**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-22XXXXX**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item:** 4.3.8

**Source:** Moderator (Nokia, Nokia Shanghai Bell)

**Title:** Email discussion summary for [104-bis-e][319] NR\_exto71GHz\_Demod\_Part1

**Document for:** Information

# Introduction

This document contains the summary for guiding the discussion on the email thread [104-bis-e][319] NR\_exto71GHz\_Demod\_Part1, which discusses demodulation requirements for extension to 71 GHz, with general issues and issues related to base station demodulation. Issues related to UE demodulation are discussed on [104-bis-e][320] NR\_exto71GHz\_Demod\_Part2.

This summary is based on the contributions submitted to the agenda items:

* 4.3.7 Demodulation and CSI requirements [NR\_ext\_to\_71GHz-Perf]
* 4.3.7.1 General (incl. Channel models) [NR\_ext\_to\_71GHz-Perf]
* (…) \* AI 4.3.7.2 is covered by [104-bis-e][320] NR\_exto71GHz\_Demod\_Part2
* 4.3.7.3 BS demodulation requirements [NR\_ext\_to\_71GHz-Perf]
* 4.3.7.3.1 PUSCH requirements [NR\_ext\_to\_71GHz-Perf]
* 4.3.7.3.2 PUCCH requirements [NR\_ext\_to\_71GHz-Perf]
* 4.3.7.3.3 PRACH requirements [NR\_ext\_to\_71GHz-Perf]

The topics for this discussion are organized as follows:

* Topic #1 includes general aspects which apply for BS demod
* Topic #2 includes BS demodulation aspects only related to PUSCH
* Topic #3 includes BS demodulation aspects only related to PUCCH
* Topic #4 includes BS demodulation aspects only related to PRACH

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

* Since this is a short meeting, it is suggested to comment on the technical issues and CRs already on the first round.

Previous WFs for information:

* R4-2207223, WF on demodulation performance requirements definition for 52.6 - 71 GHz, Intel
* R4-2207205, Work plan for FR2-2 demodulation performance requirement definition, Intel
* R4-2210664, WF on general and BS aspects for FR2-2 demodulation requirements, Intel
* R4-2214655, WF on general aspects for demodulation requirements for FR2-2, Huawei
* R4-2214388, WF on PUSCH demodulation requirements for FR2-2, Nokia, Nokia Shanghai Bell
* R4-2214500, WF on PUCCH demodulation requirements for FR2-2, Ericsson
* R4-2214389, WF on PRACH demodulation requirements for FR2-2, Samsung

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Nokia, Nokia Shanghai Bell | Rafael Paiva | Rafael.paiva@nokia.com |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: General aspects for BS demodulation

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** | **Issue mapping** |
| [**R4-2215690**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215690.zip) | Ericsson | Discussion on general and PUSCH issue for FR2-2 BS demodulationObservation 1: Defining 960kHz SCS requirements as optional would lead to the same results that no tests will be done for 960kHz SCS if corresponding requirements are optional. Proposal 1: RAN4 do not consider 960kHz SCS for FR2-2 BS demodulation requirements.Proposal 2: Only consider the minimum CBW 400MHz BS demodulation requirement for 480kHz SCS in Rel-17 based on current progress. Proposal 3: Take adjusting AWGN offset level as the last method for link budget calculation when margin is not enough. And the corresponding feasibility should be checked. Proposal 4: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage. Observation 2: Two proposals indicate similar approach.Proposal 5: Take Option 3-3 that MCS20 with 1T2R low and MCS18 with 2T2R low If the final link budget agreement indicate 20dB SNR limit could be applied for FR2-2. | P1: Issue 1-1-1P2: 1-1-2P3: 1-2-22-1-1P4: 1-2-1P5: 2-2-1 |
| [**R4-2216691**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216691.zip) | Samsung | View on BS demodulation requirement for NR extended to 71GHzProposal 1: RAN4 applies only 120KHz and 480KHz SCS for UL requirements definition.Proposal 2: RAN4 applies only 100MHz CBW with 120KHz SCS, 400MHz CBW with 480KHz SCS for PUSCH requirement. | P1: 1-1-1 2-1-1P2: 2-1-2 |
| [**R4-2216010**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216010.zip) | Huawei,HiSilicon | Discussion on general issues for FR2-2 demodulation requirements | Discussed in [320] |
| [**R4-2216179**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216179.zip) | Qualcomm Incorporated | Draft CR to 38.101-4 for FR2-2 Demod - General section | Discussed in [320] |

