**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 8.15.1; 8.15.3

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [98-bis-e][139] NR\_DL1024QAM\_FR1

**Document for:** Information

# Introduction

This email discussion is for NR\_DL1024QAM\_FR1 Work item and deals with General issues and UE requirements. Requirements on GS is treated in another thread.

The objective for the core part is to specify downlink 1024QAM for NR PDSCH operation in FR1, together with related procedures, signalling and necessary RF requirements. The main objectives are:

* Specify high order modulation for PDSCH [RAN1]
	+ Specify 1024QAM constellation as specified in E-UTRA for DL PDSCH
	+ Specify corresponding 5-bit MCS table with 1024QAM entries as defined in E-UTRA, with 5 bit DCI overhead for MCS indication
	+ Specify corresponding CQI feedback with 1024QAM entries as defined in E-UTRA, with no changes to the CQI field and table sizes
* Specify corresponding RRC signalling and UE capabilities [RAN2]
	+ Note: DL PDSCH 1024QAM for FR1 should be defined as a per-band UE capability
* Specify corresponding UE and BS RF core requirements [RAN4]
	+ UE and BS RF core requirements are specified for stationary wireless scenarios with up to 2 layer DL MIMO
	+ The cell size(s) and type of stationary wireless scenarios for which UE and BS RF core requirements are defined will be studied and decided by RAN4.

The following topics are discussed in this email thread:

Topic #1: UE RF Requirements

Topic #2: General and work plan

# Topic #1: UE RF Requirements

This topic covers the UE RF requirements.

A proposal for work split for the UE RF requirements will be included in the 2nd round.

Note! Papers related to UE RF requirements from both Agenda Item 8.15.1 and 8.15.3 are included

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104726 | CATT | **Moderator note: This paper is also included in the BS requirements thread (314) since it also relates to BS EVM****Observation 1: Regarding crossover SNR between 1024QAM and 256QAM for Rank 1, the crossover SNR is shown as in table 2.1-2.*** + The crossover SNR with 3%/4% TX/RX EVM in TDL-A is ~35.7dB.
	+ As TX/RX EVM decreases, crossover SNR also decreases
	+ For the same TX/RX EVM, the crossover SNR in TDL-D is lower than that in TDL-A.

**Observation 2: Regarding EVM for Rank 1 between 1024QAM and 256QAM, the performance gain is shown as in table 2.1-3.** * + As TX/RX EVM decreases, throughput gain of 1024QAM compared to 256QAM increases, if TX/RX EVM decreases to 3%/3%, the throughput gain of 1024QAM compared to 256QAM in TDL-A is increased by ~19.8%.
	+ For the same TX/RX EVM, the throughput gain of 1024QAM compared to 256QAM in TDL-D is larger than that in TDL-A.

**Proposal 1: It is proposed to approve the simulation assumptions in Table 2.1-1 for further EVM evaluations.** |
| R4-2104727 | CATT | Moderators note: This document is not available, suggest to withdraw the paper. |
| R4-2104729 | CATT | **Proposal 1: 0dB relaxation is proposed for 1024QAM compared with 256QAM for both single carrier and intra-band CA.****Proposal 2: It is proposed to adopt the changes as in Table 1 and Table 2 for 38.101 for 1024QAM.** |
| R4-2106487 | Huawei, HiSilicon, CMCC, China Unicom | Moderators note: This paper is moved and is treated in the BS requirements thread (314) |
| R4-2106489 | Huawei, HiSilicon, CMCC, China Unicom | **Proposal 1: 1.5% to 2% RX EVM could be assumed in the evaluation for link-level simulation.** |
| R4-2106688 | Ericsson | **Proposal 1: Include “NOTE4: Reference measurement channel is A.3.2.x for 1024 QAM” and keep maximum input level unchanged for addition of 1024 QAM. Reference measurement channels will be discussed during UE performance stage.****Proposal for work split considerations for impacted TS:**

|  |  |
| --- | --- |
| TS No. | Sourcing Company |
| 38.101-1 |  |
| 38.101-4 | To be discussed in UE performance part |

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## Open issues summary

### Sub-topic 1-1

Sub-topic description: EVM evaluation parameters

**Issue 1-1: Link level simulation assumptions for further EVM evaluations**

* Proposals
	+ Option 1: Approve the link level simulation assumptions parameters/values provided in R4-2104726
	+ Option 2: Approve the specific Rx EVM values of 1,5% to 2% for link level simulation provided in R4-2106489, that differs from corresponding values in Option 1.
	+ Option 3: Further discuss and align link level simulation assumptions w.r.t parameters and their values
* Recommended WF
	+ TBA

### Sub-topic 1-2

Sub-topic description: Maximum input level

**Issue 1-2: Maximum input level updates**

* Proposals
	+ Agree to use a 0dB relaxation for 1024QAM compared to 256QAM
	+ Agree to introduce an appropriate note in the Maximum input tables in 38.101-1 referring to new RMCs defined in annex A (RMCs to be settled during performance part of the WI).
* Recommended WF
	+ Agree with the proposals above.

### Sub-topic 1-3

Sub-topic description: Work split for impacted TS

Moderator recommend to discuss the CR work split in the 2nd round.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1

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| **Company** | **Comments** |
| CATT | We prefer to do some evaluations. Simulation assumptions could be based on option 1 and further fine tune some parameters. |
| Ericsson | Option 3. Rx EVM values should be considered for 2% compared to Option 1 where Rx EVM is too high at 3%, 4%. Should CBW also be considered to be 100 MHz (rather than 20 MHz) since companies have highlighted this is a technical aspect different than LTE? Perhaps we can consider simulation evaluations:* CBW=100MHz, SCS=30kHz, fc=4GHz (assuming TDD midband).
* CBW=50MHz, SCS=15kHz fc=2GHz (assuming FDD lowband).
 |
| Huawei | Opion2, we agree some evaluation is needed for defining the EVM requirements in DL. 1.5% to 2% RX EVM should be included in the simulation. |

Sub topic 1-2

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| --- | --- |
| **Company** | **Comments** |
| CATT | Support the recommended WF. |
| Ericsson | Support recommended WF |
| Huawei | Ok with recommended WF |

### CRs/TPs comments collection

No CRs or TPs available at this meeting

## 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:* |

### CRs/TPs

No CRs or TPs available at this meeting

## Discussion on 2nd round (if applicable)

# Topic #2: General and work plan

This topic covers the input on Agenda Item 8.15.1 “General and workplan” that does not include anr UE RF requirements.

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2106858 | Ericsson, Nokia, Nokia Shanghai Bell | Suggested workplan provided by Rapporteurs.**RAN4#98bis-e (12 April – 20 April 2021),** * RF core (0.25 TU)
	+ Initial discussion on the UE RF receiver characteristics requirement impacts due to DL 1024QAM in FR1, e.g., maximum input level requirements.
	+ Initial discussion on the BS RF transmitter characteristics requirement impacts due to DL 1024QAM in FR1, e.g., RE power control dynamic range and transmit signal quality requirements.
	+ Discuss the CR work split for RF core part.

**RAN4#99-e (19 May – 27 May 2021)*** RF core (0.25 TU)
	+ Agree with the UE RF receiver characteristics requirements. Discuss the draft CR.
	+ Agree with the BS RF transmitter characteristics requirements. Discuss the draft CR.

**RAN4#100 (23 August – 27 August 2021)*** RF core (0.25 TU)
	+ Agree with the CR for UE RF requirements.
	+ Agree with the CR for BS RF requirements.

**RAN4#100bis (11 October – 15 October 2021)*** RF performance (0.25 TU)
	+ Discuss the DL FRC for DL 1024QAM. Discus the draft CR.
	+ Discuss the BS conducted/radiated transmitter characteristics conformance test requirements. Discuss the draft CR.
* UE demodulation and CQI reporting performance (0.5 TU)
	+ Initial discussion of UE demodulation requirements.
	+ Agree with the initial simulation assumption.

**RAN4#101 (15 November – 19 November 2021)*** RF performance (0.25 TU)
	+ Agree with the CR for UE RF FRC.
	+ Agree with the CR for BS RF conformance test requirements.
* UE demodulation and CQI reporting performance (0.5 TU)
	+ Continue the discussion of the UE demodulation requirements.
	+ Alignment of simulation results.
	+ Discuss the draft CR.

**RAN4#102 (21 February – 25 February 2022)** * UE demodulation and CQI reporting performance (0.5 TU)
	+ Alignment of the simulation results.
	+ Agree with the CR.
 |

## Open issues summary

### Sub-topic 2-1

Sub-topic description: Work plan

**Issue 2-1: Work plan**

* Proposals
	+ Approve the suggested work plan in R4-2106858
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### CRs/TPs comments collection

No CRs or TPs available at this meeting

### Open issues

Sub topic 2-1: work plan

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| **Company** | **Comments** |
| Ericsson | Approve work plan in R4-2106858 |
| Huawei | The WI objective on cell size(s) and type of stationary wireless scenario is not included in the work plan |

## 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:* |

### CRs/TPs

No CRs or TPs available at this meeting

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

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| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
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	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents