the antenna setting of the first path AWV. This means that the FTM frame sent by the ISTA on the antenna setting of the first path AWV, may not be received, or may not be received with correct antenna setting in the ISTA. The problem is illustrated in Figure 3, where we can see the distance between exchanges.

We propose a solution in which the first path AWV exchange does not need any setup before the FTM exchange. In this solution, the FTM PPDUs are transmitted using the best path AWV, while the timing measurement is performed on a TRN field which is transmitted and received using the first path AWV.

The indication that the TRN field is transmitted using first path AWV is carried in the PHY header. Due to a minimum length of the data field of PPDUs carrying TRN (restriction that all frames carrying a TRN field obey), the receiving STA has enough time to switch to the first path AWV. This is like the situation in Secure TRNs in which the time measurement is performed over the TRN field rather than the CE of the PPDU. While the times are measured on the TRN field, the reference point remains at the beginning of the PPDU.



Figure 2 - FTM exchange with first path AWV used in the TRN field



Figure 3 - FTM exchange using first path AWV

Proposed Spec changes:

***TGaz Editor: Add the following line to Table 43 – TXVECTOR and RXVECTOR parameters***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FIRST\_PATH\_AWV\_TRN | FORMAT is EDMG, EDMG\_MODULATION is EDMG\_SC\_MODE, NUM\_USERS is 1, NUM\_STS is 1 | Enumerated Type  FIRST\_PATH\_AWV\_ON\_TRN  BEST\_PATH\_AWV\_ON\_TRN  Indicates whether the TRN field of the PPDU is transmitted using the first path AWV or the best path AWV. | Y | N |
| Otherwise | Not present | N | N |

***TGaz Editor: Modify the last line of table 54 EDMG-MCS field definition when the Number of SS field is 0 as follows:***

|  |  |  |  |
| --- | --- | --- | --- |
| First Path AWV TRN | 1 | 8 | When set to 1, indicates that the TRN field is transmitted (and shall be received) using the first path AWV antenna setting. Otherwise the TRN field is transmitted and shall be received using the best path AWV antenna setting. |
| Reserved | 7 | 9 |  |

***TGaz Editor: Add the following subclause after 11.22.6.4.7.3***

**11.22.6.4.7.4 First Path AWV FTM exchange**

A first path AWV FTM burst is started when an ISTA sends the RSTA a Fine Timing Measurement Request frame with trigger field set to 2. An PEDMG ISTA may send a Fine Timing Measurement Request frame with the trigger set to 2 only if the RSTA has set the First Path Training Supported subfield to 1 in the Beamforming field of the EDMG capabilities element and the ISTA and RSTA have performed beamforming training for first path as defined in 10.43.9.6. All the Fine Timing Measurement frames sent from the RSTA to the ISTA during the FTM burst and all the ACK frames sent from the RSTA to the ISTA in response the Fine Timing Measurement Frame shall have the setting described in Table 1 (TXVECTOR parameter setting for first path AWV FTM exchange), except when used of AOD and AOA estimation:

Table 1- TXVECTOR parameter setting for first path AWV FTM exchange

|  |  |
| --- | --- |
| TXVECTOR Parameter | Value |
| EDMG\_PACKET\_TYPE | EDMG-TRN-T-PACKET |
| EDMG\_TRN\_LEN | 1 |
| RX\_TRN\_PER\_TX\_TRN | 1 |
| EDMG\_TRN\_P | 0 |
| EDMG\_TRN\_M | 3 |
| EDMG\_TRN\_N | 3 |
| TRN\_SEQ\_LENGTH | Normal |
| FIRST\_PATH\_AWV\_TRN | FIRST\_PATH\_AWV\_ON\_TRN |

The setting of TXVECTOR when the frames are used for AOA and AOD estimation is described in 11.2.6.7.4.2.

