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| Re: | "IEEE 802.16n-11/0020," in response to Call for Comments on GRIDMAN AWD |
| Abstract | Messages related to Multimode Operation on IEEE 802.16 GRIDMAN Amendment Draft Standard |
| Purpose | To discuss and adopt the proposed text in the draft amendment document on GRIDMAN |
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# Messages related to Multimode Operation over IEEE 802.16n

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## 1. Introduction

IEEE 802.16.n AWD [2] (i.e. over WirelessMAN-OFDMA [4]) describes the multimode operation and its message. However, no message format is defined. Thus, this document provides message description of multimode operation over IEEE 802.16n[4] to be consistent with that over IEEE 802.16.1a.

Message format description provided in this document is including:

- R-link channel descriptor (RCD) message (6.3.2.3.60, 11.24)

- RS-Config-CMD message (6.3.2.3.63, 11.25)

- MM-ADV message (6.3.2.3.98.1, 11.xy.1 (expected 11.32.1))

- MM-RS-REQ/RSP message (6.3.2.3.98.2, 11.xy.2 (expected 11.32.2))

- MM-RL-REQ/RSP message (6.3.2.3.98.3, 11.xy.3 (expected 11.32.3))

## 2. References

[1] IEEE 802.16n-10/0048r2, 802.16n System Requirement Document including SARM annex, July 2011.
[2] IEEE 802.16n-11/0024, P802.16n Draft AWD, October 2011.
[3] IEEE 802.16n-11/0025, P802.16.1a Draft AWD, October 2011.
[4] IEEE P802.16Rev3/D2, IEEE Draft Standard for Local and metropolitan area networks; Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems," October 2011.
[5] IEEE P802.16.1$^{TM}$/D2, [Draft] WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems, October 2011.

## 3. Proposed Text on the IEEE 802.16n Amendment Draft Standard

[----------Start of Text Proposal----------]

**[*Remedy1: Insert the following text in 6.3.2.3 in the 802.16n AWD.*]**

### 6.3.2.3.60 R-link channel descriptor (RCD) message

*Insert the following text after 5th paragraph (before Table 184) of 6.3.2.3.60:*

In addition, RCD message consists of TLVs that define the characteristics of relay link between an HR-BS acting as HR-RS or HR-MS acting as HR-RS and its superordinate station, with every instance of RS replaced by HR-BS acting as HR-RS or HR-MS acting as HR-RS.

### 6.3.2.3.63 RS configuration command (RS_Config-CMD) message

*Insert the following text after 2nd paragraph (before Table 187) of 6.3.2.3.63:*

In addition, RS_Config-CMD message consists of TLVs that provide configuration parameters that are applicable to an HR-BS acting as HR-RS or HR-MS acting as HR-RS, with every instance of RS replaced by HR-BS acting as HR-RS or HR-MS acting as HR-RS.

**[*Remedy2: Insert the following text at the end of 6.3.2.3.98.1 (line 29, page 12) in the 802.16n AWD:*]**

**Table aaa - MM-ADV message format**

| Syntax | Size (bit) | Notes |
|---|---|---|
| MM-ADV message format () { | - | - |
| **Management Message Type = xx** | 8 | - |
| **Action Type** | 3 | Used to indicate the purpose of this message<br>0b000: Reconfiguration of HR-BS/RS including multimode BS/RS<br>0b001: Restart of HR-BS/RS including multimode BS/RS<br>0b010: Power down (including FA down) of HR-BS/RS including multimode BS/RS<br>0b011: Power reduction of HR-BS/RS including multimode BS/RS<br>0b100: Backhaul link down of HR-BS<br>0b101: Backhaul link up of HR-BS<br>0b110: FA change of HR-BS/RS including multimode BS/RS<br>0b111: Multimode service end of HR-MS |
| *reserved* | 5 | |
| **TLV encodings for MM-ADV** | *variable* | TLV-specific |

| Syntax | Size (bit) | Notes |
|---|---|---|
| } | | |

All parameters according to action type are coded as TLV tuples, as defined in 11.xy.1.

