IEEE P802.11
Wireless LANs

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| Changes to Link Measurement Request/Report frame format |
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Abstract

This submission proposes changes to the format of Link Measurement Request/Report frame.

The proposed changes are in reference to Draft IEEE 802.11ay/D2.2 and IEEE 802.11REVmd\_D2.0.

Problem description:

In D2.1, several optional fields are added to Link Measurement Request frame and Link Measurement Report frame. However, directly adding optional fields to existing frames is generally not a preferred option in 802.11. In some cases, this may even cause some issues in terms of interpreting the added optional fields.

For example, the current format of Link Measurement Report frame is as follows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Category | Radio Measurement Action | Dialog Token | TPC Report element | Receive Antenna ID | Transmit Antenna ID | RCPI  | RSNI |
| Octets | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | DMG Link Margin | DMG Link Adaptation Acknowledgement | Periodic Report Control | Report Interval Start Time | Statistics Reset Time Offset |
| Octets | Variable | Variable | 1 | 4 | 2 |

The last three fields are newly added for periodic link measurement, and are optionally present. Both of DMG Link Margin element and DMG Link Adaptation Acknowledgement element are also optionally present.

The issues for the current format are as follows. When a DMG STA receives a Link Measurement Report frame and decode the frame after RSNI field, it will not be able to know whether the remaining bits are corresponding to the optional DMG Link Margin or DMG Link Adaptation Acknowledge element, or corresponding to the optional Periodic Report Control, Report Interval Start Time, and Statistics Reset Time Offset fields.

As a result, we propose to perform the following changes with respect to the newly added optional fields in Link Measurement Request/Report frame.

Instead of directly adding new optional fields to the end of Link Measurement Request/Report frame, we can combine them as an optional information element. Since every information element is associated with a unique Element ID, a DMG STA that receives a Link Measurement Request/Report frame is therefore able to identify which optional element(s) the frame includes.

The detailed proposed changes are as follows:

**9.6.6.4 Link Measurement Request frame format**

*Change Figure 9-829 as follows:*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Category | Radio Measurement Action | Dialog Token | Transmit Power Used | Max Transmit Power | Extended Link Measurement |  |  |  |  |
| Octets | 1 | 1 | 1 | 1 | 1 | Variable |  |  |  |  |

*Change the following paragraphs as follows:*

The Extended Link Measurement field is optionally present. When present, it contains an Extended Link Measurement element (see 9.4.2.xxx1 (Extended Link Measurement element)).

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**9.6.6.5 Link Measurement Report frame format**

*Change Figure 9-840 as follows:*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Category | Radio Measurement Action | Dialog Token | TPC Report element | Receive Antenna ID | Transmit Antenna ID | RCPI  | RSNI |
| Octets | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | DMG Link Margin | DMG Link Adaptation Acknowledgement | Extended Link Measurement |  |  |  |
| Octets | Variable | Variable | Variable |  |  |  |

*Change the following paragraphs as follows:*

The Extended Link Measurement field is optionally present. When present, it contains an Extended Link Measurement element (see 9.4.2.xxx1 (Extended Link Measurement element)).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
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*Insert the following subclauses*

**9.4.2.xxx1 Extended Link Measurement element**

The Extended Link Measurement element contains additional information to solicit link measurement report and is optionally included in Link Measurement Request frame and Link Measurement Report frame. The format of Extended Link Measurement element is shown in Figure xxx1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Optional Subelements |
| Octets | 1 | 1 | 1 | Variable |

Figure xxx1 --- Extended Link Measurement element format

The Element ID, Length and Element ID Extension fields are defined in 9.4.2.1.

The Optional Subelements field contains zero or more subelements. The subelement format and ordering of subelements are defined in 9.4.3 (Subelements).

The Subelement ID field values for the defined subelements are shown in Table xxx1. A subelement does not appear more than once in the Extended Link Measurement element.

Table xxx1 --- Optional subelement IDs

|  |  |  |
| --- | --- | --- |
| Subelement ID | Name  | Extensible |
| 0 | Periodic Report Request | Yes |
| 1 | EDMG TPC Configuration  | Yes |
| 2 | EDMG Transmit Power | Yes |
| 3 | Periodic Report | Yes |
| 4-255 | Reserved |  |

**9.4.2.xxx2 Periodic Report Request subelement**

The Periodic Report Request subelement contains information to solicit periodic link measurement report and is optionally included in Link Measurement Request frame. The format of Periodic Report Request subelement is shown in Figure xxx2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Report Start Time | Report Interval | Report Count |
| Octets | 4 | 2 | 2 |

Figure xxx2 --- Periodic Report Request subelement format

The Report Start Time subfield indicates the lower 4 octets of the TSF timer at the start of the first reporting interval.

