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Title	**MSS Feedback Mechanism for MBS connections**
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Re:	IEEE P802.16e/D5a-2004
Abstract	This contribution provides a feedback mechanism to be used by MSSs that is subscribed to an active MBS connection. This feedback mechanism allows BS to select a more optimal DIUC for MBS data transmission.
Purpose	Review and adopt suggested change into P802.16/D5
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MSS Feedback Mechanism for MBS Connections

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1. Problem Statement

In current IEEE P802.16e-D5a-2004, MSS cannot provide channel condition feedback to the BS for MBS connections. Without MSS feedback, the BS cannot select an optimal DIUC for MBS data burst transmission. If the BS selects the most robust DIUC, there could be a sizable waste on the DL bandwidth; if the BS selects a less robust DIUC, it may cause MBS service outage for some of the MSSs.

However, since there is usually a large group of MSSs involved in MBS connections, an effective feedback mechanism is needed to reduce the number of feedbacks received over the UL.

2. Proposed Solutions

In this contribution, a MSS feedback mechanism is introduced for MBS connections. To reduce the number of feedbacks for MBS connection, a negative feedback scheme is defined. Hence, the MSS only sends feedback when the current MBS connection channel condition cannot support the current MBS DIUC. Also, a MBS Feedback Backoff period is defined to further limit the MSS feedback frequency.

A new feedback type, MBS Preferred DIUC feedback, is added for the generic feedback header. This new feedback header contains MSS preferred DIUC for a MBS connection and its connection ID. The MSS can autonomously transmit the MBS feedback header or the BS can request the feedback using Feedback Polling IE. When the periodic feedback is enabled for a MBS connection, the MSS should not perform the autonomous feedback operation.

For the autonomous feedback operation, MSS performs the following:

- When a MSS determines a preferred DIUC for a MBS connection, it compares the preferred DIUC with the current MBS DIUC. The current MBS DIUC is defined as the DIUC of the last transmitted data burst for the MBS connection. If the MSS' preferred DIUC is more robust than the DIUC last used for the MBS connection, the MSS sends its preferred DIUC in a MBS Preferred DIUC Feedback header to the BS; if the MSS' preferred DIUC is less robust than the current MBS DIUC, the MSS does not send the preferred DIUC to the BS.
- After sending an autonomous feedback for a MBS connection to the BS, the MSS cannot send another autonomous feedback for the same MBS connection within MBS Feedback Backoff period. The MBS Feedback Backoff period is included in DCD message.

The BS can adjust the DIUC used for a MBS connection based on MSS feedback provided through this mechanism.

3. Specific Text Changes

[Modify the following section:]

6.3.2.1.4.1 Feedback header

Table 7b—Feedback type and feedback content

Feedback Type	Feedback contents	Description
0b0000	Set as described in Table 296d	MIMO mode and permutation feedback

0b0001	DL average CQI (5 bits)	5 bits CQI feedback
0b0010	Number of index, *L* (2 bits) + *L* occurances of Antenna index (2 bits) +MIMO coefficients (5 bits, 8.4.5.4.10.6)	MIMO coefficients feedback
0b0011	Preferred-DIUC (4 bits)	Preferred DL channel DIUC feedback
0b0100	UL-TX-Power (7 bits) (see Table 7a)	UL transmission power
0b0101	Preferred DIUC(4 bits) + UL-TXPower(7 bits) + UL-headroom (6 bits) (see Table 7a)	PHY channel feedback
0b0110	Number of bands, *N* (2 bits) + *N* occurances of 'band index (6 bits) + CQI (5bits)'	CQIs of multiple AMC bands
0b0111	Number of feedback types, *0* (2 bits) *+0* occurances of 'feedback type (4 bits)+ feedback content (variable)'	Multiple types of feedback
0b10001	MBS Preferred DIUC feedback, Preferred DIUC (4 bits) + MBS CID (16 bits)	Preferred DIUC for MBS connection identified by MBS CID
0b1001-0b1111	Reserved for future use	

[Insert the following section:]

6.3.2.1.4.4MBS Preferred DIUC Feedback header

The MBS Preferred DIUC feedback header is sent by the MSS to report its preferred DIUC for a MBS connection. The MBS Preferred DIUC feedback header is only defined without CID field since BS does not need to know which MSS has sent the MBS Preferred DIUC feedback header. The MSS shall transmit the MBS Preferred DIUC feedback header to BS according to section 6.3.13.3.

<table>
<tr><td>HT=1(1)</td><td>EC=1(1)</td><td>N/M=0 (1)</td><td>CII=0(1)</td><td>Feedback Type =1001 (4)</td><td>PREFERRED-DIUC (4)</td><td>Reserved (4)</td></tr>
<tr><td colspan="5">MBS CID MSB(8)</td><td colspan="2">MBS CID LSB (8)</td></tr>
<tr><td colspan="5">Reserved (8)</td><td colspan="2">HCS (8)</td></tr>
</table>

Figure 20x—MBS Preferred DIUC Feedback header without CID field

The MBS Preferred DIUC Feedback header shall have the following properties:

a) The length of the header shall always be 6 bytes.
b) The Feedback TYPE field shall be "1000"
c) PREERRED-DIUC indicates the preferred DIUC suggested by the MSS. The DIUC shall be defined in the DCD message sent by the serving BS.
d) MBS CID is the CID for MBS connection that the MSS is reporting for.

[Insert the following section:]

6.3.13.3 MSS Feedback Operation for MBS connections

For the MSS that is participating in a downlink MBS connection, the MSS shall support both autonomous feedback and BS polling feedback operation while the MSS is not in Idle mode. For each MBS connection that the MSS is participating in, the MSS shall perform the feedback operation according to the following:

- The MSS shall provide autonomous feedback to the BS when it is participating a downlink MBS connection. After the MSS determines its preferred DIUC for the MBS connection, the MSS shall compare its preferred DIUC with the current MBS DIUC. The current MBS DIUC is defined as the DIUC of the last transmitted data burst for the MBS connection. If the MSS' preferred DIUC is more robust than the DIUC last used for the MBS connection, the MSS shall send MBS Preferred DIUC Feedback header to the BS; if the MSS' preferred DIUC is less robust than or the same as the current MBS DIUC, no feedback shall be sent to the BS by the MSS.
- After an autonomous feedback is sent for a MBS connection to the BS, the MSS shall not send another autonomous feedback for the same MBS connection within MBS Feedback Backoff period.
- When a Feedback Polling IE is received by the MSS for a MBS connection, the MSS shall send MBS Preferred DIUC Feedback header to the BS as indicated by the Feedback Polling IE. If periodic feedback is enabled by the Feedback Polling IE for, the MSS shall stop autonomous feedback operation until the expiration of periodic feedback duration.

[Modify the following section:]

8.4.5.3.19 Feedback polling IE

This IE is used by BS to allocate dedicated UL resource for the purpose to obtain certain type of feedback from one or more MSS.

Syntax	Size	Notes
Feedback polling IE () {		
Extended UIUC	4 bits	0x??
Length	4 bits	Length in bytes of following fields
for (i=0; i < Num Allocations; i++)		
{		
Feedback type	6 bits	See Table 7b
If (Feedback type == 0b10001)		MBS Preferred DIUC feedback
{		
MBS CID	16 bits	Connect ID of the MBS connection that the MSS should feedback for
}		
Else		

{		
Basic CID	16 bits	
}		
UIUC	4 bits	
~~Feedback Type~~	~~6 bits~~	~~See Table 7b~~
Duration	10 bits	In OFDMA slots (see 8.4.3.1)
….	….	….

[Modify the following rows to table 347a UCD Channel encoding:]

11.3.1 UCD channel encodings

MBS Feedback Backoff	9	1	Number of frames that a MSS has to wait before sending another autonomous MBS Preferred DIUC Feedback header after an autonomous feedback is done, expressed as a power of 2. Range: 0-15 (the highest order bits shall be unused and set to 0).	OFDMA

4. References

[1] IEEE 802.16- 2004 IEEE Standards for local and metropolitan area networks part 16: Air interface for fixed broadband wireless access systems

[2] IEEE P802.16e-D5a-2004