When a Fine Timing Measurement frame is sent with the FIRST\_PATH\_AWV\_TRN parameter set to FIRST\_PATH\_AWV\_ON\_TRN the Ack frame sent in response to this frame shall have the FIRST\_PATH\_AWV\_TRN parameter set to FIRST\_PATH\_AWV\_ON\_TRN. In both these frames the TRN field shall be received by the ISTA and RSTA using the first path AWV receive antenna setting.

***TGaz Editor: Modify the text in P119L29-37 as follows:***

An FTM exchange in which the trigger field in the Fine Timing Measurement Request that initiated the exchange is set to 2 is denoted as a first path AWV FTM exchange.In a Direction Measurement FTM pair that agreed on R2I AOA, the ISTA shall add a TRN field to the FTM frames in the exchanges specified by the Direction Measurement Density field by setting the TRN\_LEN to the value of the L\_RX field sent by the RSTA and PACKET\_TYPE to 0. In a first path AWV FTM exchange the ISTA shall set the FIRST\_PATH\_AWV\_TRN TXVECTOR parameter set to FIRST\_PATH\_AWV\_ON\_TRN in the Fine Timing Measurement frames it sends to the RSTA. The ISTA may receive the TRN field using implementation dependent AWV settings.

In a Direction Measurement FTM pair that agreed on I2R AOA, the RSTA shall add a TRN field to the Ack frames in the exchanges specified by the Direction Measurement Density field by setting the TRN\_LEN to the value of the L\_RX field of the DMG Direction Measurement Parameters received from the ISTA and PACKET\_TYPE to 0. In a first path AWV FTM exchange the RSTA shall set the FIRST\_PATH\_AWV\_TRN TXVECTOR parameter set to FIRST\_PATH\_AWV\_ON\_TRN in the Ack frames it sends to the RSTA. The RSTA may receive the TRN field using implementation dependent AWV setting. The RSTA shall provide the AOA measurement results in the Direction Measurement Result element included in the next FTM frame sent to the ISTA.

In a Direction Measurement FTM pair that agreed on R2I AOD, the RSTA shall add a TRN field to the FTM frames in the exchanges specified by the Direction Measurement Density field by setting the TRN\_LEN to a non-zero value and PACKET\_TYPE to 1. In a first path AWV FTM exchange the ISTA shall set the FIRST\_PATH\_AWV\_TRN TXVECTOR parameter set to FIRST\_PATH\_AWV\_ON\_TRN in the Fine Timing Measurement frames it sends to the RSTA. The RSTA shall receive the TRN field using the first path AWV setting. The ISTA may use implementation dependent AWV (such as sectors) in the TRN field.

In a Direction Measurement FTM pair that agreed on I2R AOD, the ISTA shall add a TRN field to the Ack frames in the exchanges specified by the Direction Measurement Density by setting the TRN\_LEN to a non-zero value and PACKET\_TYPE to 1. In a first path AWV FTM exchange the RSTA shall set the FIRST\_PATH\_AWV\_TRN TXVECTOR parameter set to FIRST\_PATH\_AWV\_ON\_TRN in the Ack frames it sends to the RSTA. The ISTA shall receive the TRN field using the first path AWV setting. The RSTA may use implementation dependent AWV (such as sectors) in the TRN field. The RSTA shall set the Best AWV Id field in the Fine Timing Measurement frames sent to the ISTA following these Ack frames to the AWV Id or the Best Sector Index of the TRN field (if the ACK was an EDMG/DMG PPDU respectively). If the RSTA has set the AOD Channel Measurement Feedback subfield to 1 in the DMG Direction Measurement Capabilities field, it shall also append a Channel Measurement Feedback element to the Fine Timing Measurement frames sent to the ISTA following the reception of the Ack frames with PACKET-TYPE equal to TRN-T-PACKET or EDMG-PACKET-TYPE equal to EDMG-TRN-T-PACKET and TRN-LEN greater than 0 or EDMG-TRN-LEN greater than 0.

**References:**

1] Draft P802.11azD1.0

[2] Draft P802.11ayD3.0

[3] Draft P802.11RevMD\_2.1