

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Closed-loop MIMO enhancement	
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Re:	Response to Recirculation Ballot #14c	
Abstract	To improve the closed loop MIMO. The added text is highlighted in green; the deleted text is stroked out.	
Purpose	To incorporate the changes here proposed into the 802.16e D5 draft.	
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Closed-loop MIMO enhancement

1 Background

For the moderate and high speed mobility application, the MSS feedback MIMO channel matrix becomes ineffective. The antenna selection diversity can still provide significant performance advantage. In this case, when the BS is deployed with more antennas than the MSS receive antennas, the antenna selection at BS side for the specific individual MSS with specific STC format can be very efficient, since the feedback requirement in this case can be reduced to the antenna group index. One the example can be illustrated in Figure 1.

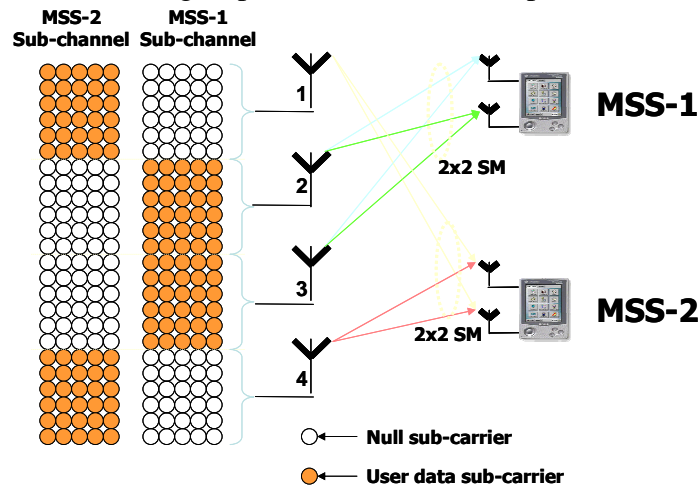


Figure 1, Antenna/sub-channel mapping for sub-MIMO transmission

The antenna and sub-channel feedback can be based on the multi-user diversity in conjunction with the MIMO mid-amble based DL channel sounding. This also allows achieving the DL quasi-water-filling over the entire antenna and sub-channel set. The space time coding formats of sub-MIMO transmission can be assigned as matrices A/B/C for each antenna configurations (2/3/4). The MSS can therefore base on its receiver/antenna capability and data rte requirement to request the BS to assign the antenna/sub-channel/STC formats. In addition, each STC formats can be weighted as pre-coding transmission, and the weight can be determined by BS or sent to BS by MSS via CQICH.

Another important application is multi-user pre-coding, in this case, multi-users are mapped onto the same sub-channel with the configuration $N_T \times N_{USER} \times N_R$ where by dirty paper coding approach, we can allocated N_{USER} user each with N_R receive antennas for the N_T spatial multiplexing transmission at BS with N_T transmit antennas. In this case, each MSS is required to feedback the sub-MIMO channel matrix.

[\[Change text\]](#)

-----Start text proposal-----

Table 298a. CQICH Enhanced allocation IE format

Syntax	Size (bits)	Notes
CQICH_Enhanced_Alloc_IE() {		
Extended DIUC	4	0x09
Length	4	Length in bytes of following fields
CQICH_ID	variable	Index to uniquely identify the CQICH resource assigned to the

		MSS
Period (=p)	2	A CQI feedback is transmitted on the CQICH every 2^p frames
Frame offset	3	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames
Duration (=d)	3	A CQI feedback is transmitted on the CQI channels indexed by the CQICH_ID for 10×2^d frames. If $d=0$, the CQICH is de-allocated. If $d=111$, the MSS should report until the BS command for the MSS to stop.
Nt actual BS antennas	3	<p>001 = Reserved</p> <p>010 = 2 actual antennas</p> <p>011 = 3 actual antennas</p> <p>100 = 4 actual antennas</p> <p>101 = 5 actual antennas</p> <p>110 = 6 actual antennas</p> <p>111 = 7 actual antennas</p> <p>000 = 8 actual antennas</p>
Feedback_type	4	<p>0000 = Open loop precoding. Pilots in burst to be precoded with W. SS to rely only on pilots in burst for channel estimation.</p> <p>0001 = Complex weight of specific element of W</p> <p>0010 = Fast DL measurement</p> <p>0011 = Layer specific channel strengths</p> <p>0100 = MIMO mode and permutation zone feedback</p> <p>0101 = Feedback of subset of antenna to use.</p> <p>0110 = Feedback Sub-MIMO set of channels</p> <p>0110 ~ 1111 reserved</p>
CQICH_Num	4	Number of CQICHs assigned to this CQICH_ID is (CQICH_Num +1)
for (i=0;i<CQICH_Num;i++) {		
Allocation index	6	Index to the fast feedback channel region marked by UIUC=0
}		
if (Feedback_type != 0011) { MIMO_permutation_feedback cycle }	2	<p>00 = No MIMO and permutation mode feedback</p> <p>01 = the MIMO and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 4 frames. The first indication is sent on the 8th CQICH frame.</p> <p>10 = the MIMO mode and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 8 frames. The first indication is sent on the 8th CQICH frame.</p> <p>11 = the MIMO mode and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every 16 frames. The first indication is sent on the 16th CQICH frame.</p>

Padding	<i>variable</i>	The padding bits are used to ensure the IE size is integer number of bytes.

-----End text proposal-----