Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Corrections Reuse 1/N CINR measurement**
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Re:	Corrigenda of IEEE802.16-2004
Abstract	Corrections for CINR measurement for reuse 1/N configurations.
Purpose	Adoption of suggested changes into IEEE802.16-2004
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Motivations

1. In the current spec., a reuse 1 permutation and reuse N permutation can be used in the same system. Even further, the combination of reuse 1 permutation and reuse N permutation can be used in a frame. In such configuration, one should know the reuse factor where the CINR is estimated. In other words, the MCS level is too week against the channel condition when the CINR for the reuse N configuration is reported and used in determination of MCS level for the reuse 1 configuration. The MCS level is too robust when the CINR of the reuse 1 configuration is used for the reuse N configuration. The current spec. does not provide how to feedback estimation of CINR for the frequency reuse factor = 1 region and frequency reuse = N region.
2. For the AAS operation, also the report of CINR measurement is necessary. The conventional REP-REQ/RSP and CQICH schemes can be used for this purpose. However, depending on the AAS operation scenario which is vendor-specific, the CINR measurement shall be done for the symbols that are beamformed or not beamformed. It is also not defined in the current specifications.
3. 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.

Suggested Remedies

1. We are proposing to use REP-REQ to indicate the feedback mode for the estimation of CINR of the different reuse case. When it is indicated to report reuse 1 or N by the REP-REQ, the following REP-RSP and fast feedback channel shall send the estimation of CINR as indicated in REP-REQ. For the unsolicited REP-RSP to trigger band AMC mode, the reuse mode indication in the latest REP-REQ shall be ignored. When fast feedback channel is allocated before any REP-REQ messages, the estimation of CINR for reuse 1 configuration on non beamformed symbols shall be sent by the allocated fast feedback channel. This document is based on C80216maint-04_46r1.
2. For the AAS operation, also the REP-REQ includes a bit field to indicator where a CINR measurement shall be done: beamformed symbols or not-beamformed symbols.
3. We propose to modify the current operation scenario to be applied for the normal MAP case.

Suggested Text changes

[Change the subclause number as follows 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 section describes the operation scenarios and requirements of CQICH, which is designed for H-ARQ enabled SS.~~ This subclause is only for OFDMA mode. 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~~. Then, the MSS reports the average CINR ~~of the BS preamble~~. From then on, the BS is able to determine the M/C level. A CINR measurement is quantized into 32 levels and encoded into 5 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 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 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 within the specified delay (CQICH Band AMC Transition Delay) in the UCD message, the SS reports the updated average CINR ~~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, the SS reports the differential increment compared to the most up-to-date report from the next CQI reporting frame.
When it is indicated to report the estimation of CINR for frequency reuse 1 configuration or frequency reuse factor N configuration by the REP-REQ, the SS shall send the estimation of CINR as indicated in REP-REQ with the subsequent REP-RSP and fast feedback channel. For the unsolicited REP-RSP to trigger band AMC mode, the reuse mode indication in the latest REP-REQ shall be ignored. When fast feedback channel is allocated before any REP-REQ messages, the estimation of CINR for reuse 1 configuration on non beamformed symbols shall be sent via the allocated fast feedback channel.

8.4.5.4.10.1 Fast DL measurement feedback

[Modify the text as follows]

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

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

When it is indicated to report the estimation of CINR for frequency reuse 1 configuration or frequency reuse factor N configuration by the REP-REQ, the SS shall send the estimation of CINR as indicated in REP-REQ with the subsequent fast feedback channel. When fast feedback channel is allocated before any REP-REQ messages, the estimation of CINR for reuse 1 configuration shall be sent via the allocated fast feedback channel.

8.4.11.3 CINR mean and standard deviation

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

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.
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.

11.11 REP-REQ management message encodings

[Modify the table as follows]

Channel Type request	1.3	1	Bit1,2,3: 000 = Normal subchannel with frequency reuse factor = 1configuration, 001 = ~~Band AMC Channel,~~ Normal subchannel with frequency reuse factor = N configuration, 010 = ~~Safety Channel~~, Band AMC Channel 011 = ~~Reserved~~, Safety Channel, Bit:4,5,6,7: reserved. Bit8: AAS CINR measurement indicator: When the 8th bit of Channel Type request is '0' the CINR measurement directed by the bit 1,2,3 shall be done for the symbols that are not beamformed. Otherwise, the CINR measurement directed by the bit 1,2,3 shall be done for the symbols that are beamformed

11.12 REP-RSP management message encodings

[Replace the last table with the following]

REP-REQ Channel Type request	Name	Type	Length	Value
Channel type = 00	Normal subchannel with frequency reuse factor = 1 configuration	2.1	1	First 5 bits for the CINR measurement report for the frequency reuse factor = 1 configuration and the rest for don't care. When the 8th bit of Channel Type request is '0' the CINR measurement shall be done for the symbols that are not beamformed. Otherwise, the CINR measurement shall be done for the symbols that are beamformed.
Channel type = 01	Normal subchannel with frequency reuse factor = N configuration	2.2	1	First 5 bits for the CINR measurement report for the frequency reuse factor = N configuration and the rest for don't care. When the 8th bit of Channel Type request is '0' the CINR measurement shall be done for the symbols that are not beamformed. Otherwise, the CINR measurement shall be done for the symbols that are beamformed.
Channel type = 10	Band AMC Channel	2.3	5	First 12 bits for the band indicating bitmap and Next 25 bits for CINR reports (5 bits per each band). When the 8th bit of Channel Type request is '0' the CINR measurement shall be done for the symbols that are not beamformed. Otherwise, the CINR measurement shall be done for the symbols that are beamformed.
Channel type = 11	Safety Channel	2.4	5	The first 20 bits for the reported bin indices and the next 20 bits for CINR reports (5 bits for each bin). When the 8th bit of Channel Type request is '0' the CINR measurement shall be done for the symbols that are not beamformed. Otherwise, the CINR measurement shall be done for the symbols that are beamformed.

[Add the following text at the end of the last table]

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

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

When it is indicated to report the estimation of CINR for frequency reuse 1 configuration or frequency reuse factor N configuration by the REP-REQ, the SS shall send the estimation of CINR as indicated in REP-REQ with the subsequent

REP-RSP and fast feedback channel. For the unsolicited REP-RSP to trigger band AMC mode, the reuse mode indication in the latest REP-REQ shall be ignored.

11.4.1 DCD channel encodings

[Add the following line in Table 356, p. 665, line 20 after "H-ARQ ACK delay"]

Name	Type	Length	Value	PHY scope
RSSI and CINR averaging parameter	XX	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

11.11 REP-REQ management message encodings

[Modify the table as follows]

Report type	1.1	1	Bit #0 =1 Include DFS Basic report Bit #1 =1 Include CINR report Bit #2 =1 Include RSSI report ~~Bit #3–6 \ in multiples of 1/32 (range [1/32, 16/32])~~ Bit #7 =1 Include current transmit power report