**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

|  |  |  |
| --- | --- | --- |
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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.
	+ Option 2 (new): Follow RF agreement and consider 20 dB SNR limit.
	+ 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 |
|  |  |
| Nokia | Issue 1-1-1: SCS for demodulation requirementsOption 2, consider all SCS for BS demodulation requirements.We understand 960 kHz is an important feature added as part of the work in FR2-2, and we would like that to be included in the requirements. Issue 1-1-2: Channel bandwidth for demodulation requirementsNo need to agree on that point as part of the general topic. This discussion is only relevant to the PUSCH topic, so we prefer to discuss that as part of the PUSCH requirements in Sub-topic 2-1.  |
| Ericsson | Issue 1-1-1: SCS for demodulation requirementsSupport Option 1. We don’t see the necessary of introducing 960kHz SCS demodulation requirements regarding it is UE optional support and test limit on larger CBW. Issue 1-1-2: Channel bandwidth for demodulation requirementsSupport Option 1.  |
| Samsung | Issue 1-1-1: SCS for demodulation requirementsSupport option 1, both 480 KHz and 960KHz SCS are UE optional supported. 960KHz SCS for the SSB is not supported by UE, and 480 kHz is an optional SSB numerology for initial access for the UE. We would like to prioritize the requirement for UE with supported SCS for both data and initial access. Considering the schedule and time plan for this WI, we prefer to define the requirement with UE mandatory supported SCSIssue 1-1-2: Channel bandwidth for demodulation requirementsSupport option 1. Regarding the CBW for requirement, the minimum CBW can meet the test purpose for baseband processing verification. Meanwhile, based on the core requirement discussion, 1600MHz for 480KHz and 2000MHz for 960KHz are UE optional. |
| Moderator (Nokia) | Update after GTW on 11th of October. Issue 1-1-1: SCS for demodulation requirements* Agreement: RAN4 agree to focus on 120kHz and 480kHz SCSs for introducing FR2-2 BS demodulation requirements in Rel-17.

No need to further discussion on Issue 1-1-1.  |
| Huawei | Issue 1-1-2: Channel bandwidth for demodulation requirementsWe support option 1. Considering bandwidth except 400MHz is optional for UE to support, we don’t the need to define cases for optional cases  |

Sub topic 1-2 SNR limit

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 1-2-1: SNR limitIssue 1-2-2: AWGN offset |
| Nokia | Issue 1-2-1: SNR limitWe proposed a new Option 2. We think that the RF agreement is clear enough and there is no reason why to make joint CBW and SNR limit agreement here since we are anyway discussing maximum CBW in subtopic 2-1. Additionally, during the last meeting R4-2213927 provided analysis considering wider bandwidths. We also provided link budget analysis in R4-2209389. Issue 1-2-2: AWGN offsetWe don’t see that agreement is needed. AWGN\_offset is a choice to be adjusted during test time and has been already used for FR2-1. We are basically using the same procedure as has been used in the past.  |
| Ericsson | Issue 1-2-1: SNR limitWe support to keep 20dB SNR limit at current stage. We are still lacking link budget calculation for BS demodulation. Issue 1-2-2: AWGN offsetWe support Option 1.  |
| Samsung | Issue 1-2-1: SNR limitWe prefer to follow RF requirement, take [20] dB SNR limit FR2-2 at starting point.Issue 1-2-2: AWGN offsetWe prefer to follow RF requirement, take AWGN offset level by using the same procedure in FR2-1 for 47GHz |
| Huawei | Issue 1-2-1: SNR limitWe support to take 20dB at temporary value Issue 1-2-2: AWGN offsetSupport option 1 |

## 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.
	+ Option 2 (new): PTRS is always enabled
	+ Other options
* Recommended WF
	+ Please comment Option 1 indicating if it is agreeable.

### Sub-topic 2-3 Channel models for PUSCH test cases

**Issue 2-3-1: Channel model for 16 QAM for PUSCH requirements**

During the last RAN4 meeting we reached the following agreement on channel models used for PUSCH requirements [R4-2214388]:

|  |
| --- |
| **TDL model used for PUSCH requirements****<Agreement>** TDL model used for PUSCH requirements* + Use MCS 4 and 16 with TDL-A and 64 QAM MCS with TDL-D.

