IEEE P802.11
Wireless LANs

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| LOS Assessment Draft Text |
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|  |  |  |  |  |

Abstract

This document presents the draft text for the LOS assessment for EDMGz devices.

**Discussion**

Location estimation assumes that measurements such as range and direction of arrival or departure are performed on a line of sight path between the devices. This is especially important when location estimation is performed using a single link as is possible in DMGz/EDMGz. Therefore, it is highly desirable to be able to determine whether the path over which the measurement is performed is a line of sight path. One way to detect that a path is not a line of sight path, is to use the polarization changes caused by reflections in a non-line of sight path. These changes can be detected if both sides of the link can repeat the same measurement of phase and power in different polarization. In a LOS path, if both the ISTA and RSTA change polarization on the same TRN subfield by 90 degrees in the same direction maintain the same AWV, the power and phase remain the same. Since reflection change the polarization, the power and phase may not be the same if the path is not a line of sight path. We propose a protocol to utilize this effect to be able to assess whether a path is a non-line of sight path. The protocol gives the ISTA tools to determine if the phase and amplitude measurement in different polarizations indicate NLOS. This protocol is based on PHY features that 11ay provides. The protocol is optional on the RSTA side and optional on the ISTA side as the ISTA initiates the requests.

*Change 1:*

Allow for new values for the trigger

***TGaz Editor: Modify the following text in the P39L24 (D0.4 - 9.6.7.32) as follows:***

***Modify the text in P1422L15 (TGmd D1.0) as follows***:

The Trigger field set to 1 indicates that the initiating STA requests that the responding STA start or continue sending Fine Timing Measurement frames (see 11.22.6 (Fine timing measurement (FTM) procedure)). The Trigger field set to 0 indicates that the initiating STA requests that the responding STA stop sending Fine Timing Measurement frames. The Trigger field is set to 2 to indicate the initiation of an DMGz/EDGMz FTM measurement exchange using the first path AWV (see 11.22.6.4.7.1 (General)). The Trigger field is set to 3 to indicate that the following FTM burst shall contain an LOS assessment measurement. If the FTM burst is performed over the first path AWV and shall contain an LOS assessment measurement the Trigger field is set to 4. Trigger field values ~~2~~5–255 are reserved.

*Change 2:*

Add a field to the capabilities

***TGaz Editor: Add new subfields to table 9-233a (******DMG Direction Measurement Capabilities field)***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 |
|  | AOA TX Capability | AOA RX Capability | AOD TX Capability | AOD RX Capability | AOD Feedback Best TRN subfield | AOD Channel Measurement Feedback | LOS Assessment TX | LOS Assessment RX |
| bits: | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

***TGaz Editor: Add the following text at the end of subclause* 9.4.2.127.7**

The LOS Assessment TX subfield is set to 1 to indicate that the STA can participate in a LOS Assessment exchange by transmitting a LOS Assessment FTM PPDU (see 11.22.6.4.7.3 LOS assessment FTM exchange). The LOS Assessment RX subfield is set to 1 to indicate that the STA can participate in a LOS Assessment exchange as an RSTA by switching polarization at receiving an ACK with TRN field and responding with channel measurement feedback by transmitting a LOS Assessment FTM PPDU.

*Change 3:*

Add a field to the parameters exchange

***TGaz Editor: Add a new field to table 9-4.f – EDMGz Direction Measurement Parameters, replacing the reserved field***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B1 | B2 | B3 | B4 | B5 B12 | B13 B15 | B16 |
|  | UL AOA Request | DL AOA Request | UL AOD Request | DL AOD Request  | L-RX  | Direction Measurement Density | LOSAssessment |
| bits: | 1 | 1 | 1 | 1 | 8 | 3 | 1 |

***TGaz Editor: Modify the last line of 9.4.2.250 (P30L7 in D0.4) as follows:***

The definitions of all fields except the LOS Assessment field, are the same as in 9.4.2.249 (DMGz Specific Parameters).

The LOS Assessment field is set to 1 in an EDMGz Direction Measurement Parameters element sent by an ISTA in an initial FTM frame to indicate a request for LOS assessment in the FTM session (see 11.26.6.4.7.N)

The LOS Assessment field is set to 1 in an EDMGz Direction Measurement Parameters element sent by an RSTA indicates an agreement to include LOS assessment in the FTM session.

*Change 4:*

Negotiation of the LOS exchange in the initial setup.

***TGaz Editor: Add the following text after 11.22.6.3.2:***

**11.22.6.3.3 EDMGz LOS Assessment negotiation**

An EDMGz STA that supports LOS assessment by transmitting a LOS Assessment FTM PPDU shall set the dot11LOSassessmentTXcapable to true and shall set it to false otherwise.

An EDMGz STA that in the role of RSTA supports LOS assessment by switching polarization while receiving a LOS Assessment FTM ACK PPDU and responds with Channel Measurement feedback shall set the dot11LOSassessmentRXcapable to true and shall set it to false otherwise.

An EDMGz STA for which the dot11LOSassessmentTXcapable is true shall set to one the LOS Assessment TX capability subfield in the DMG Direction Measurement Capabilities field.

An EDMGz STA for which the dot11LOSassessmentRXcapable is true shall set to one the LOS Assessment RX capability and the LOS assessment TX capability subfields in the DMG Direction Measurement Capabilities field.

An EDMGz STA in ISTA role for which the dot11LOSassessmentTXcapable is true may establish the FTM session that contain LOS assessment exchanges with other EDMGz STA in RSTA role if the STA’s LOS Assessment TX is set to one. The RSTA may set to one the LOS Assessment TX capability subfield.

The ISTA requests the FTM session by setting to one the LOS Assessment field in an EDMGz Direction Measurement Parameters element in the initial FTM request in the session. The responding RSTA shall set to one the LOS Assessment field in the EDGMz Direction Measurement Parameters element in the initial FTM frame in the session.

*Change 5:*

Add the description of the actual exchange

***TGaz Editor: Add the following subclause after subclause* 11.22.6.4.7.2**

**11.22.6.4.7.3 LOS assessment FTM exchange**

A LOS assessment FTM exchange may provide an ISTA with information about whether the link with the ISTA is over a non-LOS path. A LOS assessment FTM exchange is an EDMGz FTM burst as defined in 11.22.6.4.7.1 or 11.22.6.4.7.2 in which one FTM frame from the RSTA to the ISTA is a LOS assessment FTM PPDU. A LOS assessment FTM burst over the regular AWV is identified by the RSTA setting the FTM trigger to 3 at the FTM request. A LOS assessment FTM burst over the first path AWV is identified by setting the FTM trigger to 4.

A LOS assessment FTM PPDU is defined as a PPDU that contains an FTM frame has the DUAL\_POLARIZATION\_TRNS field set to 1, the EDMG\_TRN\_LEN set to a value greater than 0 and the packet type set to EDMG-TRN-R-PACKET.

The RSTA and the ISTA shall switch polarization while transmitting and receiving the TRN field of the LOS assessment FTM PPDU as described in 29.9.2.2.5 (TRN subfield definition).

If the RSTA has set the LOS Assessment RX subfield to 1 in the DMG Direction Measurement Capabilities field, the ISTA shall respond to a LOS assessment FTM PPDU with an LOS Assessment ACK PPDU.

A LOS Assessment ACK PPDU is defined to be a PPDU that contains an ACK frame and has the DUAL\_POLARIZATION\_TRNS field set to 1, the EDMG\_TRN\_LEN set a value greater than 0 and the packet type set to EDMG-TRN-R-PACKET. The ISTA and the RSTA shall switch polarization while transmitting and receiving the TRN field of the LOS assessment FTM PPDU and the LOS assessment ACK PPDU as described in 29.9.2.2.5 (TRN subfield definition). The RSTA shall send a channel measurement element based on the measurements it performed on the ACK PPDU TRN field in the next FTM frame sent to the ISTA.

Change 6:

Allowing Channel Measurement Feedback to be sent as part of an FTM frame.

***TGay Editor one fields to figure 9-810 Fine Timing Measurement Action field format (P44L96 in D0.3)***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Category | Public Action | Dialog Token | Followup Dialog Token | ToD | ToA | ToD Error |
| Octets | 1 | 1 | 1 | variable | variable | variable | 1 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ToA Error | LCI Report (optional) | Location Civic Report (optional) | Fine Timing Measurement Parameters (optional) | Fine Timing Measurement Synchronization Information (optional) | Ranging Parameters (optional) | Secure LTF Parameters (optional)  | Channel Measurement Feedback (optional) |
| Octets | 1 | 1 | Variable | variable | variable | variable | <TBD> | variable |

***TGaz Editor: Add the following text after the last paragraph of 9.6.7.33 (P41L7 of D0.4)***

The Channel Measurement Feedback element is present in the Fine Timing Measurement frame if the frame is sent after an LOS Assessment ACK PPDU and optionally in response to an ISTA to RSTA angle of departure TRN field on an ACK frame. This field contains the channel measurement feedback (see 20).

**References:**