## Open issues summary

### Sub-topic 1-1 Channel bandwidth and SCS

**Issue 1-1-1: SCS for demodulation requirements**

* Proposals
	+ Option 1: RAN4 do not consider 960kHz SCS for FR2-2 BS demodulation requirements.
	+ Option 2: Consider 120 kHz, 480 kHz and 960 kHz SCS for FR2-2 BS demodulation requirements
* Recommended WF
	+ Discuss your preferences
	+ Please notice there are specific issues discussing SCS for PUSCH, PUCCH and PRACH

**Issue 1-1-2: Channel bandwidth for demodulation requirements**

* Proposals
	+ Option 1: Only consider the minimum CBW 400MHz BS demodulation requirement for 480kHz SCS in Rel-17 based on current progress.
	+ Option 2:
* Recommended WF
	+ Please discuss the options

### Sub-topic 1-2 SNR limit

From the discussion in RAN4 #104 the following WF was open on the SNR limit R4-2214655:

|  |
| --- |
| * Proposals
	+ Option 1: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage. Pending the decision until RF have agreements on the link budget.
	+ Option 2: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage.
	+ Other options are not precluded
 |

And from RAN4 #102, we have this agreement R4-2207223:

|  |
| --- |
| **Issue 2-2-3: Test SNR limit**Take [20] dB SNR limit FR2-2 at starting point. New test cases and method should be defined if it is finally approved that FR2-2 SNR limit is much lower than [20] dB. |

From the RF session, the following agreement was reached during the previous meeting R4-2214374:

|  |
| --- |
| Sub-topic #3-1: BS demod OTA test methodologyIssue 3-1: AWGN offset**Agreement:*** RAN4 to define demodulation requirements for FR2-2 including opportunity for [0-15] dB AWGN offset as specified for FR2-1.
* Demodulation requirements can be proceeded based on the agreements from RF session.
 |

**Issue 1-2-1: SNR limit**

* Proposals
	+ Option 1: Use the minimum CBW and 20dB SNR limit for discussion at current stage. Pending the decision until RF have agreements on the link budget.
	+ Other options.
* Recommended WF
	+ Please discuss.

**Issue 1-2-2: AWGN offset**

* Proposals
	+ Option 1: Take adjusting AWGN offset level as the last method for link budget calculation when margin is not enough. And the corresponding feasibility should be checked.
	+ Other options.
* Recommended WF
	+ Please discuss.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 Channel bandwidth and SCS

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 1-1-1: SCS for demodulation requirementsIssue 1-1-2: Channel bandwidth for demodulation requirements |
|  |  |

Sub topic 1-2 SNR limit

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 1-2-1: SNR limitIssue 1-2-2: AWGN offset |
|  |  |

## 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:* |

## Discussion on 2nd round (if applicable)

# Topic #2: PUSCH requirements

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** | **Issue mapping** |
| [**R4-2215690**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215690.zip) | Ericsson | Discussion on general and PUSCH issue for FR2-2 BS demodulationObservation 1: Defining 960kHz SCS requirements as optional would lead to the same results that no tests will be done for 960kHz SCS if corresponding requirements are optional. Proposal 1: RAN4 do not consider 960kHz SCS for FR2-2 BS demodulation requirements.Proposal 2: Only consider the minimum CBW 400MHz BS demodulation requirement for 480kHz SCS in Rel-17 based on current progress. Proposal 3: Take adjusting AWGN offset level as the last method for link budget calculation when margin is not enough. And the corresponding feasibility should be checked. Proposal 4: Keep the agreement in the previous meeting that using the minimum CBW and 20dB SNR limit for discussion at current stage. Observation 2: Two proposals indicate similar approach.Proposal 5: Take Option 3-3 that MCS20 with 1T2R low and MCS18 with 2T2R low If the final link budget agreement indicate 20dB SNR limit could be applied for FR2-2. | P1: Issue 1-1-1P2: 1-1-2P3: 1-2-22-1-1P4: 1-2-1P5: 2-2-1 |
| [**R4-2215691**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215691.zip) | Ericsson | Simulation results for FR2-2 PUSCH | Simulation alignment |
| [**R4-2215694**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215694.zip) | Ericsson | draftCR for TS38.104 introduce FRC tables for FR2-2 PUSCH requirements | CR session |
| [**R4-2215695**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215695.zip) | Ericsson | draftCR for TS38.141-2 introduce FRC tables for FR2-2 PUSCH requirements | CR session |
| [**R4-2216020**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216020.zip) | Huawei,HiSilicon | Draft CR: Introduction of FR2-2 PUSCH radiated conformance testing requirements in TS 38.141-2 |  |
| [**R4-2216021**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216021.zip) | Huawei,HiSilicon | Discussions on FR2-2 PUSCH demodulation requirementsProposal 1: RAN 4 to define the PUSCH requirements with 120 SCS and 480kHz SCS.Proposal 2: Disabled PTRS for QPSK for both CP-OFDM and DFT-S-OFDM.Observation 1: For case with (120kHz SCS/100MHz bandwidth, MCS16, TDLA30-650,2T2R), the target SNR is quite close to 20dB. If we use TDLD30-650 to instead of TDLA30-650, the performance is further improved.Proposal 3: Use cases in following table for PUSCH requirements definition:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **CBW****(MHz)** | **MCS** | **Channel model** | **Antenna configuration** | **Test metric** |
| 120 | 100 | 4 | TDLA30-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 120 | 100 | 16 | TDLA30-650 | 1x2 Low | 70% of maximum TP |
| TDLD30-650 | 2x2 Low | 70% of maximum TP |
| 120 | 100 | 20 | TDLA30-200 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 4 | TDLA10-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 16 | TDLA10-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 20 | TDLD10-200 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |

 | P1: 2-1-1P2: 2-2-2P3: 2-3-1 |
| [**R4-2216022**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216022.zip) | Huawei,HiSilicon | Simulation results on FR2-2 PUSCH demodulation requirements |  |
| [**R4-2216570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216570.zip) | Nokia, Nokia Shanghai Bell | Discussion on PUSCH demodulation requirements for the extension to 71 GHzProposal 1: Define PUSCH demodulation requirements using 960 kHz SCS. Observation 3: In BS RF room use of AWGN offset was agreed for BS demod requirements. Observation 4: AWGN offset configuration can be used as a method for improving the link budget in test scenarios when TE output power level would be too high. Proposal 2: RAN4 to define demodulation requirements for CBW = 400 MHz and CBW = 1600 MHz for 480 kHz SCS.Proposal 3: RAN4 to define demodulation requirements for CBW = 400 MHz and CBW = 2000 MHz for 960 kHz SCS. | P1: 2-1-1P2: 2-1-3P3: 2-1-4 |
| [**R4-2216571**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216571.zip) | Nokia, Nokia Shanghai Bell | PUSCH simulation results for the extension to 71 GHz | Simulation alignment |
| [**R4-2216691**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216691.zip) | Samsung | View on BS demodulation requirement for NR extended to 71GHzProposal 1: RAN4 applies only 120KHz and 480KHz SCS for UL requirements definition.Proposal 2: RAN4 applies only 100MHz CBW with 120KHz SCS, 400MHz CBW with 480KHz SCS for PUSCH requirement. | P1: 1-1-1 2-1-1P2: 2-1-2 |
| [**R4-2216694**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216694.zip) | Samsung | Initial simulation results on PUSCH demodulation requirement for Rel-17 71GHz | Simulation alignment |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 Channel bandwidth and SCS

**Issue 2-1-1: Sub-carrier spacings for PUSCH requirements**

* Proposals
	+ Option 1: 120 Hz and 480 kHz
	+ Option 2: 120 kHz, 480 kHz and 960 kHz
* Recommended WF
	+ Discuss your preferences among the options having in mind the parallel discussion in the general issue

**Issue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCS**

* Proposals
	+ Option 1: 120 kHz SCS with 100 MHz
	+ Option 2: 120 kHz SCS with 100 MHz and 400 MHz
* Recommended WF
	+ Discuss your preferences among the options.

**Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCS**

* Proposals
	+ Option 1: 480 kHz SCS with 400 MHz
	+ Option 2: 480 kHz SCS with 400 MHz and 1600 MHz
* Recommended WF
	+ Discuss your preferences among the options.

**Issue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCS**

* Proposals
	+ Option 1: 960 kHz SCS with 400 MHz
	+ Option 2: 960 kHz SCS with 400 MHz and 2000 MHz
* Recommended WF
	+ Discuss your preferences among the options.

### Sub-topic 2-2 Configuration and test cases PUSCH demodulation requirements

In the last RAN4 meeting we reached the following agreements regarding MCS and Tx/Rx branches for PUSCH requirements R4-2214388:

|  |
| --- |
| **MCS and number Tx/Rx branches for PUSCH requirements****<Agreement>** Define PUSCH demodulation requirements for * + MCS 4 with 1T2R Low and 2T2R Low
	+ MCS 16 with 1T2R Low and 2T2R Low

**<Way forward>** Options for the 3rd MCS* + Option 3-1: MCS 18 with 1T2R Low and 2T2R Low
	+ Option 3-2: MCS 20 with 1T2R Low
		- Note: If the final link budget agreement indicate 20dB SNR limit could be applied for FR2-2
	+ Option 3-3: MCS 20 with 1T2R Low and MCS 18 with 2T2R Low
		- Note: If the final link budget agreement indicate 20dB SNR limit could be applied for FR2-2
 |

**Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirements**

In the previous meeting we meet agreements regarding MCS and Tx/Rx branches for QPSK and 16 QAM requirements. In this issue the proposals are discussed regarding 64 QAM.

* Proposals
	+ Option 1: MCS 20 with 1T2R Low and MCS 18 with 2T2R Low
		- Note: If the final link budget agreement indicate 20dB SNR limit could be applied for FR2-2
	+ Option 2: MCS20 with 1T2R and 2T2R Low
* Recommended WF
	+ Discuss your preferences and indicate if Option 1 is agreeable

**Issue 2-2-2: PTRS configuration**

* Proposals:
	+ Option 1: Disabled PTRS for QPSK for both CP-OFDM and DFT-S-OFDM.
	+ Other options
* Recommended WF
	+ Please comment Option 1 indicating if it is agreeable.

### Sub-topic 2-3 List of PUSCH test cases

In the last RAN4 meeting we reached the following agreements regarding MCS and Tx/Rx branches for PUSCH requirements R4-2214388:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameters for PUSCH requirements****< Agreement>**: **Proposed simulation assumptions for FR2-2 PUSCH**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **CBW****(MHz)** | **MCS** | **Channel model** | **Antenna configuration** | **70% of max TP** |
| 120 | 100 | 4 | TDLA30-650 | 1x2 Low |  |
| 2x2 Low |  |
| 120 | 100 | 16 | TDLA30-650 | 1x2 Low |  |
| 2x2 Low |  |
| 120 | 100 | 20 | TDLD30-200 | 1x2 Low |  |
| 480 | 400 | 4 | TDLA10-650 | 1x2 Low |  |
| 2x2 Low |  |
| 480 | 400 | 16 | TDLA10-650 | 1x2 Low |  |
| 2x2 Low |  |
| 480 | 400 | 20 | TDLD10-200 | 1x2 Low |  |
| NOTE: To be updated in case further agreements on CBW, antenna configuration, and SCS are reached |

 |

**Issue 2-3-1: List of test cases**

* Proposals
	+ Option 1: Update list of test cases as:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **CBW****(MHz)** | **MCS** | **Channel model** | **Antenna configuration** | **Test metric** |
| 120 | 100 | 4 | TDLA30-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 120 | 100 | 16 | TDLA30-650 | 1x2 Low | 70% of maximum TP |
| TDLD30-200 | 2x2 Low | 70% of maximum TP |
| 120 | 100 | 20 | TDLD30-200 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 4 | TDLA10-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 16 | TDLA10-650 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |
| 480 | 400 | 20 | TDLD10-200 | 1x2 Low | 70% of maximum TP |
| 2x2 Low | 70% of maximum TP |

* Recommended WF
	+ Please comment on the inclusion of TDLD30 for MCS16 and 120 kHz SCS, 2T2R.
	+ Wait for conclusions on other PUSCH issues and update test cases list in the second round.

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 Channel bandwidth and SCS

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-1-1: Sub-carrier spacings for PUSCH requirementsIssue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCSIssue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCSIssue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCS |

Sub topic 2-2 Configuration and test cases PUSCH demodulation requirements

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirementsIssue 2-2-2: PTRS configuration |

Sub topic 2-3 List of PUSCH test cases

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-3-1: List of test cases |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2215694**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215694.zip) | Company A |
| Company B |
|  |
| [**R4-2215695**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215695.zip) | Company A |
| Company B |
|  |
| [**R4-2216020**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216020.zip) | Company A |
| Company B |
|  |

## 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

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

|  |  |
| --- | --- |
| **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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: PUCCH requirements

