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Abstract	
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Corrections to CINR measurements and reports in OFDMA PHY

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1 Problem Statement

The current draft defines two mechanisms that can be used for rate adaptation: average CINR reports and preferred-DIUC requests (DBPC-REQ/RSP). While DBPC-REQ/RSP mechanism has been disabled for OFDMA PHY, the principle on which it is based is good. However, both mechanisms are incomplete and lack some important definitions.

CINR reports:

1. The text does not specify to what the CINR measurement relates. Measurements on the preamble, on pilots, and even on data subcarriers of different zones, will result in different values due to varying boosting levels, cell loading, and reuse factor. Further, when adaptive beamforming is employed, CINR measurements will vary greatly depending on the allocation used for measurement.

   The BS should specify the unique zone (by means of zone type and PRBS_ID in order to differentiate between multiple zones), and subset of major groups (for PUSC reuse-1 zone) on which the SS shall measure average CINR. Specifying the subset of major groups is important since different major groups may be transmitted with different power level or antenna beam (for example with 'dedicated pilot mode').

2. The text states that CINR is measured on "messages". It is not clear to which "messages" the text refers, as the SS is not required to decode or be aware of all messages in the frame. Further, the time scale of the message time indices is not defined; as a result, the averaging parameter has no meaning.

3. The text should specify that the CINR measurement should refer to non-boosted data subcarriers; hence the boost level of the preamble and pilots should be compensated for.

4. CINR estimates derived for CQICH should be kept distinct from reports triggered by REP-REQ/RSP. For example, we would want the ability to configure the CQICH to periodically report CINR on a specific zone, while triggering a one-time measurement on a different zone using REP-REQ/RSP.

"Preferred-DIUC" (DBPC-REQ/RSP) requests:

1. In a well-designed system, the error rate for reception of channel quality reports must be much lower than that of data (which may use H-ARQ for instance). The CQI mechanism is a very robust transport designed exactly for this purpose. However, reporting of the preferred MCS is only possible through a costly DBPC-REQ MAC message which itself uses regular MCS levels. This should also be possible through CQI.

2. DBPC-REQ/RSP does not include repetition-coding indication; hence preferred repetition coding level cannot be reported.

3. A preferred MCS must pertain to a specific target error rate, which differs between applications (low-latency voice, data with ARQ or H-ARQ, etc). Hence, the BS must specify the target error rate for which the preferred MCS shall be reported.

4. The SS should be instructed to trigger a non-periodic update of preferred-MCS in case the CQI interval is very large, otherwise consecutive downlink transmissions will fail for the duration remaining until the next CQI report arrives at the BS. This is especially important in applications that do not employ ARQ.

The following is an outline of the proposed changes:

1. Subsection 6.3.17.4 is modified to define the operation flow for CINR and preferred-MCS reports based on periodic CQI and non-periodic REP-REQ/RSP messages.

2. The CQICH_Alloc_IE is extended to include report configuration parameters (CINR-specific and preferred-MCS specific parameters).

3. REP-REQ/RSP TLVs are added to support the different CINR measurement and preferred-MCS modes.

4. Preferred MCS report should correspond to a prescribed MCS reporting profile that defines the target block error rate (and assumed block size) for which the best MCS is to be reported.

5. "Preferred MCS" encoding on the 4-bit CQI channel is defined.

6. Clarifications are added to section 8.4.11.3 on CINR measurement.

2 Detailed Text Changes

6.3.2.3.43.5 CQICH Control IE

[Add the following text to page 28 line 65]
The format of CQICH Control IE is presented in Table 93. The specific reporting value shall follow the directions indicated in the latest CQICH allocation IE (8.4.5.4.12).

[Change the sub-clause number as follows in Page 64 line 57 and reassign new sub-clause numbers for the subsequent sub-clauses]

6.3.18 ~~17.4 CQICH Operations~~ DL CINR/preferred-MCS Report Operation

This section applies to OFDMA mode only. The SS transmits CINR/preferred-MCS reports using the REP-RSP MAC message or fast-feedback (CQICH) channel. The measurement can be performed on the preamble or on a permutation zone. CINR measurement for a permutation zone can be done with pilots or data subcarriers. The SS shall implement at least one measurement scheme and negotiate its capability.

The UCD message defines multiple 'preferred-MCS reporting profiles', which define a target block error rate and assumed block length for that error rate. The BS may request a preferred-MCS report from the SS for a specific preferred-MCS reporting profile, in which case the SS shall respond with the DIUC and repetition code with which the expected block error rate, with blocks of the specified length, is closest to, but does not exceed, the target average error rate specified by the BS. When HARQ is employed, the computed block error rate shall only pertain to the first H-ARQ transmission.

6.3.18.1 DL CINR/preferred-MCS report with REP-RSP MAC message

The REP-RSP message shall be sent by the SS in response to a REP-REQ message from the BS to report estimation of DL CINR or preferred MCS.

REP-REQ shall indicate where the measurement shall be performed: preamble or a specific permutation zone. For the measurement on the preamble, BS can request SS to report the CINR/preferred MCS based on the measurement from the preamble for the different frequency reuse factors or band AMC configuration. For measurement on a specific permutation zone, the REP-REQ indicates the measurement type configuration, which includes the zone for which the CINR/preferred MCS is to be estimated. The zone is identified by its permutation type (PUSC with 'use all SC=0', PUSC with 'use all SC=1', FUSC, Optional FUSC, AMC zone, Safety channel), and PRBS ID. Also, the same permutation and PRBS ID can be differentiated by the STC or AAS indication. The SS shall not perform a measurement in a frame in which the specified zone is not allocated, and shall retain the previous measurement. For PUSC permutation zones, the SS may be instructed to report CINR/preferred MCS estimate for only a subset of the major groups. The SS may send a REP-RSP message in an unsolicited fashion.

In the case where the requested report configuration does not differ from the previous REP-REQ message in which CINR/preferred-MCS report was requested, the SS is required to send

its response within 3 frames. A REP-REQ message shall not contain more than one TLV requesting any type of CINR or preferred-MCS report.

For the Band AMC, the preferred MCS report scheme shall not be used.

[All existing text within 6.3.17.4 should go under the following title (6.3.18.2)]

6.3.18.2 Periodic CINR/preferred-MCS report with fast-feedback (CQICH) channel

[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.~~ After an SS turns on its power, the ~~only appropriate~~ subchannels that can be allocated to the MSS are all ~~kinds of~~ subchannels the SS can support except the band AMC subchannel. ~~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~~ for periodic CINR or preferred-MCS reports.

CQICH Allocation IE may indicate on what portion of the signal the measurement shall be performed: preamble or a specific permutation zone. For the measurement on the preamble, BS can request SS to report the CINR/preferred MCS based on the measurement from the preamble for the different frequency reuse factors. For the measurement on the specific permutation zones, the CQICH Allocation IE indicates the measurement type configuration, which includes the zone for which the CINR/preferred-MCS is to be estimated. The zone is identified by its permutation type (PUSC with 'use all SC=0', PUSC with 'use all SC=1', AMC AAS zone, FUSC, Optional FUSC, Safety channel), and PRBS ID. Also, the same permutation and PRBS ID can be differentiated by the STC or AAS indication. The SS shall not perform a measurement in a frame in which the specified zone is not allocated, and shall retain the previous measurement. For PUSC permutation zones, the SS may be instructed to report an estimate for only a subset of the major groups. The first CQICH Allocation IE sent to the SS shall indicate the measurement type configuration. Only a subsequent CQICH Allocation IE may update the measurement type configuration for CQI channel based reports. See sections 8.4.5.4.12 and 8.4.11.3. CQICH allocated through CQICH Control IE shall use the measurement configuration defined in the latest CQICH allocation IE. The CINR and preferred-MCS quantization and encoding onto the Fast-Feedback channel is defined in section 8.4.5.4.10.

A preferred-MCS reported on the CQI is interpreted as the SS's recommendation as to the DIUC + repetition code which best meets the specified target error rate for the duration remaining until the next scheduled CQI report.

The SS shall send an unsolicited REP-REQ message if it decides that the last recommended MCS is no longer appropriate for the duration remaining until the next periodic CQI transmission. The message is used to specify the new preferred MCS for the CQI channel. The CQI channel is identified by its CQICH_ID or by the SS's CID if the CQI channel is allocated without a CQICH_ID. The SS shall not send an unsolicited update to the preferred-

MCS of a CQI channel if 'triggered update' is disabled in the CQICH Allocation IE that allocated the CQI channel.

An SS may support 2 concurrent CQI channels (not necessarily being scheduled in the same frame) for preferred-MCS reports, both of which refer to the same zone (or both refer to the preamble) but with a different preferred-MCS reporting profile. The CQI channel is identified by the CQICH_ID field in the CQICH Allocation IE. Support for more than one concurrent CQI channel is optional and negotiated in section 11.8.3.7.X.

For the Band AMC, the preferred MCS report scheme shall not be used.

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 evennumbered 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 REPRSP, the SS starts reporting the differential of CINR for ~~five~~ four selected bands (increment: 1 and decrement: 0 with a step of 1 dB) on its CQICH. The CINR shall be measured as indicated in the REP-RSP message. 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 IE indicates to report CINR on a zone other than Band AMC zone, the SS reports the differential increment compared to the most up-to date report from the next CQI reporting frame.

[Modify table 300 (CQICH_Alloc_IE), as follows:]

Syntax	Size	Notes
…		
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 deallocated. If d is 1111, the MSS should report until the BS command for the MSS to stop.
Measurement configuration included	1 bit	Update to CINR/preferred-MCS measurement configuration is included.
If (measurement configuration included == 1) {		
Feedback Type	2 bits	0b00 = CINR feedback 0b01 = Preferred-MCS feedback 0b10-0b11 = *Reserved*
Measurement type	1 bit	0: Measurement from preamble 1: Measurement from permutation zone
If (Measurement type== 0b0) {		measure on preamble
CINR preamble measurement type	1 bit	The type of preamble-based CINR measurement 0 – Frequency reuse factor=1 configuration. 1 – Frequency reuse factor=3 configuration.
}		
Else {		measure on permutation zone
CINR zone measurement type	1 bit	0: measurement from pilot subcarriers 1: measurement from data subcarriers
Zone permutation	3 bits	The type of zone for which to report 0b 000 – PUSC with 'use all SC = 0' 0b 001 – PUSC with 'use all SC = 1' 0b 010 – FUSC 0b 011 – Optional FUSC 0b 100 – Safety Channel region 0b 101 – AMC zone (only applicable to AAS mode) 0b 110-111 – Reserved
STC Zone	1 bit	0 – zone on which to report is not an STC zone 1 – zone on which to report is an STC zone
AAS Zone	1 bit	0 – zone on which to report is not an AAS zone 1 – zone on which to report is an AAS zone
Zone PRBS_ID	2 bits	The PRBS_ID of the zone on which to report
If (Zone type == 0b000 or 0b001) {		
Major group indication	1 bit	If '0' then the report may refer to any subchannel in the PUSC zone.
If (Major group indication == 1) {		
PUSC Major group bitmap	6 bits	Reported CINR/preferred-MCS shall only be estimated for the subchannels of PUSC major groups for which the corresponding bit is set. Bit #*k* refers to major group *k*.
}		
}		
}		
If (feedback type == 0b00) {		CINR feedback
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 given in multiples of 1/16 in the range of [1/16 … 16/16] in increasing order.
}		
}		

If (feedback type == 0b01) {		Preferred-MCS feedback
Preferred-MCS reporting profile index	2 bits	Index of preferred MCS reporting profile, as defined in the UCD message.
Triggered update enabled	1 bit	0 – triggered update is disabled 1 – triggered update is enabled See section 6.2.18.2
}		
}		
…		

[Add the following text to the end of 8.4.5.4.12]

Measurement configuration included
Indicates whether an update to the report configuration exists in the IE. A value of '0' indicates that the SS shall perform CINR/preferred-MCS measurements using the latest received CQI configuration.

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

Preferred MCS reporting profile
The reporting profile to be used for determining the preferred MCS to be transmitted on the CQI channel. See section 6.3.18.

Averaging parameter included
Indicate whether a new averaging parameter α_{avg} for CINR reports exists in the IE. A value of '0' indicates that the SS shall perform CINR measurements using the last known averaging parameter.

[Add new section 8.4.5.4.10.5]

8.4.5.4.10.5 Preferred-MCS feedback for fast-feedback channel

When the feedback type field in the CQICH_IE() is 0b01 or the preferred MCS report is request by REP-REQ, the SS shall report the preferred MCS using a 4-bit encoding according to table 298a.

Table 298a – Preferred-MCS feedback encoding

Payload bit encoding	Meaning
0b0000 - 0b0111	Preferred DIUC, with encoding defined below, according to the burst profile encodings in the latest DCD message. No repetition is assumed. The 8 encoded value shall be derived as follows: enumerate the DIUCs (excluding DIUC 0) with FEC type equal to the SS's first preferred FEC type. Then, continue to enumerate the DIUCs (excluding DIUC 0) with the SS's second preferred FEC type, and so on, until 8 DIUCs are enumerated. The first enumerated DIUC is encoded as 0.

	The SS's preferred FEC types are selected from the FEC types acknowledged by the BS during capability negotiation, and are ordered as follows: 1. CTC 2. BTC 3. Zero-tail CC 4. CC For example, if CTC and CC are supported by both BS and SS following capability negotiation, the SS's preferred FEC types are first CTC and then CC.
0b1000 - 0b1010	Preferred repetition coding for the 1st DIUC with QPSK modulation in the enumerated list of 8 DIUCs above. 0b1000: Repetition coding of 2 0b1001: Repetition coding of 4 0b1010: Repetition coding of 6
0b1011-0b1101	Preferred repetition coding for the 2nd DIUC with QPSK modulation in the enumerated list of 8 DIUCs above. 0b1011: Repetition coding of 2 0b1100: Repetition coding of 4 0b1101: Repetition coding of 6
0b1110	A decrease in the CQICH duration is recommended; no change in preferred MCS. This encoding shall not be repeated over consecutive CQI allocations.
0b1111	DCD count changed.

If the 'DCD count' field in the DL-MAP of the frame in which the CQI is to be transmitted is different from the value of that field in the DCD message in which the DIUC profile was defined, then the SS shall transmit the 4-bit encoding 0b1111 instead of the preferred MCS.

[Modify the text in section 8.4.11.3 as follows]

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.

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 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.

If CINR report from the preamble was instructed, then the reported CINR shall be an estimate of the CINR over the subcarriers of the preamble. For the frequency reuse configuration=3 type, the reported CINR shall be the estimate of the CINR over the modulated subcarriers of the preamble. For the frequency reuse configuration=1, the reported CINR shall be the estimate of the average CINR over all subcarriers of the preamble except the guard subcarriers and the DC subcarriers. In other words, the signal on the unmodulated subcarriers (except the guard subcarriers and the DC subcarriers) shall also be considered as noise and interference for the CINR estimate of the frequency reuse configuration=1. The reported value shall represent the average CINR on non-boosted data subcarriers of the first zone in the frame; hence preamble boosting shall be compensated for in both desired signal and interference/noise calculation.

In case CINR report on specific permutation zone was instructed, then the reported CINR shall be an estimate of the average CINR over the pilot or data subcarriers, as instructed by the BS. The reported value shall represent the average CINR on non-boosted data subcarriers of the zone on which measurement was requested; hence pilot boosting shall be compensated for in both desired signal and interference/noise calculation.

If the BS instructs CINR reporting on an AAS zone with AMC permutation, then the SS shall report the estimate of the CINR on pilot or data subcarriers that belong to slots allocated to it. In case CINR reporting on STC zone is instructed, the SS shall report the average post-combined CINR.

[Modify the following text below eq. 144]

where r[k,n] received sample n within message measured at time index k in frame units; s[k,n]the corresponding detected or pilot sample (with channel state weighting) ~~corresponding to received symbol~~ . The message time index is incremented every frame. The SS shall maintain separate message time index counters and mean CINR estimates for REP-RSP-based reports and for Fast-Feedback-based reports. When the CINR configuration is changed (i.e. CINR report configuration in a CQICH IE or REP-REQ message differ from the previous CQICH_IE or REP-REQ), the SS shall reset the corresponding message time index to zero.

[Modify the following text below eq. 146]

~~k is the time index for the message (with the initial message being indexed by k=0, the next message by k=1, etc.);~~

[Add the following text at the end of section 8.4.11.3]

The averaging parameter (α_{avg}) may be sent as a DCD message TLV. Unless specified otherwise, the default averaging parameter (α_{avg}) is ¼. When the averaging parameter (α_{avg}) is given to an SS through REP-REQ, this value shall only be used for deriving CINR estimates reported through REP-RSP, and can further only be changed through another REP-REQ message. When the averaging parameter is given to a SS through CQICH_Allocation

IE, this value shall only be used for deriving CINR estimates reported through fast-feedback channel (CQICH), and can further only be changed through another CQICH Allocation IE. An averaging parameter value sent through DCD shall not override the averaging parameter value sent in a dedicated REP-REQ message or a CQICH Allocation IE.

[Add the following entry to the end of table 353, section 11.3.1]

Preferred-MCS reporting profiles	ZZZ	4	Each byte corresponds to a reporting profile, starting from reporting profile #0, with the following structure: Bits #0-#2: (=n) Target block error rate, defined as $2^{(-n-2)}$. Bits #3-#7: (=k) Target block length for computing block error rate, defined as 60*(k+1), in units of bytes.

[Add the following entry to the end of table 358, section 11.4.1]

Default RSSI and CINR averaging parameter	ZZZ	1	Bit #0~3: Default averaging parameter α_{avg} for CINR measurements, in multiples of 1/16 (range [1/16, 16/16], 0x0 for 1/16, 0xF for 16/16). Bit #4-#7: Default averaging parameter α_{avg} for RSSI measurements, in multiples of 1/16 (range [1/16, 16/16], 0x0 for 1/16, 0xF for 16/16). The default value is 0x3.	OFDMA

[Add the following new section]

11.8.3.7.X OFDMA SS CINR/preferred-MCS measurement capability

[Add the table as follows at pp.135, line 27]

Type	Length	Value	Scope
XXX	1	Bit #0: CINR measurement from the preamble Bit #1: CINR measurement for a permutation zone from pilot subcarriers Bit #2: CINR measurement for a permutation zone from data subcarriers Bit #3: Preferred-MCS reports Bit #4: Support for 2 concurrent CQI channels with preferred-MCS reports. Bit #5~7: *Reserved*; shall be set to zero	SBC-REQ (see 6.3.2.3.23) SBC-RSP (see 6.3.2.3.24)

[Add the following to the 2nd table in section 11.11 (REP-REQ) of 802.16-2004 as follows]

11.11 REP-REQ management message encodings

Zone-specific CINR request	1.4	3	Bits #0-2: Type of zone on which CINR is to be reported 0b000: PUSC zone with 'use all SC=0' 0b001: PUSC zone with 'use all SC=1' / PUSC AAS zone 0b010: FUSC zone 0b011: Optional FUSC zone 0b100: Safety Channel region 0b101: AMC zone 0b110 - 0b111: *Reserved*

			Bit #3: 1 if zone for which CINR should be estimated is STC zone, 0 otherwise. Bit #4: 1 if zone for which CINR should be estimated is AAS zone, 0 otherwise. Bits #5-6: PRBS_ID of the zone for which CINR should be estimated. Ignored for Safety Channel. Bit #7: data/pilot-based CINR measurement: 0 - Report the CINR estimate from pilot subcarriers, 1 - Report the CINR estimate from data subcarriers Bits #8-13 : Reported CINR shall only be estimated for the subchannels of PUSC major groups for which the corresponding bit is set. Bit #(*k*+7) refers to major group *k*. Only applicable for CINR measurement on a PUSC zone Bits #14-17: α_{avg} in multiples of 1/16 (range is [1/16,16/16]) Bit #18: 0 – report only mean of CINR 1 – report both mean and standard deviation of CINR Bits #19-23: *reserved*
Preamble CINR request	1.5	1	Bits #0-1: Type of preamble CINR measurement 0b00 - Report the estimation of CINR measured from preamble for frequency reuse configuration=1 0b01 - Report the estimation of CINR measured from preamble for frequency reuse configuration=3 0b10 - Report the estimation of CINR measured from preamble for band AMC 0b11 - *Reserved* Bits #2-5: α_{avg} in multiples of 1/16 (range is [1/16,16/16]) Bit #6: 0 – report only mean of CINR 1 – report both mean and standard deviation of CINR Bit #7: Reserved (shall be set to zero)
Preferred-MCS request	1.6	2	Bits #0-2: Type of zone on which preferred MCS is to be reported 0b000: PUSC zone with 'use all SC=0' 0b001: PUSC zone with 'use all SC=1' / PUSC AAS zone 0b010: FUSC zone 0b011: Optional FUSC zone 0b100: *Reserved* 0b101: AMC zone (only applicable to AAS mode) 0b110 - 0b111: *Reserved* Bit #3: 1 if zone for which preferred-MCS should be reported is STC zone, 0 otherwise. Bit #4: 1 if zone for which CINR should be estimated is AAS zone, 0 otherwise. Bits #5-6: PRBS_ID of the zone for which preferred-MCS should be reported. Ignored for Safety Channel. Bit #7: *Reserved* Bits #8-13: Reported CINR shall only be estimated for the subchannels of PUSC major groups for which the corresponding bit is set. Bit #(*k*+7) refers to major group *k*. Only applicable for CINR measurement on a PUSC zone Bit #14-15: Index of preferred-MCS reporting profile, as defined in the UCD message. See section 6.3.18.
Preamble preferred-MCS request	1.7	1	Bits #0-1: Type of preamble-based preferred-MCS measurement 0b00 - Report the estimation of preferred-MCS measured from preamble for frequency reuse configuration=1 0b01 - Report the estimation of preferred-MCS measured from preamble for frequency reuse configuration=3 0b10-11 - *Reserved* Bit #2-3: Index of preferred-MCS reporting profile, as defined in the UCD message. See section 6.3.18. Bit #4-7: Reserved (shall be set to zero)

[Add the following tables at the end of 11.12]

REP-REQ Zone-specific CINR request	Name	Type	Length	Value

Bits #0-2 = 0b000	PUSC zone with 'use all SC=0'	3.1	1 / 2	Bit #0-4: mean of CINR estimate for PUSC zone with 'use all SC=0' and PRBS_ID indicated in 'zone-specific CINR request'. Bit #5: Report type: 0 - CINR estimated from pilot subcarriers, 1- CINR estimated from data subcarriers Bit #6-7: reserved Bit #8-12: standard deviation of CINR estimate for PUSC zone with 'use all SC=0' and PRBS_ID indicated in 'zone-specific CINR request'. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.
Bits #0-2 = 0b001	PUSC zone with 'use all SC=1'	3.2	1 / 2	Bit #0-4: mean of CINR estimate for PUSC zone with 'use all SC=1' and PRBS_ID indicated in 'zone-specific CINR request'. CINR reported corresponds to a subset of major groups as specified in 'CINR type request'. Bit #5: Report type: 0 - CINR estimated from pilot subcarriers, 1- CINR estimated from data subcarriers Bit #6-7: reserved Bit #8-12: standard deviation of CINR estimate for PUSC zone with 'use all SC=1' and PRBS_ID indicated in 'zone-specific CINR request'. CINR reported corresponds to a subset of major groups as specified in 'CINR type request'. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.
Bits #0-2 = 0b010	FUSC zone	3.3	1 / 2	Bit #0-4: mean of CINR estimate for FUSC zone with PRBS_ID indicated in 'zone-specific CINR request'. Bit #5: Report type: 0 - CINR estimated from pilot subcarriers, 1- CINR estimated from data subcarriers Bit #6-7: reserved Bit #8-12: standard deviation of CINR estimate for FUSC zone with PRBS_ID indicated in 'zone-specific CINR request'. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.
Bits #0-2 = 0b011	Optional FUSC zone	3.4	1 / 2	Bit #0~4: mean of CINR estimate for Optional FUSC with PRBS_ID indicated in 'zone-specific CINR request'. Bit #5: Report type: 0 - CINR estimated from pilot subcarriers, 1- CINR estimated from data subcarriers Bit #6-7: reserved Bit #8~12: standard deviation of CINR estimate for Optional FUSC with PRBS_ID indicated in 'zone-specific CINR request'. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.

Bits #0-2 = 0b100	Safety channel	3.5	5	The first 20 bits for the reported bin indices and the next 20 bits for CINR reports (5 bits for each bin).
Bits #0-2 = 0b101	AMC zone	3.6	1 / 2	Bit #0~4: mean of CINR estimate for AMC AAS zone. Bit #5: Report type: 0 - CINR estimated from pilot subcarriers, 1- CINR estimated from data subcarriers Bit #6-7: reserved Bit #8~12: standard deviation of CINR estimate for AMC AAS zone. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.

REP-REQ Preamble CINR request	Name	Type	Length	Value
Bits #0-1 = 0b00	The estimation of CINR measured from preamble for frequency reuse configuration=1	4.1	1 / 2	Bit #0~4: The mean of CINR estimation measured from preamble for frequency reuse configuration=1. Bit #5~7: reserved. Bit #8~12: The standard deviation of CINR estimation measured from preamble for frequency reuse configuration=1. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.
Bits #0-1 = 0b01	The estimation of CINR measured from preamble for frequency reuse configuration=3	4.2	1 / 2	Bit #0~4: The mean of CINR estimation measured from preamble for frequency reuse configuration=3. Bit #5~7: reserved. Bit #8~12: The standard deviation of CINR estimation measured from preamble for frequency reuse configuration=3. Bit #13-15: reserved Note: The 2nd byte shall only be sent if length=2.
Bits #0-1 = 0b10	The estimation of CINR measured from preamble for Band AMC zone.	4.3	4	The estimation of CINR measured from preamble for band AMC subchannel. First 12 bits for the band indicating bitmap and Next 20 bits for CINR reports (5 bits per each band).

REP-REQ Preferred-MCS request	Name	Type	Length	Value
Bits #0-2 = 0b000	PUSC zone with 'use all SC=0'	5.1	1	Bit #0-5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) for PUSC zone with 'use all SC=0' and PRBS_ID indicated by 'Preferred MCS request'.

				Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.
Bits #0-2 = 0b001	PUSC zone with 'use all SC=1' / PUSC AAS zone	5.2	1	Bit #0-5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) for PUSC zone with 'use all SC=1' (or PUSC AAS zone) and PRBS_ID indicated by 'Preferred MCS request'. Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.
Bits #0-2 = 0b010	FUSC zone	5.3	1	Bit #0-5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) for FUSC zone with PRBS_ID indicated by 'Preferred MCS request'. Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.
Bits #0-2 = 0b011	Optional FUSC zone	5.4	1	Bit #0-5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) for Optional FUSC zone with PRBS_ID indicated by 'Preferred MCS request'. Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.
Bits #0-2 = 0b101	AMC AAS zone	5.5	1	Bit #0-5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) for AMC AAS zone with PRBS_ID indicated by 'Preferred MCS request'. Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.

REP-REQ Preamble Preferred-MCS request	Name	Type	Length	Value
Bits #0-1 = 0b00	The estimation of preferred-MCS measured from preamble for frequency reuse configuration=1	6.1	1	Bit #0~5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) based on measurement from preamble with frequency reuse configuration=1.

				Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.
Bits #0-1 = 0b01	The estimation of preferred-MCS measured from preamble for frequency reuse configuration=3	6.2	1	Bit #0~5: Preferred DIUC (bits #0-3) and repetition rate (bits #4-5) based on measurement from preamble with frequency reuse configuration=3. Bit #6-7: 2 least significant bits of CQICH_ID Note: CQICH_ID applies to preferred-MCS triggered update (see section 6.3.18.2) for CQI channel allocated with a CQICH_ID, and shall be zero in all other cases.

[Add the following text at the end of the last table in 11.2]

For the TLVs with type 3.x and 4.x, the following 5 bit CINR measurement encoding shall be used:

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