**Delay spread used for the channel model for PUSCH requirements****<Agreement>** Define PUSCH requirements with 10ns RMS delay spread.**Doppler spread for PUSCH requirements****<Agreement >**: Following agreements for general part, adopt the following channel models* For channel bandwidth larger than 200 MHz, TDLA 10-650 and TDLD 10-200
* For channel bandwidth smaller or equal to 200 MHz, TDLA 30-650 and TDLD 30-200
 |

As part of the contributions during this meeting, a suggestion for modification of channel model for MCS 16 was proposed. Please consider the following options:

* Proposals:
	+ Option 1: Update channel model for MCS 16 with 120 kHz SCS as
		- For 1x2 Low, use TDLA30-650
		- For 2x2 Low, use TDLA30-650
	+ Option 2: Update channel model for MCS 16 with 120 kHz SCS as
		- For 1x2 Low, use TDLA30-650
		- For 2x2 Low, use TDLD30-650
	+ Option 3: Update channel model for MCS 16 with 120 kHz SCS as
		- For 1x2 Low, use TDLA30-650
		- For 2x2 Low, use TDLD30-200
	+ Other options
* Recommended WF
	+ Please comment whether channel model should be updated for this configuration.

### Sub-topic 2-4 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 2-4-1: 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 |
| TDLD30-650 | 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 |

* + Option 2: 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 |
| Nokia | Issue 2-1-1: Sub-carrier spacings for PUSCH requirementsOption 2, consider all SCS for BS demodulation requirements.We understand 960 kHz is an important feature added as part of the work in FR2-2, and we would like that to be included in the requirements.Issue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCSOption 2We should test 120 kHz SCS with minimum and at least another CBW. There is no reason to preclude 400 MHz for 120 kHz SCS requirements. Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCSOption 2We want to test 480 kHz with minimum CBW and maximum CBW. If we are open to consider 800 MHz for the second CBW as well. Issue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCSOption 2We would like to test 960 kHz SCS with minimum CBW and maximum CBW. We are open to discuss another option for the second CBW, such as 800 MHz and 1600 MHz.  |
| Ericsson | Issue 2-1-1: Sub-carrier spacings for PUSCH requirementsOption 1.Issue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCSWe slightly tend to Option 2 for 120kHz. According to RF session, it seems 400MHz CBW could be possible for the OTA UL tests. In that case, it would be better to cover 400MHz for 120kHz SCS. Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCSWe support Option 1. Issue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCSDepend on the decision of 2-1-1. |
| Samsung | Issue 2-1-1: Sub-carrier spacings for PUSCH requirementsOption1, we would like to prioritize the requirement for UE with supported SCS for both data and initial access, Issue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCSOption 1, although both 100 KHz and 400KHz are mandatory CBW, we would like to prefer the define the requirement with typical CBW. The minimum CBW can meet the test purpose for baseband processing. If 400Hz is feasible from OTA test aspect, we are open to further discuss Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCSOption 1, based on the core requirement discussion, 1600MHz for 480KHz is UE optional. Issue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCSOption 1 if 960 KHz SCS is considered, based on the core requirement discussion, 2000MHz for 960KHz are UE optional.  |
| Moderator (Nokia) | Update after GTW on 11th October. Issue 2-1-1: Sub-carrier spacings for PUSCH requirementsConsidering agreement on Issue 1-1-1, no further discussion is needed. Issue 2-1-2: Channel bandwidth for PUSCH requirements with 120 kHz SCS* Agreement: 120kHz SCS with 100MHz and/or [400MHz]
	+ 400MHz introduction pending on further confirmation of the test feasibility
	+ Further discuss test applicable rules considering the mandatory CHBW sets for BS

Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCS* Agreement: For 480kHz SCS at least 400MHz
	+ FFS for 800MHz and/or 1600MHz
		- Test applicable rules can be considered if larger CHBW introduced besides 400MHz

Issue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCSConsidering agreement on Issue 1-1-1, no further discussion is needed.  |
| Huawei | **Issue 2-1-1: Sub-carrier spacings for PUSCH requirements**According to R4-2214374, it is feasible to test 400MHz bandwidth:Therefore we are OK to introduce 400MHz requirementsThe applicability rules can be reused from existing rules:For each subcarrier spacing declared to be supported, the test requirements for a specific channel bandwidth shall apply only if the BS supports it (see D.7 in table 4.6-1).Unless otherwise stated, for each subcarrier spacing declared to be supported, the tests shall be done only for the widest supported channel bandwidth. If performance requirement is not specified for this widest supported channel bandwidth, the tests shall be done by using performance requirement for the closest channel bandwidth lower than this widest supported bandwidth; the tested PRBs shall then be centered in this widest supported channel bandwidth.Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCSWe support option 1. We don’t see the need to define the requirements for 1600MMHz considering it is optional. Furthermore, RF didn’t confirm testability of such bandwidthIssue 2-1-4: Channel bandwidth for PUSCH requirements with 960 kHz SCS.We support option 1. Same views as 480kHz |
| Ericsson 2 | **Issue 2-1-1: Sub-carrier spacings for PUSCH requirements**We share same view as Huawei. Both 100MHz and 400MHz CBW are mandatory for 120kHz SCS. The testability on 400MHz is confirmed by RF session, then 400MHz requirements should be introduced. The available applicability rule on CBW could be reused.**Issue 2-1-3: Channel bandwidth for PUSCH requirements with 480 kHz SCS**We support Option 1. Only 400MHz CBW is mandatory for 480kHz SCS. The testability on larger CBW is not clear for now on RF, we don’t see it is feasible to introduce requirement for it. |

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 |
| Nokia | Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirementsWe are fine with both options. We should just keep some flexibility in case we need to reduce the MCS due to exceeding the 20 dB SNR limit. Issue 2-2-2: PTRS configurationWe prefer Option 2 (new).  Always configure PTRS.  |
| Ericsson | Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirementsWe need to check MCS20 for 2Tx2Rx results. If the results are less than 15dB, we think it might be OK for the requirements. Issue 2-2-2: PTRS configurationWe are fine with Option 1. |
| Samsung | Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirementsBased on our initial results, we prefer MCS 20 with 1T2R only, the target SNR for MCS 18 with 2T2R is larger than 20dB. In FR2-1, we also have MCS 20 for 1T2R, considering the test limitation Issue 2-2-2: PTRS configurationConsidering the phase noise impact in FR2-2 compared with FR2-1, we slightly support option 2 |
| Huawei | Issue 2-2-1: MCS and number Tx/Rx branches for PUSCH requirementsBased on our simulation results, the target SNR for MCS20,2T2R is around 15 dB, we think it is feasible to define such requirements.We propose to define MCS 20 instead of MCS18 considering MCS20 is testable.If weIssue 2-2-2: PTRS configurationWe support option 1. Our simulation results show phase noise has no impact on performance for QPSK. However, PTRS enabled will reduce the resource utilization,. Hence we think BS always disable PTRS in reality. |

Sub topic 2-3 Channel models for PUSCH test cases

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-3-1: Channel model for 16 QAM for PUSCH requirements |
| Nokia | Issue 2-3-1: Channel model for 16 QAM for PUSCH requirementsWe don’t understand that well why this is needed for 120 kHz SCS only. Maybe we could also wait for some better simulation alignment to check whether it is needed?We are also waiting for simulation results to confirm that.  |
| Ericsson | Issue 2-3-1: Channel model for 16 QAM for PUSCH requirementsFirst of all, it was agreed to use TDLD30-200 for LOS channel model. For MCS16, our simulation results show that the target SNR would be ~15dB for 2Tx2Rx with TDLA30-650. We think it could be OK for the requirement, but we are open for the further discussion based on companies’ double check.  |
| Samsung | Issue 2-3-1: Channel model for 16 QAM for PUSCH requirementsWe prefer to follow the agreement in the last meeting, since TDLA 30-650 is feasible for MCS 16. We do not think it is reasonable to define one MCS requirement for different antenna configuration with different channel model in typical scenario. |
| Huawei | Issue 2-3-1: Channel model for 16 QAM for PUSCH requirementsOur simulation show that the target SNR is 19.6dB for this case, which is closed to 20dB, but all other companies don’t see this problem, we can double check our simulations and further discuss next meeting  |

Sub topic 2-4 List of PUSCH test cases

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-4-1: List of test cases |
| Nokia | Issue 2-4-1: List of test casesFinal list depends on the outcome of the other issues.  |
| Ericsson | Issue 2-4-1: List of test casesDepend on the decisions of issue 2-2 and 2-3.  |
| Samsung | Issue 2-4-1: List of test casesWe prefer to follow the agreement in the last meeting, since TDLA 30-650 is feasible for MCS 16. We do not think it is reasonable to define one MCS requirement for different antenna configuration with different channel model in typical scenario  |

### 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) | Nokia: To include 120 kHz SCS with 400 MHz CBW as per GTW agreementShould we add FR2-2 instead of FR2 in the title of the table? |
| Company B |
|  |
| [**R4-2215695**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215695.zip) | Nokia: To include 120 kHz SCS with 400 MHz CBW as per GTW agreementShould we add FR2-2 instead of FR2 in the title of the table? |
| Company B |
|  |
| [**R4-2216020**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216020.zip) | Ericsson: The start part of the change looks confused. Would Huawei clarify it? |
| Nokia: We agree with Ericsson. The start of the CR contains some change that is repeated in the end of the CR for 8.2.1.5.2. Also 8.2.1.5.2 appears two times, Please remove that. Please include 120 kHz SCS with 400 MHz CBW as per GTW agreementPlease include also test cases with transform precoding.In the title of 8.2.1.5.2 you have a typo, * Test requirement for *BS type 2-O for opeating in FR2-1*

should be * Test requirement for *BS type 2-O operating in FR2-1*

We would prefer that instead of creating a new clause 8.2.1.5.3 you simply add the tables related to FR2-2 in the clause 8.2.1.5.2. Table 8.2.1.5.3-1 and Table 8.2.1.5.3-2 have sizes larger thant he page border. Please try to fix the table size accordingly. All the læines in Table 8.2.1.5.3-1 and Table 8.2.1.5.3-2 include DMRS configuration pos1, it should have pos0 and pos1 |
|  |

## 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.
	+ Proposal 3a: Adopt DRMS configuration 1+0 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 |
| Nokia | Issue 3-1-1: Sub-carrier spacings for PUCCH requirementsOption 2, consider all SCS for BS demodulation requirements.We understand 960 kHz is an important feature added as part of the work in FR2-2, and we would like that to be included in the requirements. |
| Ericsson | Issue 3-1-1: Sub-carrier spacings for PUCCH requirementsOption 1. |
| Samsung | Issue 3-1-1: Sub-carrier spacings for PUCCH requirementsOption 1, same as PUSCH requirements |
| Moderator (Nokia) | Update after GTW on 11th October. Issue 3-1-1: Sub-carrier spacings for PUCCH requirementsConsidering GTW agreement on 1-1-1, no further discussion is needed for this issue.  |
|  |  |

Sub topic 3-2 PUCCH format 3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-2-1: DMRs configuration for PUCCH format 3 |
| Nokia | Issue 3-2-1: DMRs configuration for PUCCH format 3We agree with proposals 1, 2 and 3aWe made a typo on our original proposal 3. We brought this proposal after noting that the current agreement want exactly matching the FR2-1 requirements. The main difference of the proposals in comparison to the previous agreement is that 1+1 is only used for the configuration with 14 OFDM symbols, not the one with 4 OFDM symbols.  |
| Ericsson | Issue 3-2-1: DMRs configuration for PUCCH format 3We are fine with proposal 1 to align with FR2-1. |
| Samsung | Issue 3-2-1: DMRs configuration for PUCCH format 3Support option 1, option 2 and option 3a, since DMRS configuration 1+0 is only available for 4 OFDM symbols  |
| Moderator (Nokia) | Update after GTW on 11th October.Issue 3-2-1: DMRs configuration for PUCCH format 3* + RAN4 to align DRMS configuration of PUCH format 3 in FR2-2 with the existing configuration for FR2-1.
		- Adopt DRMS configuration 1+1 and 1+0 for PUCCH format 3 with 14 OFDM symbols.
		- Adopt DRMS configuration 1+0 for PUCCH format 3 with 4 OFDM symbols.
 |

### 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) | Nokia: We would personally prefer to include the requirements as separate tables, not with a new clause 11.3.2.3. We can try to align with other companies on their preferences. All the tables for 480 kHz SCS are for 100 MHz, but it should be 400 MHz. All the tables have “**number of Rx antennas**” for FR2 we use “**number of demodulation branches**”Table 11.3.2.7.1-1 don’t need TBD on first symbol, We can use the same as in FR2-1, 13 for 1 symbol12 for 2 symbolsTable 11.3.2.7.2-2 should be for 400 mHz not, 100 MHzTables 11.3.2.8.1.2-1 11.3.2.8.1.2-2 don’t have the correct parameters according to our agreement. For example we use 14 symbols for PF1. And the case for 480 kHz SCS should be for 400 MHzIn clause 11.3.2.8.2.2, you have a typo* + The ACK miss probability
* Should be
	+ The ACK missed detection probability

Table 11.3.2.9.1.2-1 and Table 11.3.2.9.1.2-2 not in line with previous agreements. Also only one row is necessary since we have only 1 symbol for that case. Table 11.3.2.9.2.2-1 and Table 11.3.2.9.2.2-2 need only 2 OFDM symbols line |
| 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 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  |
| Nokia | Issue 4-1-1: SCS for PRACH requirementsOption 1. We prefer to include all the SCSs. We understand 960 kHz is an important feature added as part of the work in FR2-2, and we would like that to be included in the requirementsIssue 4-1-2: Channel model for PRACH requirementsOption 1. If we keep Option 2 that would force the TE vendors to implement TDL10 channel model with updated tap delay resolution also for 100 MHz test cases. So it is better to keep the general agreement and adopt TDLA30 for 120 kHz which could be using 100 MHz CBW. Issue 4-1-3: Ncs, logical sequence index combinations Option 1. The Ncs proposals didn’t really have objection during the last meeting, so we brough this proposal based on the previous WF focusing only on NCS and LRA combinations. These values were calculated in our paper considering how to keep the coverage area for each LRA/Ncs combination.  |
| Ericsson | Issue 4-1-1: SCS for PRACH requirementsOption 2.Issue 4-1-2: Channel model for PRACH requirementsWe are OK with Option 1 to align channel model agreement. Issue 4-1-3: Ncs, logical sequence index combinations We are OK with Proposal 1. |
| Samsung | Issue 4-1-1: SCS for PRACH requirementsOption 2 , same as PUSCH and PUCCHIssue 4-1-2: Channel model for PRACH requirementsOption2, we prefer to keep the previous agreement as AWGN and TDL-A 10-650 for all SCSs., similar as FR2-1, there is no different processing. Meanwhile, the test coverage of different channel is covered by PUSCH, Issue 4-1-3: Ncs, logical sequence index combinations Ok with option 1 |
| Moderator (Nokia) | Update after GTW session on 11th of October. Issue 4-1-1: SCS for PRACH requirementsNo need for further discussion considering GTW agreement on Issue 1-1-1. Issue 4-1-2: Channel model for PRACH requirements* Tentative agreement: Option 1.

Issue 4-1-3: Ncs, logical sequence index combinations Considering comments on the 1st round, can we agree on Option 1? |
| Huawei | Issue 4-1-3: Ncs, logical sequence index combinations Option 1 is OK |

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 |
| Nokia | Issue 4-2-1: PRACH time error tolerance general aspectsWe agree with Proposal 1 and Proposal 2.Proposal 1 is following assumptions also used in other WIDs such as NR-U. Proposal 2 is how we understand the time error tolerance was calculated so far. Issue 4-2-2: PRACH time error tolerance for 120 kHz SCSWe agree with option 2. If we agree with using TDLA30 for 120 kHz SCS, we can reuse the time error tolerance from FR2-1. Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSOption 1. This fits our calculations considering the updated channel model taps agreed during the last RAN4 meeting.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS** | **Channel model** | **LRA** | **Min PRACH resolution (ns)** | **TAC resolution (ns)** | **11th tap (ns)** | **TAC resol + 11th tap** | **Time error tolerance (ns)** |
| 480 | AWGN | 139 | 15.0 | 16.3 | 0 | 16.3 | 18 |
|  | AWGN | 571 | 3.6 | 16.3 | 0 | 16.3 | 18 |
|  | TDLA10-650 | 139 | 15.0 | 16.3 | 50 | 66.3 | 68 |
|  | TDLA10-650 | 571 | 3.6 | 16.3 | 50 | 66.3 | 68 |

Issue 4-2-4: PRACH time error tolerance for 960 kHz SCSOption 1. This fits our calculations considering the updated channel model taps agreed during the last RAN4 meeting.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS** | **Channel model** | **LRA** | **Min PRACH resolution (ns)** | **TAC resolution (ns)** | **11th tap (ns)** | **TAC resol + 11th tap** | **Time error tolerance (ns)** |
| 960 | AWGN | 139 | 7.5 | 8.1 | 0 | 8.1 | 9 |
|  | TDLA10-650 | 139 | 7.5 | 8.1 | 50 | 58.1 | 59 |

 |
| Ericsson | Issue 4-2-1: PRACH time error tolerance general aspectsWe are fine with Proposal 1 and 2. Maybe more clarification could be added that using following formula: Time error tolerance = max(AWGN\_tolerance + 2nd last tap delay, minimum timing advance command step). Issue 4-2-2: PRACH time error tolerance for 120 kHz SCSDepend on the decision of Issue 4-1-2. Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSWe are OK with Option 1. |
| Samsung | Issue 4-2-1: PRACH time error tolerance general aspectsOk with option1 and option 2, for time error tolerance for fading channel, we prefer to apply the AWGN tolerance combined with the last tap delay, considering the power of last tap is close to the 2nd last tap delayIssue 4-2-2: PRACH time error tolerance for 120 kHz SCSOption1, same channel model for different SCS , as FR2-1Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSOption 1 |
| Nokia | Update after GTW session on the 11th of October. Issue 4-2-1: PRACH time error tolerance general aspects* + Proposal 1 agreed
	+ Reuse calculation of PRACH time error tolerance for fading channel from Rel 15 and Rel 16

Issue 4-2-2: PRACH time error tolerance for 120 kHz SCSPlease consider if we can agree on Option 2 considering the outcome of 4-1-2 and 4-2-1?Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSPlease consider if we can agree on Option 1 considering the outcome of 4-2-1?Issue 4-2-4: PRACH time error tolerance for 960 kHz SCSNo further discussion needed given the GTW agreement on Issue 1-1-1.  |
| Huawei | Issue 4-2-2: PRACH time error tolerance for 120 kHz SCSOption 2Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSOption 1 |
| Ericsson 2 | Issue 4-2-2: PRACH time error tolerance for 120 kHz SCSAgree with Option 2.Issue 4-2-3: PRACH time error tolerance for 480 kHz SCSAgree with Option 1. |

Sub topic 4-3 Test cases

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 4-3-1: List of test cases for PRACH demodulation requirements |
| Nokia | Issue 4-3-1: List of test cases for PRACH demodulation requirementsTo be updated pending the agreements on the previous issues.  |
| Ericsson | Issue 4-3-1: List of test cases for PRACH demodulation requirementsDepend on the decisions from issues above. |
| Samsung | Issue 4-3-1: List of test cases for PRACH demodulation requirementsPending on the decisions of previous issues |

### 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) | NokiaWe noticed that some channel models are not according to our agreements in the tables. We would like a revision for that.  |
| Company B |
|  |
| [**R4-2216577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216577.zip) | NokiaRemoval of mention to 960 kHz is needed |
| Company B |
|  |
| [**R4-2216692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216692.zip) | NokiaIt is good that the channel models are included. I think it is not necessary to redevined TDLA30, since it is already there for FR2-1. We also don’t need to distinguish FR2-1 and FR2-2 in my view. So the new tables could be in G.2.1.2 without need for new clause. Why do we need to create a “A” table like Table A.6-2A? Cant we just continue the normal numbering, like Table A.6-8? |
| Company B |
|  |
| [**R4-2216693**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216693.zip) | NokiaIt is good that the channel models are included. I think it is not necessary to redevined TDLA30, since it is already there for FR2-1. We also don’t need to distinguish FR2-1 and FR2-2 in my view. So the new tables could be in G.2.1.2 without need for new clause. Why do we need to create a “A” table like Table A.6-2A? Cant we just continue the normal numbering, like Table A.6-8? |
| 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