IEEE P802.11
Wireless LANs

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| 11be Spec text for various motions related to MLO Power-save Procedure |
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Abstract

We propose the draft text related to motions on MLO power-save procedure (specifically listen interval) to help the creation of TGbe draft D0.3.

Revisions:

* Rev 0: Initial version of the document.

**The proposed texts is based on the following motions:**

The Listen Interval field in the (Re)Association Request frame sent by a non-AP MLD shall apply to the MLD level, and not to the STA level in R1.

**[Motion 135, #SP241[183]]**

The AP MLD aging function shall not cause the buffered BUs to be discarded after any period that is shorter than that indicated by the non-AP MLD for which the BUs are buffered in the Listen Interval field of its (Re)Association Request frame in R1.

* This is independent of MSDU lifetime, which is also used to discard the frames.
* The exact specification of the aging function is beyond the scope of this standard.

**[Motion 135, #SP242[183]]**

The existing Listen Interval field in the (Re)Association Request frame is reused for the non-AP MLD in R1.

**[Motion 135, #SP243[183]]**

The value of the Listen Interval field sent by the non-AP MLD is in units of the maximum value of beacon intervals corresponding to the links that the non-AP MLD intends to setup in R1.

**[Motion 137, #SP247 [184]]**

In R1, an AP MLD may delete buffer for the implementation dependent reasons, including the use of an aging function and availability of buffers where the aging function is based on the listen interval indicated by the non-AP MLD in its (Re)Association Request frame.

**[Motion 137, #SP248 [184]]**

**Proposed spec text:**

The baseline for this text is 802.11 REVmd draft D5.0 and 802.11be D0.2.

* **Listen Interval field**

***TGbe editor: Please update this subclause as follows:***

* + - * 1. **General**

The Listen Interval field is used to indicate to the AP how often an S1G STA with dot11NonTIMModeActivated equal to false in power save mode wakes to listen to Beacon frames. It is also used to indicate to an AP the duration during which an S1G STA with dot11NonTIMModeActivated equal to true is required to transmit at least one frame that is addressed to the associated AP.

The Listen Interval field is used to indicate to the AP how often a non-S1G STA that has performed an association that is not a multi-link setup and is in power save mode wakes to listen to Beacon frames.

The Listen Interval field is used to indicate to the AP MLD how often at least one STA of an associated non-AP MLD that has all its affiliated STAs in power save mode wakes to listen to Beacon frames transmitted by the AP of the AP MLD operating on its link.

This field is derived from the ListenInterval parameter when present as a parameter of an MLME primitive.

or an AP MLD or a non-AP MLD

* + - * 1. **Listen interval value**

When a non-AP STA transmits a (Re)Association Request frame sent to initate an association that not a multi-link setup, the value of listen interval for that STA is in units of beacon interval if dot11ShortBeaconInterval is false and in units of short beacon interval if dot11ShortBeaconInterval is true (see 11.1.3.10.2 (Generation of S1G Beacon frames)). When a STA transmits a (Re)Association Request frame sent to initate a multi-link setup, the value of listen interval requested by the non-AP MLD affiliated with the STA is in units of maximum value of beacon intervals corresponding to the links that the non-AP MLD intends to setup. An AP MLD computes the listen interval value to be used for a non-AP MLD by following the procedure defined in 35.3.9.3 (Listen interval of a non-AP MLD).

* + - * 1. **Listen Interval field format**

The length of the Listen Interval field is 2 octets. The Listen Interval field is shown in Figure 9-88 (Listen Interval field format carried in a non-S1G PPDU).

NOTE—The value 0 might be used by a STA or a non-AP MLD that never enters power save mode.

|  |  |
| --- | --- |
|  | Listen Interval |
| Octets: | 2 |
| * **Listen Interval field format carried in a non-S1G PPDU**
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The Listen Interval field carried in an S1G PPDU is shown in Figure 9-89 (Listen Interval field format carried in an S1G PPDU).

|  |  |  |
| --- | --- | --- |
|  | B0 B13 | B14 B15 |
|  | Unscaled Interval | Unified Scaling Factor |
| Bits: | 14 | 2 |
| * **Listen Interval field format carried in an S1G PPDU**
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In an S1G STA, the ListenInterval parameter used by the MLME primitives is equal to the Unscaled Interval subfield multiplied by the scaling factor that corresponds to the value indicated in the Unified Scaling Factor subfield. The Unified Scaling Factor subfield encoding is defined in Table 9-48 (Unified Scaling Factor subfield encoding).

|  |
| --- |
| * **Unified Scaling Factor subfield encoding**
 |
| **Unified Scaling Factor** | **Scaling factor** |
| 0 | 1 |
| 1 | 10 |
| 2 | 1000 |
| 3 | 10 000 |

* Multi-link power management

***TGbe editor: Please add a new subclause under this clause as shown below:***

* + - 1. Listen Interval of a non-AP MLD

It is possible that an AP MLD accepts a subset of links during multi-link (re)setup by following the procedure defined in 35.3.5.1 (Multi-link (re)setup procedure). The AP MLD computes the listen interval for a non-AP MLD based on the value carried the Listen Interval field of the (Re)Association Request frame and the links established during multi-link (re)setup as follows:

LIactual = ceil ( LIrequested x ( max(BIrequested)/max(BIaccepted) ) )

where,

LIactual is the listen interval value to be used by the AP MLD for making decisions on discarding buffered BUs for the non-AP MLD (see 11.2.3.6 (AP or AP MLD operation)). It is in units of maximum value of beacon intervals corresponding to the links that are accepted during multi-link (re)setup

LIrequested is the value carried in the Listen Interval field of the (Re)Association Request frame received from a STA of the non-AP MLD during mutli-link (re)setup

max(BIrequested) is the maximum value of beacon intervals corresponding to the links that are requested by the non-AP MLD in the (Re)Association Request frame during multi-link (re)setup.

max(BIaccepted) is the maximum value of beacon intervals corresponding to the links that are accepted by the AP MLD in the (Re)Association Response frame during multi-link (re)setup.

NOTE – By rounding the computed listen interval value to the next BI, the AP MLD can ensure that it doesn’t discard the buffered BUs before the listen interval requested by the non-AP MLD (in the (Re)Association Request frame) expires.

* Multi-link (re)setup procedure

***TGbe editor: Please update the 3rd and 4th paragraph in this subclause as follows:***

A STA of a non-AP MLD shall include Basic variant Multi-Link element in (Re)Association Request frame to initiate a multi-link (re)setup. In the (Re)Association Request frame, the non-AP MLD indicates the links that are requested for (re)setup as described in 35.3.5.4 (Usage and rules of Basic variant Multi-link element in the context of multi-link setup).

* AP or AP MLD operation

***TGbe editor: Please update the kth item of the following paragraph in this subclause as follows:***

The following rules describe the operation:

* An AP or AP MLD may delete buffered BUs for implementation dependent reasons (subject to 11.2.3.10 (AP or AP MLD aging function)), including the use of an aging function and availability of buffers. An AP may base the aging function on the listen interval indicated by the non-AP STA in its (Re)Association Request frame sent to initiate an association that is not a multi-link setup or the WNM sleep interval specified by the non-AP STA in the WNM Sleep Mode Request frame. An AP MLD may base the aging function on the listen interval established after multi-link setup (see 35.3.9.3 (Listen interval of a non-AP MLD)) or the WNM sleep interval specified by a STA of a non-AP MLD in the WNM Sleep Mode Request frame. In addition, the S1G AP may base the aging function on the listen interval indicated by the AP in the (Re)Association Response frame.
* **AP or AP MLD aging function**

***TGbe editor: Please add a new paragraph in this subclause before the NOTE as follows:***

Any AP aging function shall not cause the buffered BU to be discarded after any period that is shorter than that indicated by the STA for which the BUs are buffered, in the Listen Interval field of its (Re)Association Request frame. The exact specification of the aging function is beyond the scope of this standard.

Any AP MLD aging function shall not cause the buffered BU to be discarded after any period that is shorter than listen interval computed for a non-AP MLD after multi-link setup (see 35.3.9.3 (Listen interval of a non-AP MLD)). The exact specification of the aging function is beyond the scope of this standard.

NOTE—This aging function is independent of (i.e., in addition to) other causes of MSDU discard within the MAC, such as due to the operation of a per-TS MSDU lifetime, or related to dot11QAPEDCATableMSDULifetime.

* **4-way handshake implementation considerations**

***TGbe editor: Please update the following paragraph in this subclause as follows:***

If the Authenticator does not receive a reply to its messages, it shall attempt dot11RSNAConfigPairwiseUpdateCount transmits of the message, plus a final timeout. The retransmit timeout value shall be 100 ms for the first timeout, half the listen interval for the second timeout, and the listen interval for subsequent timeouts. If there is no listen interval or the listen interval is zero, then 100 ms shall be used for all timeout values. If it still has not received a response after these retries, then for PTK generation the Authenticator should deauthenticate the STA or the non-AP MLD.

* **Group key handshake implementation considerations**

***TGbe editor: Please update the following paragraph in this subclause as follows:***

If the Authenticator does not receive a reply to its messages, it shall attempt dot11RSNAConfigGroupUpdateCount transmits of the message, plus a final timeout. The retransmit timeout value shall be 100 ms for the first timeout, half the listen interval for the second timeout, and the listen interval for subsequent timeouts. If there is no listen interval or the listen interval is zero, then 100 ms shall be used for all timeout values. If it still has not received a response after this, then the Authenticator’s STA should use the MLME-DEAUTHENTICATE.request primitive to deauthenticate the STA or the non-AP MLD.