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Title	**Corrections for CINR report of CQICH**
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Re:	IEEE P802.16-2004/Cor1-D1
Abstract	Corrections for CINR measurement in CQICH
Purpose	Adoption of suggested changes into IEEE P802.16-2004/Cor1-D1
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Introduction

In the current spec. the CINR report is carried with REP-RSP MAC message or fast feedback channel (CQICH). However, there are still some ambiguities regarding the frequency reuse factor, whether the loading is reflected on the estimate or not. In this contribution, we propose the clarification to get rid of such ambiguities for fast feedback channel.

Motivations

1. In the current spec., various permutation schemes that possibly use different frequency reuse factor can be placed within a frame. However, the current reporting scheme only says to report the CINR of the preamble and does not provide how to indicate the reuse factor.
2. Additionally, though the CQICH is supported by normal MAP and H-ARQ MAP, the current CQICH operation scenario is confined only for H-ARQ enabled MSS.
3. Further, some correction on CINR measurement are provided.

Suggested Remedies

1. We modify the CQICH IE to indicate reporting the CINR estimate from the preamble for the different frequency reuse factors or band AMC differential CINR.
   A. Because the reporting of CINR for Band AMC is related with REP-REQ/RSP, there is no specific indication to report the CINR for Band AMC.
2. This document is based on C80216maint-04_46r1 which clarify some ambiguities of the current CINR report.
3. We propose to modify the current operation scenario to be applied for the normal MAP case.
4. It is described that the fast feedback channel can be allocated to SS only with FAST_FEEDBACK MAC subheader. In fact it can be allocated by CQICH allocation IE. It is corrected.

Suggested Text changes

[Add the following text the end of section 6.3.2.2.6 at pp.10 line 56]

When the feedback type is '00', and no CINR type parameters were provided by a previous CQICH IE, the reported the estimation of CINR measured from preamble for frequency reuse configuration=1 in the frame. Otherwise, the CINR type parameters provided by a previous CQICH IE shall be used.

6.3.2.3.43.5 CQICH Control IE

[Modify the table 95 of section **6.3.2.3.43.5 at pp 19, line 21]**

Table 95. CQICH_Control IE format

Syntax	Size	Notes
CQICH_Control_IE () {	_	_
CQICH indicator	1 bit	If the indicator is set to 1, the CQICH Control IE follows.
if CQICH indicator == 1 {	_	_
Allocation Index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS.
Period (=p)	2 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2^p frames.
Frame offset	3 bits	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)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for 2^{d-1} frames. If d is 0000, the CQICH is de-allocated. If d is 1111, the MSS should report until the BS command for the MSS to stop.
CINR type included	1 bit	
If (CINR type included=1){		
Report type	2 bits	The report type of CINR estimate measured from preamble 0b 00 – Frequency reuse factor=1 configuration. 0b 01 – Frequency reuse factor=3 configuration.
}		
Averaging parameter included	1 bit	
If (Averaging parameter included == 1) {		
Averaging parameter	4 bits	Averaging parameter α_{avg} used for deriving CINR estimates reported through CQICH. This value is in multiples of 1/16 ranging [1/16,16/16] in increasing order.
}		
Padding	Var	Add zeros for the nibble align.
}		
else {	_	
Reserved	3 bits	
}		
}	_	

[Add the following text at the end of **6.3.2.3.43.5]**

CINR type included

Indicates whether an update to the CQI configuration exists in the IE. A value of '0' indicates that the SS shall perform CINR measurements using the latest received CQI configuration.

CINR type

Indicates where the CQI report shall be measured. SS can measure the estimation of the CINR from the preamble ('0') or the permutation zone indicated ('1').

Averaging parameter included

Indicate whether the averaging parameter α_{avg} is exists in the IE. A value of '0' indicates that the SS shall perform CINR measurements using the latest received averaging parameter.

[Change the subclause number as follows in Page 32 line 22 and reassign new subcalsue numbers for the subsequent subclauses]

6.3.18~~17.4~~ CQICH Operations

[Modify the text as follows in 6.3.17.4]

This subclause is only for OFDMA mode. ~~This section describes the operation scenarios and requirements of CQICH, which is designed for H-ARQ enabled SS.~~ After an SS turns on its power, the only appropriate subchannels that can be allocated to the MSS are normal subchannels. To determine the M/C level of normal subchannels, the average CINR measurement is enough for the BS to determine the M/C levels of uplink and downlink. As soon as the BS and the SS know the capabilities of both entities modulation and coding, the BS may allocate a CQICH subchannel using a CQICH IE (CQICH allocation IE or CQICH Control IE)~~a CQICH Control IE~~. BS may request SS to report the CINR estimate from the preamble for the different frequency reuse factors. The first CQICH IE sent to the SS shall indicate the CINR type configuration.

Then, the MSS reports the average CINR ~~of the BS preamble~~ as indicated in the CQICH IE. From then on, the BS is able to determine the M/C level. A CINR measurement is quantized into ~~32~~16 levels and encoded into ~~5~~4 information bits.

At any time, the BS may de-allocate the SS' CQICH by putting another CQICH ~~Control~~ IE with Duration d = 0000. Before the CQICH life timer which is set at the receipt of the CQICH ~~Control~~ IE expires, sending another CQICH ~~Control~~ IE overwrites all the information related to the CQICH such as Allocation Index, Period, Frame offset, and Duration. Hence, unless the BS refreshes the timer, the SS should stop reporting as soon as the timer expires. However, in case of sending the MAP IE for re-allocation or deallocation, the BS should make sure if the previous CQICH is released before it is re-allocated to another SS.

The SS sends the REP-RSP message in an unsolicited fashion to BS to trigger Band AMC operation. The triggering conditions are given by TLV encodings in UCD messages. The REP-RSP (see 11.12 for the TLV encodings) includes the CINR measurements of ~~five~~ four best bands. Only when an SS reports its BS the CINR measurements of Band AMC channels, its logical definition is differently made as follows. If the number of bands is 48 (2048 FFT in 20 MHz), the two contiguous bands are paired and renumbered the same as a 24 band system. Then, if the LSB of an SS MAC address is 1, it only uses the odd-numbered bands. If not, it only uses the even-numbered bands. Hence, for example, the LSB of an SS MAC address is 1, (4m+2, 4m+3) bands are paired and the paired band is the m-th band of the SS. Similarly, for an even-numbered SS, (4m, 4m+1) bands are paired and the paired band is the m-th band of the SS.

The BS acknowledges the trigger by allocating Band AMC subchannels. From the next frame when the SS sent the REP-RSP, the SS starts reporting the differential of CINR ~~five~~ four selected bands (increment: 1 and decrement: 0 with a step of 1 dB) on its CQICH. If the BS does not allocate the Band AMC subchannels or send REP-REQ to indicate reporting Band AMC CINR within the specified delay (CQICH Band AMC Transition Delay) in the UCD message, the SS reports the updated average CINR as indicated in the latest CQICH IE. ~~of the preamble for normal subchannel allocations~~.

When the BS wants to trigger the transition to Band AMC mode or update the CINR reports, it sends the REP-REQ message (see 11.11 for the TLV encodings). When the SS receives the message, it replies with REP-RSP. When the BS receives the REP-RSP, it should synchronize the selection of bands reported and their CINR. Unless the BS allocates normal subchannels or the CQICH alloc IE indicate to report other CINR report except the Band AMC zone, the SS reports the differential increment compared to the most up-to-date report from the next CQI reporting frame.

8.4.5.4.10 FAST_FEEDBACK channels

[Modify the text as follows in pp. 81 line 60]

Fast feedback slots may be individually allocated to SS for transmission of PHY related information that requires fast response

from the SS. The allocations are done in unicast manner through the FAST_FEEDBACK MAC subheader (~~see~~ refer to 6.3.2.2.6) or CQICH Allocation IE (refer to 8.4.5.4.12) and the transmission takes place in a specific UL region designated by UIUC = 0.

8.4.5.4.10.1 Fast DL measurement feedback
[Modify the text as follows in Page 82 line 14]

~~When the FAST_FEEDBACK subheader Feedback Type field is '00' t~~The SS shall report the ~~S/N~~ CINR it measures on the DL. The following formula shall be used:

[Add the following text at the end of the section]

For band AMC operation, SS shall report differential of CINR of four selected bands (increment: 1 and decrement: 0 with a step of 1 dB) on its fast feedback channel.

8.4.5.4.12 CQICH Allocation IE Format
[Modify the table 300 as follows at pp.84 line38]

Table 300—CQICH alloc IE format

Syntax	Size	Notes
CQICH_Alloc_IE() () {		
Extended DIUC	4 bits	CQICH = 0x03
Length	4 bits	Length of the message in bytes (variable)
CQICH_ID	variable	Index to uniquely identify the CQICH resource assigned to the SS The size of this field is dependent on system parameter defined in DCD.
Allocation offset	6 bits	Index to the fast feedback channel region marked by UIUC = 0.
Period (p)	2 bits	A CQI feedback is transmitted on the CQICH every 2^p frames.
Frame offset	3 bits	The SS starts reporting at the frame of which the number has the same 3 LSB as the speci-fied frame offset. If the current frame is spec-ified, the SS should start reporting in 8 frames
Duration (d)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the CQICH_ID for 10 x 2dframes. If d == 0, the CQI-CH is deallocated. If d == 0b111, the SS should report until the BS command for the SS to stop.
CINR type included	1 bit	
If (CINR type included=1){		
Report type	2 bits	The report type of CINR estimate measured from preamble 0b 00 – Frequency reuse factor=1 configuration. 0b 01 – Frequency reuse factor=3 configuration.
}		
Averaging parameter included	1 bit	
If (Averaging parameter included == 1) {		
Averaging parameter	4 bits	Averaging parameter α_{avg} used for deriving CINR estimates reported through CQICH. This value is in multiples of 1/16 ranging [1/16,16/16] in increasing order.
}		
MIMO_permutation_feedback_cycle	2bits	0b00 = No MIMO and permutation mode feedback 0b01 = The MIMO and permutation mode indication shall be transmitted on the CQICH indexed by the CQICH_ID every four frames. The first indication is sent on the fourth CQICH frame. 0b10 = 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.

		0b11 = 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.
Padding	Variable	Number of bits required to align to byte length, shall be set to zero.
}		

[Add the following text to page 85, line 47]

CINR type included

Indicates whether an update to the CQI configuration exists in the IE. A value of '0' indicates that the SS shall perform CINR measurements using the latest received CQI configuration.

CINR type

Indicates where the CQI report shall be measured. SS can measure the estimation of the CINR from the preamble ('0') or the permutation zone indicated ('1').

Averaging parameter included

Indicate whether the averaging parameter α_{avg} is exists in the IE. A value of '0' indicates that the SS shall perform CINR measurements using the latest received averaging parameter.

8.4.11.3 CINR mean and standard deviation

[Modify the text as follows in **page 119, line 28**]

When CINR measurements are mandated by the BS, an SS shall obtain a CINR measurement (implementation- specific). From a succession of these measurements, the SS shall derive and update estimates of the mean and/or the standard deviation of the CINR, and report them via REP-RSP messages and/or report the estimate of the mean of the CINR via the fast feedback channel (CQICH).

For the REP-RSP, the following encoding shall be used unless different encoding scheme is defined. Mean and standard deviation statistics for CINR shall be reported in units of dB. To prepare such reports, statistics shall be quantized in 1 dB increments, ranging from a minimum of –10 dB (encoded 0x00) to a maximum of 53 dB (encoded 0x3F). Values outside this range shall be assigned the closest extreme value within the scale. In addition, the range over which these single-packet measurements are measured should extend 3 dB on each side beyond the –10 dB to 53 dB limits for the final reported, averaged statistics.

The method used to estimate the CINR of a single message is left to individual implementation, but the relative and absolute accuracy of a CINR measurement derived from a single message shall be ± 1 dB and ± 2 dB, respectively. The specified accuracy shall apply to the range of CINR values starting from 3 dB below SNR of the most robust rate, to 10 dB above the SNR of the least robust rate. See Table 336. ~~In addition, the range over which these single-packet measurements are measured should extend 3 dB on each side beyond the –10 dB to 53 dB limits for the final reported, averaged statistics.~~

[Add the following text at the end of third paragraph at **page 119, line 28**]

The SS is required to estimate the CINR at the input to the decoder, so that implementation losses (due to non-idealities of the receiver) are included in the estimate. In addition, any implementation losses of the decoder should be added to the CINR estimate. The reported value should be computed such that the SS reporting CINR value higher or equal to a C/N value appearing in table 332 (Normalized C/N per modulation) is able to demodulate data in the respective modulation and coding rate in a flat AWGN channel with the same average SNR per subcarrier with BER 10-6. For example, a SS reporting CINR=6dB should be able to decode QPSK rate 1/2 in a flat channel with SNR=6dB per subcarrier. When repetition code is applied it is considered part of the coding, and the CINR value doesn't include the SNR improvement resulting from repetition. CINR value refers to non-boosted data subcarriers. When estimating CINR from the preamble/pilots rather than directly on data subcarriers, the SS is required to separate between interference and noise on the preamble/pilots and apply the correct compensation due to different boosting of the preamble and the pilots with respect to data subcarriers.

[Add the following text at the end of the section at **page 119, line 28**]

The averaging parameter (α_{avg}) is given in DCD for FAST_FEEDBACK, CQICH and REP-RSP. If not transmitted in DCD, the default value of α_{avg} shall be 1/4. When the averaging parameter (α_{avg}) is given to a SS through REP-REQ, this value overrides any previous averaging parameter and can be changed only through another REP-REQ.

11.4.1 DCD channel encodings

[Add the following entry in Table 358, p. 129, line 41 after "H-ARQ ACK delay for DL burst"]

Name	Type	Length	Value	PHY scope
RSSI and CINR averaging parameter	18	1	Averaging parameter α_{avg} for CINR and RSSI measurements not indicated by REP-REQ (e.g. FAST_FEEDBACK, CQICH), in multiples of 1/256 (range [1/256, 256/256], 0x0 for 1/256, 0xFF for 256/256).	OFDMA

[Add the following text at the end of 11.12, page 136 line 12]

For the type 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 the following 5 bit CINR measurement encoding shall be used:

$$Payload\ bits = \begin{cases} 0, & CINR \le -3dB \\ n, & (n-4) < CINR \le (n-3), \quad 0 < n < 31 \\ 31, & CINR > 27 \end{cases}$$