The following parameter shall be included if action type is set to 0b000, 0b001, 0b010, and 0b011 may be included if action type is set to 0b101, 0b110, and 0b111 in MM-ADV message:

**Time to start the action**

Expected time to start the action in unit of 8-bit LSBs of frame number

The following parameter shall be included if action type is set to 0b000, 0b001, and 0b011 may be included if action type is set to 0b010, 0b100, and 0b110 in MM-ADV message:

**Time during action**

Expected time during the action in unit of 8-bit LSBs of frame number

The following parameters may be included only if action type is set to 0b000 in MM-ADV message:

**New DCD**

New DCD setting that the BS will use after the reconfiguration

**New UCD**

New UCD setting that the BS will use after the reconfiguration

The following parameter shall be included only if action type is set to 0b011 in MM-ADV message:

**Tx Power Reduction**

dB value of Tx power reduction, included in DCD setting

The following parameter shall be included only if action type is set to 0b110 in MM-ADV message:

**FA index**

FA index that the BS will use after changing FA, included in DCD setting

**[*Remedy3: Insert the following text at the end of 6.3.2.3.98.2 (line 33, page 12) in the 802.16n AWD:*]**

**Table aaa+1 - MM-RS-REQ message format**

| Syntax | Size (bit) | Notes |
|---|---|---|
| MM-RS-REQ message format () { | - | - |
| **Management Message Type = xx+1** | 8 | - |
| **TLV Encoded Information** | *variable* | TLV-specific |
| } | | |

All parameters are coded as TLV tuples, as defined in 11.xy.2.

The following parameter shall be included in the MM-RS-REQ message when the message is relayed from an SS to the MR-BS by a scheduling HR-RS operating in local CID allocation mode:

**Station Information TLV**

This following parameters shall be included in the MM-RS-REQ message sent by all RS types:

**RSRTG**

**RSTTG**

This following parameters shall be included in the MM-RS-REQ message sent by an HR-MS to act as HR-RS when the HR-MS acting as HR-RS supports the capability to support the centralized scheduling mode of operation:

**Minimum RS forwarding delay in direct relay zone TLV**

The minimum RS forwarding delay TLV indicates the minimum delay between an RS receiving and forwarding a MAC PDU when operating in centralized scheduling mode.

**Minimum RS forwarding delay TLV**

The minimum RS forwarding delay TLV indicates the minimum delay between an RS receiving and forwarding a MAC PDU when operating in centralized scheduling mode.

This following parameters shall be included in the MM-RS-REQ message sent by an HR-MS to act as HR-RS when the HR-MS acting as HR-RS supports the capability to support the STR relay mode of operation:

**Supported second RS carrier configurations**

to enable the RS to indicate the different second carrier configurations supported. Two of these TLVs enable the supported band configurations to be indicated and the third the minimum separation required between the carrier frequencies used by the RS.

**[*Remedy4: Insert the following text at the end of 6.3.2.3.98.3 (line 37, page 12) in the 802.16n AWD:*]**

**Table aaa+2 - MM-RS-RSP message format**

| Syntax | Size (bit) | Notes |
|---|---|---|
| MM-RS-RSP message format () { | - | - |
| **Management Message Type = xx+2** | 8 | - |
| **TLV Encoded Information** | *variable* | TLV-specific |
| } | | |

All parameters are coded as TLV tuples, as defined in 11.xy.3.

The following parameter shall be included in the MM-RS-RSP message when the message is transmitted from a superordinate HR-BS in response to request by the subordinate station:

**Response code**

The following parameter shall be included in the MM-RS-RSP message when the response code is set to 0x00 and the message is relayed from an SS to the MR-BS by a scheduling HR-RS operating in local CID allocation mode:

**Station Information TLV**

This following parameters shall be included in the MM-RS-RSP message when the response code is set to 0x00 and for all RS types:

**RSRTG**

**RSTTG**

This following parameters shall be included in the MM-RS-RSP message sent when the response code is set to 0xb00 and the HR-MS acting as HR-RS supports the capability to support the centralized scheduling mode of operation:

**Minimum RS forwarding delay in direct relay zone TLV**

The minimum RS forwarding delay TLV indicates the minimum delay between an RS receiving and forwarding a MAC PDU when operating in centralized scheduling mode.

**Minimum RS forwarding delay TLV**

The minimum RS forwarding delay TLV indicates the minimum delay between an RS receiving and forwarding a MAC PDU when operating in centralized scheduling mode.

This following parameters shall be included in the MM-RS-RSP message sent by HR-BS to subordinate HR station to act as HR-RS when response code is set to 0x00 and the HR-MS acting as HR-RS supports the capability to support the STR relay mode of operation:

**Supported second RS carrier configurations**

to enable the RS to indicate the different second carrier configurations supported. Two of these TLVs enable the supported band configurations to be indicated and the third the minimum separation required between the carrier frequencies used by the RS.

This following parameter shall be included in the MM-RS-RSP message sent by HR-BS to subordinate HR station to act as HR-RS when response code is set to 0x01:

**Action Time**

to allow the request after the action time expires.

**[*Remedy5: Insert the following text at the end of 6.3.2.3.98.4 (line 42, page 12) in the 802.16n AWD:*]**

**Table aaa+3 - MM-RL-REQ message format**

| Syntax | Size (bit) | Notes |
|---|---|---|
| MM-RL-REQ message format () { | - | - |
| **Management Message Type = xx+3** | 8 | - |
| **Release request code** | 2 | Used to indicate the purpose of this message<br><br>0b00: multimode release<br>0b01: response for the unsolicited MM-RL-RSP message by HR-BS<br>0b01: reject for the unsolicited MM-RL-RSP message by HR-BS. This code is applicable only when UL data is pending to transmit.<br>0b11: *reserved* |
| *Reserved* | 6 | |
| } | | |

**[*Remedy6: Insert the following text at the end of 6.3.2.3.98.5 (line 4, page 13) in*

***the 802.16n AWD:*]**

**Table aaa+4 - MM-RL-RSP message format**

| Syntax | Size (bit) | Notes |
|---|---|---|
| MM-RL-RSP message format () { | - | - |
| **Management Message Type = xx+4** | 8 | - |
| **Action code** | 2 | Used to indicate the purpose of this message<br><br>0b00: HR-MS shall immediately terminate multimode service and return its original HR-MS mode.<br>0b01: HR-MS shall terminate multimode service and return its original HR-MS mode at the action time expires<br>0b10: In response to MM-RL-REQ message to allow HR-MS to transmit MS-initiated request after action time expires<br>0b11: In response to MM-RL-REQ message to reject the request of HR-MS |
| *Reserved* | 6 | |
| } | | |

All parameters are coded as TLV tuples, as defined in 11.xy.3.

The following parameter shall be included in the MM-RL-RSP message when the action code is set to 0b01 or 0b10 in response to MM-RL-REQ:

**Action Time**

to start releasing the multimode or re-transmit MM-RL-REQ message after this action time expires.

**[*Remedy7: Insert the following text in 11.24 in the 802.16n AWD:*]**

## 11.24 R-link channel descriptor (RCD) TLV encoding

### 11.24.1 Generic channel description

*Change the 1st sentence of 11.24.1 as follows:*

This field may be used by an MR-BS to configure one or all RSs, including HR-BS acting as HR-RS and HR-MS acting as HR-RS.

### 11.24.2 Reserved preamble indexed for mobile relay station

*Change the 1st sentence of 11.24.2 as follows:*

This field may be used by an MR-BS to broadcast to relay stations the preamble indexes reserved for the mobile relay stations, including HR-BS acting as HR-RS and HR-MS acting as HR-RS.

### 11.24.3 Preamble reselection thresholds for mobile relay station

*Change the 1st sentence of 11.24.3 as follows:*

This field may be used by an MR-BS to broadcast the preamble reselection thresholds for moving relay station, including HR-BS acting as HR-RS and HR-MS acting as HR-RS.

**[*Remedy8: Add the following text in 11.25 in the 802.16n AWD.*]**

## 11.25 RS_Config-CMD message TLV encoding

### 11.25.1 Generic configuration

*Change the 1st sentence of 11.25.1 as follows:*

This field may be used by an MR-BS to configure one or a group of RSs, including HR-BS acting as HR-RS and HR-MS acting as HR-RS with every instance of RS replaced by HR-BS acting as HR-RS or HR-MS acting as HR-RS.

### 11.25.2 MBS configuration

*Change the 1st sentence of 11.25.2 as follows:*

This TLV is sent by an MR-BS to an RS, including HR-BS acting as HR-RS and HR-MS acting as HR-RS, to configure the parameters for MBS.

### 11.25.3 Cooperative diversity configuration

*Change the 1st sentence of 11.25.3 as follows:*

This TLV is sent by an MR-BS to an RS, including HR-BS acting as HR-RS and HR-MS acting as HR-RS, to configure the cooperative diversity mode. The parameters shall be effective in STC DL zones where STC is not .“0b00.” in the corresponding STC_DL_Zone_IE.

### 11.25.4 Local CID allocation configuration

This TLV is transmitted by the MR-BS to related RSs, including HR-BS acting as HR-RS and HR-MS acting as HR-RS, to update CIDs when CID (re-)allocation is required. Upon receiving, the RS shall (re-)configure CID allocation accordingly.

***[Remedy9: Insert the following text at the end of 11 (in line 1, page 35)~~in 11.25~~ in the 802.16n AWD.]***

*Insert new subclause 11.xy at the end of 11 (after 11.31) as indicated:*

## 11.xy Message encodings for HR-Networks

### 11.xy.1 MM-ADV message encodings

The encodings described in this subclause are specific to the MM-ADV message (6.3.2.3.98.1)

| Name | Type | Length | Value |
|---|---|---|---|
| Time to start the action | 1 | 1 | Start time of the action in unit of 8-bit LSBs of frame number.<br>It indicates the unavailable time due to reconfiguration (0b000), restart (0b001), power down (0b010), backhaul link down (0b100), or FA change (0b110)<br>It also indicates the time for power reduction(0b011) or expected backhaul link up (0b111). |
| Time during action | 2 | 1 | Time for the action in unit of 8-bit LSBs of frame number.<br>If acting type is set to 0b000, 0b001, or 0b100, it is the unavailable time interval.<br>After this time during action, BS will reconfigure (0b000), restart service (0b001), or backhaul link available either by itself or via neighbor HR-BS (0b100). |
| DCD setting | 3 | *variable* | The DCD_settings is a compound TLV value that encapsulates TLVs from the BS' DCD message that may be transmitted in the advertised BS downlink channel after reconfiguration |
| UCD setting | 4 | *variable* | The UCD_settings is a compound TLV value that encapsulates TLVs from the BS' UCD message that may be transmitted in the advertised BS downlink channel after reconfiguration |

### 11.xy.2 MM-RS-REQ/RSP message encodings

The TLV encodings defined in Table 731a and this subclause are specific to the MM-RS-REQ (6.3.2.3.98.2) and MM-RS-RSP (6.3.2.3.98.3) MAC management message dialog.

**Table 731a - MM-RS-REQ/RSP management message encodings**

| Type | Parameter | Type | Parameter |
|---|---|---|---|

**Table 731a - MM-RS-REQ/RSP management message encodings**

| | | | |
|---|---|---|---|
| 1 | RS operational mode | 7 | Minimum RS forwarding delay |
| 2 | Response code | 8 | Supported second RS carrier configurations |
| 3 | Station Information | 9 | Action Time |
| 4 | RSRTG | | |
| 5 | RSTTG | | |
| 6 | Minimum RS forwarding delay in direct relay zone | | |

### 11.xy.2.1 RS operation mode

This TLV indicates the HR-RS PHY features supported by the subordinate station (i.e., HR-MS acting as HR-RS or HR-BS acting as HR-RS) and the superordinate HR-BS.

| Type | Length | Value | Scope |
|---|---|---|---|
| 1 | 2 | Bit 0: access zone preamble transmission support<br>Bit 1: MBS Data Synchronization with pre-defined relative transmission time (6.3.23.3)<br>Bit 2: MBS data synchronization with target transmission time (6.3.23.3)<br>Bit 3: cooperative relay support<br>Bit 4: support of a second carrier frequency at RS (see 8.4.4.7.2.2)<br>Bit 5: support STR RS operation (see 8.4.4.7.2.3)<br>Bits 6–9: Maximum number of HARQ channels supported in UL_DCH<br>Bit 10: FDD support in access link<br>Bit 11: H-FDD support in access link<br>Bit 12: FDD support in relay link<br>Bit 13: H-FDD support in relay link<br>Bit 14–15: *Reserved* | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.2 Response code

This TLV indicates the response code in response the request using MM-RS-REQ.

| Type | Length | Value | Scope |
|---|---|---|---|
| 2 | 1 | Bit 0: to accept the request<br>Bit 1: to allow retransmit after action time expires<br>Bit 2 : to reject the request<br>Bit 3-7 : *Reserved* | MM-RS-RSP |

### 11.xy.2.3 Station Information

This TLV indicates the HR-RS station information supported by the subordinate station (i.e., HR-MS acting as HR-RS or HR-BS acting as HR-RS).

| Type | Length | Value | Scope |
|---|---|---|---|
| 3 | 10 | Bit 0–47: SS MAC address<br>Bit 48–63: SS basic CID<br>Bit 64–79: SS primary management CID | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.4 RSRTG

This TLV shall be used to indicate the RSRTG of the HR-RS.

| Type | Length | Value | Scope |
|---|---|---|---|
| 4 | 10 | RSRTG in μs | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.5 RSTTG

This TLV shall be used to indicate the RSTTG of the HR-RS.

| Type | Length | Value | Scope |
|---|---|---|---|
| 5 | 10 | RSTTG in μs | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.6 Minimum RS forwarding delay in direct relay zone

| Type | Length | Value | Scope |
|---|---|---|---|
| 6 | *variable* | The RS downlink process delay is a compound TLV value that encapsulates TLVs that may be transmitted by HR-MS to act as HR-RS.<br>RS forwarding delay in DL direct relay zone (unit: OFDMA symbols) and/or RS forwarding delay in UL direct relay zone (unit: OFDMA symbols) may be included (see 11.8.19). | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.7 Minimum RS forwarding delay

| Type | Length | Value | Scope |
|---|---|---|---|
| 7 | *variable* | The RS downlink process delay is a compound TLV value that encapsulates TLVs that may be transmitted by HR-MS to act as HR-RS.<br>RS forwarding delay in DL zone and/or RS forwarding delay in UL zone may be included (see 11.8.20). | MM-RS-REQ, MM-RS-RSP |

### 11.xy.2.8 Supported second RS carrier configuration

| Type | Length | Value | Scope |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 8 | *variable* | The Supported second RS carrier configuration is a compound TLV value that encapsulates TLVs that may be transmitted by HR-MS to act as HR-RS.<br>predefined second carrier configurations or undefined subbands to be supported by the HR-RS (See 11.8.3.5.24) | MM-RS-REQ, MM-RS-RSP |

**11.xy.2.9 Action Time**

This TLV shall be included in the MM-RS-RSP message sent by HR-BS to subordinate HR station to act as HR-RS to allow the request after the action time expires:

| Type | Length | Value | Scope |
|---|---|---|---|
| 9 | 1 | Bit 0-3: 4-bit LSBs of frame number to allow the request after action time expires.<br>Bit 4-7 : *reserved* | MM-RS-RSP |

**11.xy.3 MM-RL-RSP message encodings**

The encodings described in this subclause are specific to the MM-RL-RSP message (6.3.2.3.98.5)

| Name | Type | Length | Value |
|---|---|---|---|
| Action Time | 1 | 1 | Bit 0-3: 4-bit LSBs of frame number to start releasing the multimode or allow the request after action time expires.<br>Bit 4-7: *reserved* |

[----------End of Text Proposal----------]