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** | **Issue mapping** |
| [**R4-2215692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215692.zip) | Ericsson | Simulation results for FR2-2 PUCCH | Simulation alignment |
| [**R4-2216023**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216023.zip) | Huawei,HiSilicon | Discussions and simulation results on FR2-2 PUCCH demodulation requirementsProposal 1: Not consider 960kHz SCS for PUCCH requirements definition. | Simulation alignmentP1: 3-1-1 |
| [**R4-2216024**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216024.zip) | Huawei,HiSilicon | Draft CR Introduction of FR2-2 PUCCH performance requirements in TS 38.104 | CR |
| [**R4-2216572**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216572.zip) | Nokia, Nokia Shanghai Bell | Discussion on PUCCH demodulation requirements for the extension to 71 GHzProposal 1: Define PUCCH demodulation requirements using 960 kHz SCS. Observation 1: Existing FR2-1 requirements for PUCCH format 3 include test cases with a. 14 OFDM symbols and DMRS configurations 1+1 and 1+0b. 4 OFDM symbols and DMRS configuration 1+0Proposal 2: RAN4 to align DRMS configuration of PUCH format 3 in FR2-2 with the existing configuration for FR2-1. Proposal 3: Adopt DRMS configuration 1+1 and 1+0 for PUCCH format 3 with 14 OFDM symbols.Proposal 4: Adopt DRMS configuration 1+1 for PUCCH format 3 with 4 OFDM symbols. | P1: 3-1-1P2-4: 3-2-1 |
| [**R4-2216573**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216573.zip) | Nokia, Nokia Shanghai Bell | PUCCH simulation results for the extension to 71 GHz | Simulation alignment |
| [**R4-2216t695**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216695.zip) | Samsung | Initial simulation results on PUCCH demodulation requirement for Rel-17 71GHz |  |

## Open issues summary

### Sub-topic 3-1 Channel bandwidth and SCS

**Issue 3-1-1: Sub-carrier spacings for PUCCH requirements**

* Proposals
	+ Option 1: 120 Hz and 480 kHz
	+ Option 2: 120 kHz, 480 kHz and 960 kHz
* Recommended WF
	+ Discuss your preferences among the options having in mind the parallel discussion in the general issue

### Sub-topic 3-2 PUCCH format 3

Previous agreement on the format 3 is:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Issue 2-4-2: DMRs configuration for PUCCH format 3****Agreement: Define PUCCH format 3 test cases with DMRS 1+0 and 1+1.** **Issue 2-4-3: Test configurations for PUCCH format 3****Agreement: Take following table as FR2-2 PUCCH format 3 configurations.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TXantennas | Number of demodulationbranches | Modulation order | Propagation conditions and correlation matrix  | SCS(kHz) | CBW(MHz) | Number of OFDMsymbols | Number of PRB | Numberof bits | Hopping | AdditionalDMRSconfiguration | Test metric |
|  |
| 1 | 2 | QPSK | TDLA30-650 Low | 120 | 100 | 14 | 1 | 16 | Enabled | 1+0 and1+1 | Prob(UCI BLER)<1% |
| 4 | 3 | 16 | Enabled | 1+0 and1+1 | Prob(UCI BLER)<1% |
| TDLA10-650 Low | 480 | 400 | 14 | 1 | 16 | Enabled | 1+0 and1+1 | Prob(UCI BLER)<1% |
| 4 | 3 | 16 | Enabled | 1+0 and 1+1 | Prob(UCI BLER)<1% |
| [960]\* | [400] | 14 | 1 | 16 | Enabled | 1+0 and1+1 | Prob(UCI BLER)<1% |
| 4 | 3 | 16 | Enabled | 1+0 and 1+1 | Prob(UCI BLER)<1% |
| \*To be revisited after agreements on SCS. |

 |

**Issue 3-2-1: DMRs configuration for PUCCH format 3**

* Proposals
	+ Proposal 1: RAN4 to align DRMS configuration of PUCH format 3 in FR2-2 with the existing configuration for FR2-1.
	+ Proposal 2: Adopt DRMS configuration 1+1 and 1+0 for PUCCH format 3 with 14 OFDM symbols.
	+ Proposal 3: Adopt DRMS configuration 1+1 for PUCCH format 3 with 4 OFDM symbols.
* Recommended WF
	+ Discuss among the proposals

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 Channel bandwidth and SCS

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-1-1: Sub-carrier spacings for PUCCH requirements |

Sub topic 3-2 PUCCH format 3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-2-1: DMRs configuration for PUCCH format 3 |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2216024**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216024.zip) | Company A |
| Company B |
|  |

# Topic #4: PRACH requirements

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** | **Issue mapping** |
| [**R4-2215693**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215693.zip) | Ericsson | Simulation results for FR2-2 PRACH | Simulation alignment |
| [**R4-2216025**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216025.zip) | Huawei,HiSilicon | Discussions on FR2-2 PRACH demodulation requirementsProposal 1: RAN 4 to define the PRACH requirements with 120kHz SCS and 480kHz SCS.Proposal 2: Use following configurations as time error tolerance:

|  |  |  |
| --- | --- | --- |
| **SCS** | **Channel model** | **Time error tolerance (ns)** |
| 120 | AWGN | 70 |
|  |  |
|  | TDLA10-650 | 120 |
| 480 | AWGN | 18 |
|  |  |
|  | TDLA10-650 | 68 |

 | P1: 4-1-1P2: 4-2-2 4-2-3 |
| [**R4-2216026**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216026.zip) | Huawei,HiSilicon | Simulation results on FR2-2 PRACH demodulation requirements | Simulation alignment |
| [**R4-2216574**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216574.zip) | Nokia, Nokia Shanghai Bell | Discussion on PRACH demodulation requirements for the extension to 71 GHz1. Channel model agreement for 120 kHz SCS is contradicting agreement for PRACH demodulation requirements.
2. RAN4 to define PRACH demodulation requirements using AWGN and TDL-A 30-650 channel model for 120 kHz SCS and using AWGN and TDL-A 10-650 channel model for other SCSs.
3. Define PRACH demodulation requirements using 960 kHz SCS.
4. The $N\_{CS}$ parameters used for FR2 requirements (Ncs=69) are the ones that provide the maximum coverage area for LRA=139.
5. The LRA=139 and Ncs=69 provide a similar coverage area to LRA=571 and Ncs=285 and LRA=1151 and Ncs=575.
6. RAN4 to define PRACH demodulation performance requirements using the following Ncs parameters: -For requirements with LRA=139 use NCS=69 -For requirements with LRA=571 use NCS=285 -For requirements with LRA=1151 use NCS=575

Rel 16 NR-U requirements are defined such that PRACH time error tolerance is larger or equal to TAC resolution. 1. Not to define time error tolerance that is smaller than the minimum possible step for the timing advance command.

Rel 15 and Rel 16 requirements are defined such that PRACH time error tolerance with fading channel is the AWGN tolerance combined with the second last tap used for the requirement. 1. Reuse calculation of PRACH time error tolerance for fading channel from Rel 15 and Rel 16 as the AWGN tolerance combined with the second last tap used for the requirement.
2. Reuse calculation of PRACH time error tolerance for 120 kHz SCS requirements with AWGN and TDLA30.
3. RAN4 to define time error tolerance of PRACH timing with 480 kHz SCS and TDLA10 as 18 ns for AWGN and 68 ns for TDLA10.
4. RAN4 to define time error tolerance of PRACH timing with 960 kHz SCS and TDLA10 as 9 ns for AWGN and 59 ns for TDLA10.
5. Use the table below for the test cases and parameters related to PRACH demodulation requirements:
 | P1: 4-1-2P2: 4-1-1P3: 4-1-3P4: 4-2-1P5: 4-2-1P6: 4-2-2P7: 4-2-3P8: 4-2-4 P9: 4-3-1 |
| [**R4-2216575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216575.zip) | Nokia, Nokia Shanghai Bell | PRACH simulation results for demodulation requirements for the extension to 71 GHz | Simulation alignment |
| [**R4-2216576**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216576.zip) | Nokia, Nokia Shanghai Bell | Draft CR 38.104: PRACH requirements for FR2-2 | CR |
| [**R4-2216577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216577.zip) | Nokia, Nokia Shanghai Bell | Draft CR 38.141-2: PRACH requirements for FR2-2 | CR |
| [**R4-2216692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216692.zip) | Samsung | Draft CR on annex for PRACH requirement for TS 38.104 | CR |
| [**R4-2216693**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216693.zip) | Samsung | Draft CR on annex for PRACH requirement for TS 38.141-2 | CR |
| [**R4-2216696**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216696.zip) | Samsung | Initial simulation results on PRACH demodulation requirement for Rel-17 71GHz | Simulation alignment |

## Open issues summary

### Sub-topic 4-1 PRACH configurations

**Issue 4-1-1: SCS for PRACH requirements**

* Proposals
	+ Option 1: Define requirements for PRACH using 120 kHz, 480 kHz and 960 kHz SCS
	+ Option 2: Define requirements for PRACH using 120 kHz and 480 kHz SCS.
* Recommended WF
	+ Please discuss your preferences among Option 1 and Option 2 having in mind the parallel discussion in the general Issue 1-1-1

**Issue 4-1-2: Channel model for PRACH requirements**

During the last RAN4 meeting, we reached agreement on AWGN and TDL-A 10 for PRACH requirements. However, a general agreement was reached for using TDLA30 for 120 kHz with 100 MHz CBW.

Previous agreements are R4-2214389:

|  |
| --- |
| Sub-topic 1-3: Channel Model**Way forward**: need to be confirm* RAN4 to define PRACH demodulation requirements using AWGN and TDL-A 10-650 channel model.
 |

And form the general WF R4-2214655:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RMS delay spread*** Adopt channel model according to the channel bandwidth as:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS [kHz] | CBW [MHz] | Applicable channel models  | Tap resolution [ns] | Tap number |
| 120 | 100 | TDLA30-650TDLD30-200 | 5 | 12 |
| 120480[960] | ≥400 | TDLA10-650TDLD10-200 | 2 | 16 |

 |

Considering that, please consider the proposals on that issue:

* Proposals:
	+ Option 1: RAN4 to define PRACH demodulation requirements using AWGN and TDL-A 30-650 channel model for 120 kHz SCS and using AWGN and TDL-A 10-650 channel model for other SCSs.
	+ Option 2: Keep the PRACH agreement with AWGN and TDL-A 10-650 for all SCSs.
* Recommended WF:
	+ Please consider the previous agreements on PRACH and general WFs, and indicate which option is agreeable.

**Issue 4-1-3: Ncs, logical sequence index combinations**

* Proposals:
	+ Proposal 1: RAN4 to define PRACH demodulation performance requirements using the following Ncs parameters:
		- For requirements with LRA=139 use NCS=69
		- For requirements with LRA=571 use NCS=285
		- For requirements with LRA=1151 use NCS=575
* Recommended WF:
	+ Please comment if Proposal 1 is agreeable.

### Sub-topic 4-2 Accuracy and test procedure

**Issue 4-2-1: PRACH time error tolerance general aspects**

* Proposals
	+ Proposal 1: Not to define time error tolerance that is smaller than the minimum possible step for the timing advance command.
	+ Proposal 2: Reuse calculation of PRACH time error tolerance for fading channel from Rel 15 and Rel 16 as the AWGN tolerance combined with the second last tap used for the requirement.
* Recommended WF
	+ Please discuss if proposal 1 and proposal 2 are agreeable

**Issue 4-2-2: PRACH time error tolerance for 120 kHz SCS**

* Proposals
	+ Option 1: Use following configurations as time error tolerance:

|  |  |  |
| --- | --- | --- |
| **SCS** | **Channel model** | **Time error tolerance (ns)** |
| 120 | AWGN | 70 |
|  |  |
|  | TDLA10-650 | 120 |

* + Option 2: Reuse calculation of PRACH time error tolerance for 120 kHz SCS requirements with AWGN and TDLA30.
* Recommended WF
	+ Discuss options 1 and 2 having in mind relation to channel model issue 4-1-2.

**Issue 4-2-3: PRACH time error tolerance for 480 kHz SCS**

* Proposals
	+ Option 1: Use following configurations as time error tolerance:

|  |  |  |
| --- | --- | --- |
| **SCS** | **Channel model** | **Time error tolerance (ns)** |
| 480 | AWGN | 18 |
|  |  |
|  | TDLA10-650 | 68 |

* Recommended WF
	+ Comment on option 1 and indicate if it is agreeable.

**Issue 4-2-4: PRACH time error tolerance for 960 kHz SCS**

* Proposals
	+ Option 1: RAN4 to define time error tolerance of PRACH timing with 960 kHz SCS and TDLA10 as 9 ns for AWGN and 59 ns for TDLA10.
* Recommended WF
	+ Depends on the outcome of the Issue 4-1-1.

### Sub-topic 4-3 Test cases

**Issue 4-3-1: List of test cases for PRACH demodulation requirements**

* Proposals:
	+ Option 1: Use the table below for the test cases and parameters related to PRACH demodulation requirements:

| **Format** | **SCS** | **Prach sequence length** | **Ncs** | **Propagation condition** | **Frequency Offset (Hz)** | **Time estimation tolerance** |
| --- | --- | --- | --- | --- | --- | --- |
| A2 | 120kHz | 139 | 69 | AWGN | 0 | 70 ns |
| B4 | 120kHz | 139 | 69 | AWGN | 0 | 70 ns |
| C2 | 120kHz | 139 | 69 | AWGN | 0 | 70 ns |
| A2 | 120kHz | 139 | 69 | TDLA30-650 | 7100 | 220 ns |
| B4 | 120kHz | 139 | 69 | TDLA30-650 | 7100 | 220 ns |
| C2 | 120kHz | 139 | 69 | TDLA30-650 | 7100 | 220 ns |
| A2 | 120kHz | 571 | 285 | AWGN | 0 | 70 ns |
| B4 | 120kHz | 571 | 285 | AWGN | 0 | 70 ns |
| C2 | 120kHz | 571 | 285 | AWGN | 0 | 70 ns |
| A2 | 120kHz | 571 | 285 | TDLA30-650 | 7100 | 220 ns |
| B4 | 120kHz | 571 | 285 | TDLA30-650 | 7100 | 220 ns |
| C2 | 120kHz | 571 | 285 | TDLA30-650 | 7100 | 220 ns |
| A2 | 120kHz | 1151 | 575 | AWGN | 0 | 70 ns |
| B4 | 120kHz | 1151 | 575 | AWGN | 0 | 70 ns |
| C2 | 120kHz | 1151 | 575 | AWGN | 0 | 70 ns |
| A2 | 120kHz | 1151 | 575 | TDLA30-650 | 7100 | 220 ns |
| B4 | 120kHz | 1151 | 575 | TDLA30-650 | 7100 | 220 ns |
| C2 | 120kHz | 1151 | 575 | TDLA30-650 | 7100 | 220 ns |
| A2 | 480kHz | 139 | 69 | AWGN | 0 | 18 ns |
| B4 | 480kHz | 139 | 69 | AWGN | 0 | 18 ns |
| C2 | 480kHz | 139 | 69 | AWGN | 0 | 18 ns |
| A2 | 480kHz | 139 | 69 | TDLA10-650 | 7100 | 68 ns |
| B4 | 480kHz | 139 | 69 | TDLA10-650 | 7100 | 68 ns |
| C2 | 480kHz | 139 | 69 | TDLA10-650 | 7100 | 68 ns |
| A2 | 480kHz | 571 | 285 | AWGN | 0 | 18 ns |
| B4 | 480kHz | 571 | 285 | AWGN | 0 | 18 ns |
| C2 | 480kHz | 571 | 285 | AWGN | 0 | 18 ns |
| A2 | 480kHz | 571 | 285 | TDLA10-650 | 7100 | 68 ns |
| B4 | 480kHz | 571 | 285 | TDLA10-650 | 7100 | 68 ns |
| C2 | 480kHz | 571 | 285 | TDLA10-650 | 7100 | 68 ns |
| A2 | 960kHz | 139 | 69 | AWGN | 0 | 9 ns |
| B4 | 960kHz | 139 | 69 | AWGN | 0 | 9 ns |
| C2 | 960kHz | 139 | 69 | AWGN | 0 | 9 ns |
| A2 | 960kHz | 139 | 69 | TDLA10-650 | 7100 | 59 ns |
| B4 | 960kHz | 139 | 69 | TDLA10-650 | 7100 | 59 ns |
| C2 | 960kHz | 139 | 69 | TDLA10-650 | 7100 | 59 ns |

* Recommended WF
	+ The list should be updated in the 2nd round after more agreements on other issues.

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1 PRACH configurations

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 4-1-1: SCS for PRACH requirementsIssue 4-1-2: Channel model for PRACH requirementsIssue 4-1-3: Ncs, logical sequence index combinations  |

Sub topic 4-2 Accuracy and test procedure

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 4-2-1: PRACH time error tolerance general aspectsIssue 4-2-2: PRACH time error tolerance for 120 kHz SCSIssue 4-2-3: PRACH time error tolerance for 480 kHz SCSIssue 4-2-4: PRACH time error tolerance for 960 kHz SCS |

Sub topic 4-3 Test cases

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 4-3-1: List of test cases for PRACH demodulation requirements |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2216576**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216576.zip) | Company A |
| Company B |
|  |
| [**R4-2216577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216577.zip) | Company A |
| Company B |
|  |
| [**R4-2216692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216692.zip) | Company A |
| Company B |
|  |
| [**R4-2216693**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216693.zip) | Company A |
| Company B |
|  |

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

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:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents