**3GPP TSG-RAN WG4 Meeting #96-e R4-200xxxx**

**Electronic Meeting, 17 - 28 Aug, 2020**

**Agenda item:** 7.10.3

**Source:** Moderator (China Telecom)

**Title:** Email discussion summary for [96e][321] NR\_DL256QAM\_FR2\_Demod

**Document for:** Information

# Introduction

This email thread discusses the demodulation and CSI reporting requirements for FR2 DL 256QAM in agenda 7.10.3.

List of candidate target of email discussion for 1st round and 2nd round:

* 1st round: Invite companies to review the recommended WF in each sub-topic, and provide comments (if any) in section 1.3, 2.3 and 3.3.
* 2nd round: TBA

# Topic #1: PDSCH normal demodulation requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009584 | China Telecom | Proposal 1: Not model Rx impairment in the simulation.  Proposal 2: Use rank 1 for FR2 PDSCH demodulation requirements.  Proposal 3: Use TDLA30-300 fading channel for rank 1. |
| R4-2009728 | Intel Corporation | Proposal 1: Define FR2 256QAM demodulation requirements only for scenarios with Rank 1 and Static or TDL-D channel model. |
| R4-2010996 | Huawei, HiSilicon | Observation 1: For NR DL 256QAM for FR2, the maximum testable SNR is 22.6dB for 50MHz bandwidth and 19.4dB for 100MHz bandwidth respectively.  Observation 2: Fading channel with rank 2 is not feasible.  Observation 3: For 100MHz CBW, only cases for AWGN/TDL-D30-35 with MCS 20 and rank 1 are feasible.  Proposal 1: RAN4 should define the performance requirements for NR DL 256QAM for FR2 with the cases that satisfying the demand that required SNR is less than 22.6dB for 50MHz bandwidth and 19.4dB for 100MHz bandwidth respectively.  Proposal 2: Define requirements for NR DL 256QAM for FR2 with the following parameters:   |  |  | | --- | --- | | Parameters | Value | | Rank | 1 | | MCS | 20 | | CBW | 50MHz | | Propagation condition | TDL-C30-300 | | Rx impairment | No explicit modelling | |
| R4-2011041 | NTT DOCOMO, INC. | Observation 1  Table 1. Summary of ideal simulation results   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Rank | Channel Model | Antenna configuration | CBW (MHz) | SNR point (dB) @70%TP  Using MCS index: | | 20 | | 1 | TDLD  30-35 | 2x2 | 50 | 16.5 dB | | 2 | Static | 2x2 | 50 | 19.9 dB |   Observation 2: Considering around 3dB impairment margin, TDL-D 30-35 is testable under 50MHz CBW with full PRB allocation.  Proposal 1: Consider following options for propagation condition for FR2 DL 256QAM   * For Rank 1 * TDL-D (30-35 or 30-75) or TDL-A (30-300) |
| R4-2011374 | Ericsson | Observation 1: Under ideal simulations (without impairment), the 70% testing point is close to the SNR limit with OTA testing.  Proposal 1: Do not create demodulation requirements using static channel model. |
| R4- 2011424 | Qualcomm Incorporated | Observation 1: Maximum testable SNR for FR2 band n260, 50MHz/120kHz under Mode 1 (used for fixed MCS, CQI reporting requirements) is 21.0 dB.  Proposal 1: Define FR2 DL 256QAM fixed MCS requirements for TDLD30-75, MCS20, Rank1.  Proposal 2: Do not define FR2 DL 256QAM fixed MCS requirements for Rank 2. |

## Open issues summary

### PDSCH normal test parameters

**Issue 1-0: Maximum testable SNR for PDSCH demodulation requirements (for information)**

* Summary of companies’ observations:
  + Huawei: **22.6dB** for 50MHz bandwidth and 19.4dB for 100MHz bandwidth.
    - UE can’t assume which test method is used, therefore only the maximum SNR 19.4dB can be ensured which is the maximum SNR using DFF method. For channel bandwidth 50MHz, we calculate that the maximum testable SNR using DFF method is 22.6dB derived from spreadsheet in TS 38.810.
  + Intel: **22.4dB** for 50MHz bandwidth and 19.4dB for 100MHz bandwidth.
    - For DFF method and CBW 100 MHz, maximum testable SNR is 19.4 dB. As 50 MHz CBW will be used for FR2 256QAM requirements, SNR 22.4 dB can be assumed as maximum testable for further analysis.
  + Qualcomm: Maximum testable SNR for FR2 band n260, 50MHz/120kHz under Mode 1 (used for fixed MCS, CQI reporting requirements) is **21.0dB**.
    - Using the Demod SNR range calculator spreadsheet in 38.810, we computed the testable SNR for Mode1 (with Noc) as presented in below observation assuming multi-band relaxation factor of 1.7dB in Cell K5 as per maximum value in Table 6.2.1.3-4 in 38.101-2.
  + CTC: 19.9dB for 100MHz bandwidth
    - According to the “Spreadsheet 2 - Demod SNR range calculator.xls” file attached to the TR 38.810, for indirect far field (IFF) method, at least the SNR of 19.9 dB is feasible for 100MHz channel bandwidth.

**Issue 1-1: Rx impairment modelling**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *The following scenarios can be considered for band agnostic requirements definition; and FFS for other scenarios*
    - *Static channel mode: MCS 20-23, rank 1*
    - *TDL-D channel mode: MCS 20-21, rank 1*
    - *TDL-A channel mode: MCS 20-21, rank 1*
  + *FFS on whether to explicitly model Rx impairment until the next meeting*
* Proposal on Rx impairment modelling
  + Option 1: Not explicitly model Rx impairment (CTC, Huawei)
    - CTC: Aligned with Rel-15 FR2 demodulation tests.
    - Huawei: In Rel-15, there is no explicit phase noise modelling and all cases are band agnostic. Also, phase noise model in TR 38.803 is just an example. It is not suitable to use such example model when defining performance requirements.
* Recommended WF
  + Not explicitly model Rx impairment.

**Issue 1-2: Rank**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *Rank*
    - *Option 1: Rank 1*
    - *Option 2: Define requirements for Rank 1, FFS on whether to define requirements for rank 2*
    - *Option 3: Define requirements for single Rank configuration, i.e., either rank1 or rank 2*
* Proposal
  + Option 1: Rank 1 only (CTC, Intel, Huawei, DCM, Qualcomm)
* Recommended WF
  + Use rank 1 only.

**Issue 1-3: Propagation condition and MCS**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *MCS*
    - *MCS 20 for rank 1, if requirements for rank 1 are to be defined.*
    - *FFS for rank 2*
  + *Propagation condition*
    - *Option 1: Fading channel*
      * *Option 1A: TDLA30-300*
      * *Option 1B: TDLD30-75*
      * *Option 1C: TDLD30-35*
    - *Option 2: Static channel*
    - *TBD in the next meeting based on more companies’ simulation results*
* Proposals on MCS for rank1
  + Option 1: MCS20 (Huawei, Qualcomm, agreement in the last meeting)
* Proposals on propagation condition for rank1
  + Option 1: Fading channel (CTC, Huawei, DCM, Ericsson, Intel, Qualcomm)
    - Option 1A: TDLA30-300 (CTC, [Huawei], DCM)
    - Option 1B: TDLD30-75 (Intel, DCM, Qualcomm)
    - Option 1C: TDLD30-35 (Intel, DCM)
      * CTC: NLOS channel is more typical for demodulation tests. Note that LOS channel models including TDL-D and TDL-E have been not specified in TS 38.101-4 yet.
      * Huawei: Considering the extra workload for simplifying TDL-D channel model, we are OK to define [TDL-A] cases.
      * DCM: Considering that performance gain from DL 256QAM would be quite limited in NLOS condition, it is natural to assume LOS propagation model, i.e. TDL-D, for DL 256QAM. On the other hand, only for Rank 1, some performance gain would be considered even in NLOS condition.
      * Ericsson: We do not think testing demodulation requirements with static channel models should be considered. There are already defined REFSENS scenarios with static channel models in place.
      * Intel: we have sufficient margin only for scenarios with Rank 1 transmission and Static or TDL-D channel model.
  + Option 2: Static channel (Intel)
* Summary of companies’ ideal simulation results for FR2 256QAM demodulation with 120kHz SCS

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rank | Channel Model | Antenna configuration | CBW (MHz)/PRB allocation (full/partial) | SNR point (dB) @70%TP (Ideal) | | | | | |
| CTC | Intel | Huawei | DCM | Ericsson | QC |
| 1 | Static | 1x2 | 50/full |  | 16.1 | 15.92 |  | 15.3 | 17.30 |
| 1 | TDLD30-35 | 2x2 | 50/full |  | 17.9 | 16.70 | 16.5 |  | 17.85 |
| 1 | TDLD30-75 | 2x2 | 50/full |  |  |  |  |  | 17.84 |
| 1 | TDLA30-300 | 2x2 | 50/full |  | 18.9 | 17.94 |  | 17.3 | 19.54 |
| 1 | TDLA30-300 | 2x2 | 100/full | 17.76 |  |  |  |  |  |
| 1 | TDLA30-75 | 2x2 | 100/full | 17.82 |  |  |  |  |  |
| 1 | TDLC60-300 | 2x2 | 100/full | 17.80 |  |  |  |  |  |
| 2 | Static | 2x2 | 50/full |  | 19.1 | 18.94 | 19.9 |  | 20.59 |
| 2 | TDLD30-35 | 2x2 | 50/full |  | 23.9 |  |  |  |  |
| 2 | TDLA30-300 | 2x2 | 50/full |  | 29.5 |  |  |  |  |

* Recommended WF
  + MCS for rank 1:
    - Keep the agreement in the last meeting, i.e., use MCS 20
  + Propagation condition for rank 1:
    - Use fading channel, and further decide whether to use TDLA30-300 or TDLD30-75
      * Pros of using TDLA30-300: avoid extra workload for simplifying TDL-D channel model
      * Pros of using TDLD30-75: lower SNR is required

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | **Topic #1: PDSCH normal demodulation requirements**  Issue 1-1: Rx impairment modelling  Issue 1-2: Rank  Issue 1-3: Propagation condition and MCS  Others |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
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### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: SDR requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009584 | China Telecom | Observation 1: The chance for using 256QAM in FR2 SDR test does exist, it is not reasonable to prevent introducing FR2 SDR tests due to the testability issue.  Proposal 4: Define FR2 SDR requirements for 256QAM:   * Add MCS indexes 26, 21, 20 and 11 in MCS table 2 for both 1 and 2 MIMO layers. * Run simulations to derive the required SNR at 85% throughput for MCS 20 to MCS 26 in MCS table 2, with both 1 layer and 2 layers. |
| R4-2009729 | Intel Corporation | Proposal 1: Do not define SDR requirements for FR2 256QAM. |
| R4-2010997 | Huawei, HiSilicon | Observation 1: Considering extra 0.8dB margin,   * For maximum supporting MIMO layer 1, MCS 26 can be test only for the bandwidth less than 200MHz, MCS 20 can be test for the bandwidth less than 500MHz. * For maximum supporting MIMO layer 2, MCS 26 can be test only for the bandwidth of 50MHz, MCS 20 can be test for the bandwidth less than 200MHz.   Proposal 1: Do not define SDR requirements for FR2 256QAM for Rel-16. |
| R4-2011042 | NTT DOCOMO, INC. | Proposal 1: Define FR2 256QAM SDR requirements both for rank 1 and rank 2 |
| R4- 2011425 | Qualcomm Incorporated | Observation 1: Maximum testable SNRs for FR2 band n260 under Mode 2 (used for SDR requirements) are given in Table 1.  Proposal 1: Define SDR requirements for FR2 256QAM. |

## Open issues summary

### SDR test parameters

**Issue 2-1: Whether to define SDR requirements for FR2 256QAM**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *In the next meeting, decide whether to define SDR requirements for FR2 256QAM, based on more simulation results and analysis for testable SNR*
* Proposal
  + Option 1: Define FR2 SDR requirements for 256QAM (CTC, DCM, QC)
    - CTC: The chance for using 256QAM in FR2 SDR test does exist, it is not reasonable to prevent introducing FR2 SDR tests due to the testability issue.
    - DCM: From operator perspective, we consider that DL rank 2 transmission is one of typical configurations even for FR2. It is important to ensure the UE functionality of FR2 256QAM with Rank 2 as Rank 1.
    - QC: Based on preliminary simulation results, we can get to higher throughput than 64QAM for some cases.
  + Option 2: Not to define FR2 SDR requirements for 256QAM (Intel, Huawei)
    - Intel: 1) 256QAM MCS and Rank 2 can be tested for channel bandwidth up to 400 MHz for bands n257, n258, n261 and up to 200 MHz for band n260. 2) rather high MCSs (i.e. MCS 24-27) can be tested mainly for 50 and 100 MHz aggregated channel bandwidth.
    - Huawei: 1) For maximum supporting MIMO layer 1, MCS 26 can be test only for the bandwidth less than 200MHz, MCS 20 can be test for the bandwidth less than 500MHz. 2) For maximum supporting MIMO layer 2, MCS 26 can be test only for the bandwidth of 50MHz, MCS 20 can be test for the bandwidth less than 200MHz.
* Summary of companies’ simulation results for SDR test

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rank** | **MCS** | **Ideal 85% SNR point (dB)** | | | | **Impairment 85% SNR point (dB)** | | | |
| **CTC** | **Intel** | **Huawei** | **QC** | **CTC** | **Intel** | **Huawei** | **QC** |
| 1 | 27 |  | 24.2 |  |  |  | 27.2 |  |  |
| 1 | 26 | 21.3 | 22.7 | 21.56 |  | 24.1 | 25.7 | 24.06 |  |
| 1 | 25 |  | 21.6 | 20.70 | 25.71 |  | 24.6 | 23.20 | 28.51 |
| 1 | 24 |  | 20.4 | 19.73 | 23.30 |  | 23.4 | 22.23 | 26.1 |
| 1 | 23 |  | 19.7 | 18.61 | 21.50 |  | 22.7 | 21.01 | 24.3 |
| 1 | 22 |  | 18.5 | 17.21 | 19.82 |  | 21.5 | 19.71 | 22.62 |
| 1 | 21 | 16.0 | 17.1 | 16.55 | 18.28 | 18.8 | 20.1 | 19.05 | 21.08 |
| 1 | 20 | 15.4 | 16.5 | 15.78 | 17.56 | 18.2 | 19.5 | 18.28 | 20.36 |
| 1 | 11 | 6.8 |  |  |  | 9.6 |  |  |  |
| 2 | 27 |  | 27.2 |  |  |  | 30.2 |  |  |
| 2 | 26 | 24.4 | 25.7 | 24.60 |  | 27.2 | 28.5 | 27.10 |  |
| 2 | 25 |  | 24.6 | 23.51 |  |  | 27.4 | 26.01 |  |
| 2 | 24 |  | 23.4 | 22.66 |  |  | 26.3 | 25.16 |  |
| 2 | 23 |  | 22.7 | 21.48 |  |  | 25.7 | 23.98 |  |
| 2 | 22 |  | 21.5 | 20.13 | 23.23 |  | 24.4 | 22.63 | 26.03 |
| 2 | 21 | 19.3 | 20.1 | 19.39 | 21.64 | 22.1 | 23.0 | 21.89 | 24.44 |
| 2 | 20 | 18.5 | 19.5 | 18.65 | 20.75 | 21.3 | 22.5 | 21.15 | 23.55 |
| 2 | 11 | 9.9 |  |  |  | 12.7 |  |  |  |

* Analysis on testable SNR for SDR requirements:
  + Huawei: The maximum testable SNR can be derived as per the following equations referenced from TS 38.810.

|  |
| --- |
| SNRmax = Ps,max / Pnoise,Σ  Pnoise,Σ = NnoiseRF \* BW  Ptotal,max = Ps,max  SNRmax = Ptotal,max / (NnoiseRF \* BW) |

|  |  |  |  |
| --- | --- | --- | --- |
| Channel Bandwidth/MHz | Maximum SNR/dB | | |
| DNF | DFF | IFF |
| 50 | 32.75 | 29.55 | 29.85 |
| 100 | 29.87 | 26.67 | 26.97 |
| 200 | 26.86 | 23.66 | 23.96 |
| 400 | 23.85 | 20.65 | 20.95 |
| 500 | 22.88 | 19.68 | 19.98 |
| 600 | 22.09 | 18.89 | 19.19 |
| 700 | 21.42 | 18.22 | 18.52 |
| 800 | 20.84 | 17.64 | 17.94 |
| 900 | 19.83 | 16.63 | 16.93 |
| 1000 | 19.37 | 16.17 | 16.47 |

* + Intel: Testable SNR for Normal and SDR requirements is different because generation of noise is not needed for SDR and more power can be used for generation of useful signal.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band** |  | **Aggregated channel bandwidth, [MHz]** | | | | | | | | |
|  | **50** | **100** | **200** | **400** | **500** | **600** | **700** | **800** | **1000** |
| **n257, 258, 261** | **TE SNR, [dB]** | 32.1 | 29.3 | 26.3 | 23.2 | 22.3 | 21.5 | 20.8 | 20.2 | 18.8 |
| **Feasible MCS (Rank 1)** | MCS27 | MCS27 | MCS26 | MCS23 | MCS22 | MCS22 | MCS21 | MCS21 | N/A |
| **Feasible MCS (Rank 2)** | MCS27 | MCS26 | MCS23 | MCS21 | N/A | N/A | N/A | N/A | N/A |
| **n260** | **TE SNR, [dB]** | 29.5 | 26.7 | 23.7 | 20.6 | 19.7 | 18.9 | 18.2 | 17.6 | 16.2 |
| **Feasible MCS (Rank 1)** | MCS27 | MCS26 | MCS22 | MCS21 | MCS20 | N/A | N/A | N/A | N/A |
| **Feasible MCS (Rank 2)** | MCS26 | MCS23 | MCS21 | N/A | N/A | N/A | N/A | N/A | N/A |

* + Qualcomm: Using the Demod SNR range calculator spreadsheet in 38.810, the testable SNR for SDR scenario (Mode 2) is presented assuming multi-band relaxation factor of 1.7dB in Cell K5 as per maximum value in Table 6.2.1.3-4 in 38.101-2. For deriving testable SNR for SDR requirements, we set Cell M11 in the spreadsheet to 20dB and vary the number of RBs in Cell K28 based on CBW.

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| --- | --- | --- | --- | --- | --- | --- |
| CBW (MHz) | 50 | 100 | 200 | 400 | 800 | 1200 |
| Number of RBs | 32 | 66 | 132 | 264 | 528 | 792 |
| Max Testable SNR in dB | 28.1 | 25.0 | 22.0 | 18.9 | 15.9 | 14.2 |

* **Moderator’s observation**
  + It is common understanding that the testable SNR is higher for SDR test compared to normal test, although there are different views on the exact testable SNR numbers.
  + The chance for using 256QAM in FR2 SDR test does exist. The question is how large the opportunity of using 256QAM is and whether it worth to define the tests.
* Recommended WF
  + Since we agreed to decide whether to define SDR requirements for FR2 256QAM in this meeting, encourage further discussion.

**Issue 2-2: MCS and rank for SDR test**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *If it is agreed to define SDR requirements, consider the following test parameters:*
    - *MCS and rank*
  + *Option 1: Add MCS indexes 26, 21, 20 and 11 in MCS table 2 for both 1 and 2 MIMO layers. Run simulations for MCS 20 to MCS 26 in MCS table 2 to derive the required SNR achieving 85% of peak throughput under AWGN conditions.*
  + *Other options are not precluded.*
* Proposal
  + Option 1 (CTC)
    - Add MCS indexes 26, 21, 20 and 11 in MCS table 2 for both 1 and 2 MIMO layers.
    - Run simulations to derive the required SNR at 85% throughput for MCS 20 to MCS 26 in MCS table 2, with both 1 layer and 2 layers.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Company A | **Topic #2: SDR requirements**  Issue 2-1: Whether to define SDR requirements for FR2 256QAM  Issue 2-2: MCS and rank for SDR test |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
|  |  |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: CQI reporting requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009584 | China Telecom | Proposal 5: Define FR2 CQI reporting test using CQI Table 2.  Proposal 6: For the test applicability for UE supporting FR2 256QAM , the corresponding Rel-15 FR2 CQI test using CQI Table 1 can be replaced by the new defined CQI Table 2 test.  Proposal 7: Cover both AWGN and fading conditions.  Observation 2: In AGWN condition, when the SNR is 18dB or lower, the chance of reporting CQI corresponding to 256QAM (i.e., CQI index > 11) is nearly none.  Proposal 8: To cover CQI reporting corresponding to 256QAM, configure higher SNR test points, i.e., 19/20 dB for AWGN condition and 17/18 dB for fading condition in FR2 CQI table 2 test.  Proposal 9: Use channel bandwidth of 50MHz for both AWGN and fading conditions to have higher achievable SNR.  Proposal 10: The other test parameters defined for Rel-15 CQI Table 1 test can be reused. |
| R4-2010998 | Huawei, HiSilicon | Observation 1: For NR DL 256QAM for FR2, the maximum testable SNR is 22.6dB for 50MHz bandwidth and 19.4dB for 100MHz bandwidth respectively.  Proposal 1: RAN4 should define the performance requirements for NR DL 256QAM for FR2 with the cases that satisfying the demand that required SNR is less than 22.6dB for 50MHz bandwidth and 19.4dB for 100MHz bandwidth respectively.  Proposal 2: Do not define CQI reporting requirements under AWGN channel. |
| R4- 2011433 | Qualcomm Incorporated | Observation 1: Maximum testable SNR for FR2 band n260, 50MHz/120kHz under Mode 1 (used for fixed MCS, CQI reporting requirements) is 21.0 dB.  Observation 2: It is not possible to reach 256QAM CQI under fading condition due to the testable SNR limit for FR2.  Proposal 1: Do not define FR2 256QAM fading CQI reporting requirements. |

## Open issues summary

### CQI test parameters

**Issue 3-1: Whether to define FR2 CQI reporting requirements for CQI table 2**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *In the next meeting, decide whether to define FR2 CQI reporting requirements for CQI table 2*
* Proposal
  + For AWGN condition:
    - Option 1: Yes (CTC)
    - CTC: Based on our simulation results, when the SNR is 19dB and 20dB, the chance of reporting CQI corresponding to 256QAM (i.e., CQI index > 11) is 49% and 99% respectively.
    - Option 2: No (Huawei)
    - Huawei: For AWGN case, Median CQI 11 is expected at SNR 22dB (add 3dB margin), of which the modulation order is 64QAM.
  + For fading condition:
    - Option 1: Yes (CTC)
    - CTC: Under fading condition, it is expected that lower SNR will be needed for UE to report CQI corresponding to 256QAM with certain opportunity.
    - Option 2: No (QC)
    - Qualcomm: The alignment required SNR to achieve 90% of peak throughput for fixed MCS21 (minimum 256QAM CQI) is 22.52dB under TDLA30-35 and 19.44dB under TDLD30-35. It is not possible to reach 256QAM CQI under fading condition due to the testable SNR limit for FR2.
* Recommended WF
  + TBA whether to define FR2 CQI reporting requirements for CQI table 2
  + If it is agreed to define FR2 CQI reporting requirements for CQI table 2, use channel bandwidth of 50MHz.

**Issue 3-2: Test applicability for FR2 256QAM CQI Test**

* Proposal
  + Option 1: Replace the corresponding Rel-15 FR2 CQI test using CQI Table 1 by the new defined CQI Table 2 test. (CTC)
* Recommended WF
  + Encourage feedback from more companies.

**Issue 3-3: SNR testing point**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *If it is agreed to define FR2 CQI reporting, consider the following test parameters*
    - *SNR testing point*
    - *Option 1: Cover higher SNR testing point compared to that in Rel-15 FR2 CQI tests*
    - *Other options are not precluded*
* Proposal
  + For AWGN condition:
    - Option 1: 19/20 dB (CTC)
    - CTC: In AGWN condition, when the SNR is 18dB or lower, the chance of reporting CQI corresponding to 256QAM (i.e., CQI index > 11) is nearly none.
  + For fading condition:
    - Option 1: 17/18 dB (CTC)
* Recommended WF
  + Encourage feedback from more companies.

**Issue 3-4: Other parameters**

* *Agreement in RAN4 #95e (R4-2008817, WF)*
  + *If it is agreed to define FR2 CQI reporting, consider the following test parameters*
    - *Other parameters*
    - *Option 1: Reuse the assumptions in Rel-15 FR2 CQI tests*
    - *Other options are not precluded*
* Proposal
  + Option 1: reuse the assumptions in Rel-15 FR2 CQI tests (CTC)
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Topic #3: CQI reporting requirements**  Issue 3-1: Whether to define FR2 CQI reporting requirements for CQI table 2  Issue 3-2: Test applicability for FR2 256QAM CQI Test  Issue 3-3: SNR testing point  Issue 3-4: Other parameters |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
|  |  |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |