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Title	**Proposed Changes in 16m/D2 Related to DL Feedback in Multicarrier Systems (15.2.8)**
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Re:	IEEE 802.16 Working Group Letter Ballot #30a on P802.16m/D2
Abstract	The contribution proposes the changes in 16m/D2 regarding the DL feedback in multicarrier systems.
Purpose	To be discussed and adopted by TGm for the 802.16m DRAFT amendment.
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Proposed Changes in 802.16m/D2 Related to DL Feedback in Multicarrier Systems (15.2.8)

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1 Introduction

The comment #508 in the comment database 80216-09_0047.cmt for the IEEE 802.16 Working Group Letter Ballot #30 on P802.16m/D1 identified an issue related to the DL feedback of the secondary carriers, particularly, unpaired DL carriers, in multicarrier systems. During the comment resolution discussion in the Jeju meeting, the Multicarrier (MC) ad hoc group suggested, after a quite long discussion about the issue, that although the identified issue needs to be resolved, they "reject" to the comment #508, under the consideration that the suggested remedy is incomplete. This contribution proposes the changes in 802.16m/D2 to further address the DL feedback issue in multicarrier systems as identified by comment #508 in 80216-09_0047.cmt.

2 Discussions

As indicated by the paragraph in line 8 on page 152 in the 802.16m/D2, there are two basic ways for the AMS to provide the DL feedback of the active secondary carriers in multicarrier systems: one is PHY fast feedback channel, and the other is MAC messages. However, the current 802.16m/D2 does not have any details regarding how the AMS provides DL feedback in either PHY feedback channel or MAC messages. Moreover, in the feedback channel allocation section, 15.3.6.5.2.11, on page 391, the first paragraph explicitly excludes the case of more than one feedback channel allocated to an AMS.

Based on the discussion in Jeju, we believe it is important for the AMS to provide DL feedback for the active DL secondary carriers, including the unpaired active DL secondary carriers. The unpaired active DL carrier refers to the active DL carrier that does not have corresponding active UL carrier, e.g., partially configured carriers, DL-only activated carrier, etc.

The following provides a discussion regarding PHY and MAC mechanisms for the AMS to provide DL feedback of the active secondary carriers in multicarrier systems.

2.1 PHY UL Feedback Channel

When a PHY UL feedback channel is used for the AMS to provide DL feedback of the active secondary carriers, it has the following two basic cases:

1) Feedback channel on the same carrier

   The feedback channel is allocated in the UL carrier of the corresponding DL carrier of the same carrier. In this case, no changes are really needed in the 802.16m/D2, as the current 802.16m multicarrier operation has the resource allocation control signals for each active carrier are transmitted in the respective carrier, where the relationships among the feedback channel allocation transmission, the feedback channel location, and the reported DL carrier are clearly defined, i.e.,

   - a feedback allocation A-MAP IE is transmitted in the DL;
   - the feedback channels are allocated in the corresponding UL; and
   - the reported DL is the DL where the feedback allocation A-MAP IE is transmitted.

   However, this does not apply to all the cases of the currently defined 802.16m multicarrier operations. For example, for a partially configured carrier, it is DL only, i.e., no corresponding UL. Also, the 802.16m multicarrier systems allow activating the DL carrier only. Furthermore, even for a DL carrier having paired UL carrier, the ABS may wants its feedback sent on the primary UL carrier. Therefore, we need to address another case, i.e., the feedback channel allocated on a different carrier.

2) Feedback channel on a different carrier

   The feedback channel is allocated on a different carrier from the reported DL carrier, e.g., use the feedback channel on the primary carrier UL channel to report an active secondary DL.

   In this case, some changes are needed in the 802.16m/D2 to provide the necessary supporting mechanisms, e.g., the mapping between a feedback channel and its reported DL carrier. Such a mapping can be indicated in either in the feedback channel allocations or in the feedback contents. Considering the very limited number of bits that a feedback channel can carry, we propose to use feedback channel allocation specification to provide the mapping information between a feedback channel and its reported DL carrier. There are two basic ways to do such a mapping: one is to map at the feedback region level; the other is to map at the feedback channel level. For simplicity, this contribution proposes to map at the feedback channel level, i.e., to use the feedback allocation A-MAP IE to specify the mapping between a feedback channel and its reported DL carrier. This requires the following two changes in the 802.16m/D2:

   a) Change the limitation of one feedback channel per AMS to a limitation of one feedback channel per active DL carrier;
   b) Change the feedback allocation A-MAP IE to include the information of the DL carrier which the feedback channel reports for, e.g., adding a field to indicate the DL carrier index.

   Note that the relationship between the DL channel where the feedback allocation A-MAP IE

is transmitted and the UL carrier where the feedback channel is allocated shall not be changed, because it is one of the design basics of the 802.16m multicarrier operation, i.e., the resource allocation signals of each active carriers are transmitted in the respective carrier. This means the feedback allocation A-MAP IE allocates feedback channels in the UL that is of the same carrier of the DL where the feedback allocation A-MAP IE is transmitted.

2.2 MAC messages for DL carrier feedback

According to the paragraph in line 8 on page 151, in multicarrier systems when MAC messages are used for DL CINR report, the messages are transmitted on the AMS's primary carrier. In order to use MAC messages to provide DL CINR reports for the DL active secondary carriers, the MAC messages have to indicate the corresponding DL carrier of each CINR report. Two types of MAC messages are proposed in this contribution: one is the MAC control messages, AAI_REP-REQ/RSP; and the other is a MAC signaling header for DL CINR report.

3 Suggested changes in the 802.16m/D2

Based on the above discussion, we propose the following changes in the 802.16m/D2. Note that the new text is marked with blue and underline; the deleted text are marked with red and strikethrough.

Suggested change #1: page 152, line 8

Change the paragraph in line 8 on page 152 as follows:

An ABS may assign feedback ~~CQI~~ channels to each carrier of an AMS. When feedback ~~CQI~~ channel is assigned, the AMS reports CINR for a carrier over the assigned feedback ~~CQI~~ channel of the corresponding carrier. ABS may also direct AMS to report CINRs of active carriers through feedback ~~CQI~~ channel(s) on the primary carrier by the Feedback Allocation A-MAP IE with the indication of the reported DL active carrier as defined in Section 15.3.6.5.2.11. When measurement/report MAC messages are used for DL CINR report operation, the messages are transmitted on the AMS's primary carrier. In order to report the DL CINRs of the active secondary carriers, the measurement/report MAC messages includes the indication of the reported DL carriers as defined in the DL CINR Report MAC signaling header in Section 15.2.2.3.4 and the AAI_REP-REQ/RSP messages in Section 15.2.3.41. The measurement/report MAC message may contain CINR reports for all carriers or for each carrier of the AMS.

Suggested change #2: page 391 line 52

Change the text from line 52 on page 391 to line 18 on page 392 as follows:

Table 818 describes the fields in a Feedback Allocation A-MAP IE used for dynamically allocating or de-allocating UL fast feedback control channels (including both PFBCH and SFBCH) to an AMS. If an AMS has an existing fast feedback control channel for an active DL carrier and receives a new feedback channel allocation for the same active DL carrier, the original fast feedback channel is de-allocated automatically.

Definitions of the fields in the Feedback Allocation A-MAP IE are listed below in Table 818.

Table 818—Feedback Allocation A-MAP IE

Syntax	Size (bit)	Notes
Feedback-Allocation-A-MAP_IE() {		
A-MAP IE Type	[4]	Feedback Allocation A-MAP IE = 0b0010
Reported DL carrier index	[6]	The DL carrier index for which the feedback channel reports.
Channel Index	Variable	Feedback channel index within the UL fast feedback control resource region (Dependent on $L_{FB,FPi}$ defined in 15.3.8.3.3.2)
……<Other fields >	….	……

Suggested change #3: on page 30, line 5

Change Table 669 on page 30 as follows:

Table 669—Type field encodings for MAC signaling header type

Type field (4)bits	MAC Signaling Header Type
0000	BR with STID
0001	BR without STID
0010	Service specific BR without STID
0011	Sleep Control
0100~~-1111~~	~~Reserved~~ BR without STID and CINR Report
0101 - 1111	Reserved

Suggested change #4: on page 32, line 43

Insert the following text before line 43 on page 32:

15.2.2.3.4. BR without STID and CINR Report Header

BR without STID and CINR report header is sent through dedicated UL resource assigned to the

AMS. Its format is defined in Table 672a.

Table 672a—BR without STID and CINR Report Header Format

Syntax	Size (bit)	Notes
BR without STID and CINR report header() {		
FID	4	Flow Identifier. This field indicates MAC signaling header
Type	4	MAC signaling header type.
BR Type	1	Indicates whether the requested bandwidth is incremental or aggregate. 0: incremental 1: aggregate
BR Size	19	Bandwidth request size in bytes.
BR FID	4	The FID for which UL bandwidth is requested.
DL carrier index	[6]	DL carrier index of the DL carrier whose CINR is reported below.
CINR	7	indicates the CINR measured by the AMS from the ABS. It shall be interpreted as a single value from –16.0 dB to 47.5 dB in units of 0.5 dB.
Reserved	3	Reserved. This field shall be filled by 0
}		

Suggested change #5: on page 35 line 31

Append the following two rows at the end of Table 673 in line 31 on page 35:

Message Name	Message description	Security	connection
AAI_REP-REQ	Channel Measurement report request	<TBD>	Basic
AAI_REP-RSP	Channel Measurement report response	<TBD>	Basic

Suggested change #6: on page 95 line 35

Insert the following text before line 35 on page 95:

15.2.3.41 AAI_REP-REQ and AAI_REP-RSP

If the ABS requires RSSI and CINR channel measurement reports from an AMS, it shall send the Channel Measurement /report request message, AAI_REP-REQ, to the AMS. The Channel Measurement AAI_REP-REQ message shall additionally be used to request the results of the measurements the BS has previously scheduled. The AAI_REP-REQ message includes the following parameters:

- DL carrier index: indicate the DL carrier for which the channel measurement / report is requested.
- Report Request: a compound parameter that specifies the requested measurement / report.

The Channel Measurement/report response AAI_REP-RSP message shall be used by the AMS to respond to the channel measurements listed in the received Channel Measurement/report request AAI_REP-REQ messages. Where regulation mandates detection of specific signals by the AMS, the AMS shall also send a Channel Measurement/report response AAI_REP-RSP message in an unsolicited fashion upon detecting such signals on the channel in which it is operating if mandated by regulatory requirements. The AMS may also send an AAI_REP-RSP message containing channel measurement reports, in an unsolicited fashion, or when other interference is detected above a threshold value. When specific signal detection by an AMS is not mandated by regulation, the SS may indicate "Unmeasured. Channel Not Measured" in the AAI_REP-RSP message when responding to the AAI_REP-REQ message from the ABS. The AAI_REP-RSP message includes the following parameters:

- DL carrier index: indicate the DL carrier for which the channel measurement / report response is.
- Report Response: a compound parameter that contains the measurement / report responses.

4 References

[1] IEEE Std 802.16-2009

[2] IEEE P802.16m/D2, "DRAFT Amendment to IEEE Standard for Local and metropolitan area networks"