The Report Interval subfield indicates the interval of time, in microseconds, at which the responding STA needs to take measurements and send an unsolicited Link Measurement Report frame to the requesting STA. The value 0 is reserved.

The Report Count subfield indicates the number of report intervals. A responding STA sends an unsolicited Link Measurement Report frame to the requesting STA for every report interval. The value 0 is reserved.

**9.4.2.xxx3 EDMG TPC Configuration subelement**

The EDMG TPC Configuration subelement contains information for EDMG transmit power control configuration and is optionally included in Link Measurement Request frame. The format of EDMG TPC Configuration element is shown in Figure xxx3.

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 B7 |
|  | Channel Aggregation | Number of TX Chains (NTX) | Reserved |
| Bits | 1 | 3 | 4 |

Figure xxx3 --- EDMG TPC Configuration subelement format

The Channel Aggregation subfield is set to 1 to indicate that the PPDU containing the Link Measurement Request frame is transmitted over a 2.16+2.16 GHz or a 4.32+4.32 GHz channel, and is set to 0 otherwise.

The Number of TX Chains (NTX) subfield indicates the number of transmit chains used in the transmission of the PPDU containing the Link Measurement Request frame. If the Channel Aggregation subfield is 1, the Number of TX Chains subfield is an even number.

**9.4.2.xxx4 EDMG Transmit Power subelement**

The EDMG Transmit Power subelement contains information for transmit power in link measurement and is optionally included in Link Measurement Request frame. The format of EDMG Transmit Power subelement is shown in Figure xxx4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Transmit Power  | Max Transmit  | … | Transmit Power  | Max Transmit  |
| Octets | 1 | 1 |  | 1 | 1 |

Figure xxx4 --- EDMG Transmit Power subelement format

The Report Start Time subfield indicates the lower 4 octets of the TSF timer at the start of the first reporting interval.

Each Transmit Power subfield, 1 ≤ i ≤ NTX, indicates the transmit power used in the transmit chain i to transmit the PPDU containing the Link Measurement Request frame, as described in 9.4.1.20.

Each Max Transmit subfield, 1 ≤ i ≤ NTX, indicates the upper limit on the transmit power of the transmit chain i measured at the output of the antenna connected to be used by the transmitting STA on its operating channel. This subfield is described in 9.4.1.19. Each Max Transmit Power subfield is a 2s complement signed integer providing an upper limit, in a dBm scale, on the transmit power as measured at the output of the antenna connector to be used by the transmitting STA on its operating channel. The maximum tolerance for the value reported in each Max Transmit subfield is ±5 dB. The value of each Max Transmit Poweri subfield is equal to the minimum of the maximum powers at which the STA is permitted to transmit in the operating channel by device capability, policy, and regulatory authority.

**9.4.2.xxx5 Periodic Report subelement**

The Periodic Report subelement contains information in response to periodic link measurement request and is optionally included in Link Measurement Report frame. The format of Periodic Report subelement is shown in Figure xxx5.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Periodic Report Control | Report Interval Start Time | Statistics Reset Time Offset |
| Octets | 1 | 4 | 2 |

Figure xxx5 --- Periodic Report subelement format

The Periodic Report Control subfield contains indications of whether the responding STA accepts or rejects the periodic link measurement request, and whether the Periodic Report subelement includes optional fields used for periodic link measurement reports. The field is shown in Figure xxx6.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 B7 |
|  | Accept/Reject Periodic Report | Indication for Report Interval Start Time | Indication for Statistics Reset Time Offset | Reserved |
| Bits | 1 | 1 | 1 | 5 |

Figure xxx6 --- Periodic Report Control subfield format

The Accept/Reject Periodic Report subfield is set to 1 if the responding STA accepts periodic report, and is set to 0 if the responding STA rejects periodic report.

The Indication for Report Interval Start Time subfield is set to 1 if the Link Measurement Report frame contains the Report Interval Start Time field. It is set to 0 otherwise.

The Indication for Statistics Reset Time Offset subfield is set to 1 if the Link Measurement Report frame contains the Statistics Reset Time Offset field. It is set to 0 otherwise.

The Report Interval Start Time field is optionally present. If present, it indicates the lower 4 octets of the TSF timer at the start of the report interval of the corresponding Link Measurement Report frame.

The Statistics Reset Time Offset field is optionally present. If present, it indicates the relative time offset, in microseconds, of the last event when the reset condition (see 9.4.2.142.6) is met since the start of the corresponding reporting interval.

**10.44 DMG Link Adaptation**

**10.44.1 General**

If the Link Measurement Request frame is sent within a PPDU defined in Clause 29, the Number of Transmit Chains Reported (NTX) field in the DMG Link Margin element within the Link Measurement Report frame shall be set to the same value indicated in the EDMG TPC Configuration subelement within the Link Measurement Request. In this case, the requesting STA may use the reported MCS, SNR, and link margin values when transmitting frames to the STA indicated in the RA field of the Link Measurement Request frame using multiple transmit chains.

To initiate a periodic link measurement with a peer STA, the requesting STA shall transmit a Link Measurement Request frame to the peer STA that includes the Periodic Report Request subelement. The requesting STA should transmit at least one Management or Data frame (e.g., a QoS Null frame) to the peer STA, preferably requiring acknowledgement, every interval of time indicated by the value of the Reporting Interval field within the Periodic Report Request subelement to keep the statistics reported in the periodic Link Measurement Report frames transmitted by the peer STA updated.

*Change the third paragraph as follows*

If the Dialog Token field in the Link Measurement Request frame is equal to a nonzero value, the responding STA shall perform the measurement on the next frame received from the requesting STA and shall send back a Link Measurement Report frame corresponding to the received frame. If the Link Measurement Request frame includes the Periodic Report Request subelement and the responding STA accepts a periodic link measurement request, at the time indicated by the value of the Reporting Start Time subfield, the responding STA shall send at least one Link Measurement Report frame including the Periodic Report subelement to the requesting STA for each report interval. The transmission of this unsolicited Link Measurement Report frame should be as close as possible to the start of each consecutive report interval subject to channel access rules. The total number of report intervals shall be equal to the value of the Reporting Count subfield in the Link Measurement Request frame. If the Link Measurement Request frame includes the Periodic Report Request subelement and the responding STA rejects a periodic link measurement request, the responding STA shall transmit a Link Measurement Report frame and set the Accept/Reject Periodic Report subfield within the Periodic Report Control field of the Periodic Report subelement to 0.

**6.3.32.2 MLME-LINKMEASURE.request**

**6.3.32.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-LINKMEASURE.request(

PeerMACAddress,

DialogToken,

Transmit Power,

Max Transmit Power,

Periodic Report Request,

EDMG TPC Configuration,

EMDG Transmit Power,

VendorSpecificInfo.

)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid Range | Description |
| PeerMACAddress | MACAddress | Any valid individual MAC address | The address of the peer MAC entity to which the LinkMeasure Request shall be sent. |
| DialogToken transaction. | Integer  | 1–255 | The dialog token to identify the Link Measure |
| TransmitPower | Integer | As defined in9.6.6.4 (LinkMeasurementRequest frameformat) | The transmit power to be used when transmitting theLink Measurement Request frame and included in the frame body. See 9.6.6.4 (Link Measurement Request frame format). |
| Max TransmitPower | Integer | As defined in9.6.6.4 (LinkMeasurementRequest frameformat) | The maximum transmit power to be used by the transmitting STA on its operating channel, as described in 9.4.1.20 (Transmit Power Used field). |
| Periodic Report Request | As defined in 9.4.2.xxx2 (Periodic Report Request subelement) | As defined in 9.4.2.xxx2 (Periodic Report Request subelement) | Optional subelement included to request periodic report. |
| EDMG TPC Configuration | As defined in 9.4.2.xxx3 (EDMG TPC Configuration subelement)  | As defined in 9.4.2.xxx3 (EDMG TPC Configuration subelement) | Optional subelement included for transmit power control. |
| EMDG Transmit Power | As defined in 9.4.2.xxx4 (EDMG Transmit Power subelement) | As defined in 9.4.2.xxx4 (EDMG Transmit Power subelement) | Optional subelement included for transmit power information in link measurement. |
| VendorSpecificInfo | A set ofelements | As defined in9.4.2.25 (VendorSpecific element) | Zero or more elements |

**Straw Poll:**

* **Do you agree to accept proposed changes in doc 11-19/0059r0?**