**3GPP TSG-RAN WG4 Meeting #102-e R4-22xxxxx**

**Electronic Meeting, 21st Feb – 3rd Mar, 2022**

**Title:** WF on NTN SAN demodulation requirements

**Source:** Huawei, HiSilicon

**Agenda item:** 10.13.6.1

**Document for:** Approval

# Introduction

This WF capture all agreements and open issues for the following topics in [102-e][325] NR\_NTN\_Demod.

* Topic #2: Satellite Access Node demodulation requirements
	+ Issue 2-1: General assumptions
	+ Issue 2-2: PUSCH requirements
	+ Issue 2-3: PUCCH requirements
	+ Issue 2-4: PRACH requirements

The agreed WFs on NTN SAN demodulation requirements in previous meetings are listed as following.

* R4-2203043, RAN4#101bis-e

# Topic #2: Satellite Access Node demodulation requirements

## Issue 2-1: General assumptions

**Issue 2-1-1: Doppler shift model**

*Tentative agreements*

* Consider 200Hz as the maximum Doppler shift for UL in service link

*Candidate options*

* Proposals
	+ Option 1: Do not consider the residual Doppler error for UL in feeder link
	+ Option 2: Consider the residual Doppler error for UL in feeder link. 0.5pp. is the worst case.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We prefer option1, how to model the residual Doppler error, During the test, it is up to TE implementation In our understanding, the Test uncertainty can cover the impact of residual error for UL. Meanwhile, from performance aspect, we do not think the residual Doppler error will have impact |
| Huawei | We prefer Option 1. Only feeder link should be considered. |
| Ericsson | We suggest satellite companies give comments on this issue and also need more clarification on conformance test method for NTN demodulation. Following setup is captured in TR38.860 for NTN RF discussion. Based on this setup, can we assume there is no feeder link impact for UL demodulation? To avoid the risk of performance degradation in real deployment, we suggest consider a bit higher residual frequency error to give more margins.  |

**Issue 2-1-2: Delay spread model**

*Tentative agreements*

* N/A

*Candidate options*

* Proposals
	+ Option 1: Single delay spread
		- Option 1a: 100ns
		- Option 1b: 250ns
	+ Option 2: Different delay spread
		- Option 2a: 10ns/50ns/150ns
		- Option 2b: 10ns/50ns/250ns.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We are open to further discussion, Firstly, we don't think we need to cover all possible delay for each test cases, so, one value of delay spread is specified for one test, different delay spread can be considered in the different cases |
| Huawei | We prefer Option 1b or Option 2b. |
| Ericsson | We prefer taking 100ns as maximum DS based on Table 7.3.5.1.1-3 in TS38.811. We prefer only to define one DS value for each channel. For NLOS channel, the maximum DS could be considered. For LOS channel, smaller DS could be considered. For example NTN-TDLA100 and NTN-TDLC50.Table 7.3.5.1.1-3: Maximum delay spread and minimum coherence bandwidth for each deployment scenario

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|  | D1, GEO, Ka band | D2, GEO, S band | D3, LEO, S band | D4, LEO, Ka band | D5, HAPS, S band |
| **Maximum Delay spread (ns)** | 10 | 100 | 100 | 10 | 150 |
| **Min coherence bandwidth(NOTE 1, NOTE 2)** | >> MHz | 200 kHz | 200 kHz | >> MHz | 133 kHz |

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## Issue 2-2: PUSCH requirements

**Issue 2-2-1: Scope of PUSCH requirements**

*Tentative agreements*

* Not to consider the requirements for mapping Type B with non-slot transmission

*Candidate options*

* Proposals
	+ Option 1: Do not consider 2 step RACH case
	+ Option 2: Consider the 2 step RACH case

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We support option 1. we do not think it is a typical scenario for NTN with 2 step RACH, which is targeting to reduce the access delay with small payload. |
| Huawei | We prefer Option 2. |
| Ericsson | Support tentative agreements for mapping Type B with non-slot transmission. We still think 2-step RACH could be useful for NTN deployment to reduce large delay of 4-step RA.  |

**Issue 2-2-2: Channel model for PUSCH**

*Tentative agreements*

* Select NTN-TDL-A and NTN-TDL-C as the channel model for PUSCH requirements

*Candidate options*

* N/A

*Recommended WF*

* No need for 2nd round discussion.

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| **Company** | **Comments** |
| Samsung | We can use it as starting point  |
| Ericsson | We support tentative agreements. |

**Issue 2-2-3: SCS/CBW set for PUSCH requirements**

*Tentative agreements*

* N/A

*Candidate options*

* Proposals
	+ Option 1: 15kHz SCS: SCS 5MHz/10MHz/20MHz, 30kHz SCS: 10MHz/20MHz
	+ Option 2: a few of PRBs for all SCS.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We are ok with option 1, while for test, we can reuse the test applicability rule  |
| Huawei | We are OK with Option 1. |
| Ericsson | Few PRB allocation might be typical for NTN UE transmission regarding quite power limited scenario.  |

**Issue 2-2-4: Modulation order for PUSCH requirements**

*Tentative agreements*

* N/A

*Candidate options*

* Proposals
	+ Option 1: Select MCS4 for PUSCH requirements
	+ Option 2: others

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | Ok with option 1 as starting point |
| Huawei | We are OK with Option 1. |
| Ericsson | We are fine with Option 1.  |

**Issue 2-2-5: Antenna configuration for PUSCH requirements**

*Tentative agreements*

* N/A

*Candidate options*

* Proposals
	+ Option 1: UE 1Tx – SAN 1Rx and UE 1Tx – SAN 2Rx
	+ Option 2: UE 1Tx – SAN 2Rx
	+ Option 3: UE 1Tx – SAN 2Rx, UE 1Tx – SAN 4Rx and UE 1Tx – SAN 8Rx
* Moderator’s note: companies can agree with UE with 1Tx first? Satellite companies’ input are encouraged.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We prefer to focus on 1Tx and 2Rx.  |
| Huawei | We prefer Option 3. |
| Ericsson | Based on the RF receiver setup, satellite receiver antenna would be the bottle neck for whole link no matter how many Rx branches on gNB. Furthermore, the interface between GW and gNB is not introduced in RAN4 standardization. It is not suitable to consider test point on it. In summary, we prefer Option 1 to take satellite antenna configurations. But more clarification on polarization alignment between cross-polarization and circle polarization is needed. Basically, it would be similar from baseband point of view which is just considered as different channels. |

**Issue 2-2-6: Test parameters for NTN PUSCH**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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**Issue 2-2-7: Test parameters for NTN UL timing adjustment**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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**Issue 2-2-8: Test parameters for NTN PUSCH repetition type A**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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**Issue 2-2-9: Test parameters for NTN msgA PUSCH for 2-step RA type**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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## Issue 2-3: PUCCH requirements

**Issue 2-3-1: Scope of PUCCH requirements**

*Tentative agreements*

* In addition to PUCCH format 0/1/2/3/4, RAN4 to define NTN multi-slot PUCCH demodulation requirements
* Prioritize UCI with HARQ on PUCCH demodulation requirement

*Candidate options*

* N/A

*Recommended WF*

* No need for 2nd round discussion

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| **Company** | **Comments** |
| Samsung | Just one clarification, “Prioritize UCI with HARQ on PUCCH demodulation requirement” UCI including both CSI part1 and CSI part 2, or only include CSI part 1similar as Rel-15 ? |
| Huawei | From our understanding, the case that UCI with CSI part 1 will not be introduced. For PUCCH format 2, we prefer to only define ACK missed detection requirements. For PUCCH format 3 and 4, the corresponding UCI information bits and test metric can be changed. Further discussion is needed until next meeting. |
| Ericsson  | Support Tentative agreement. Detailed configuration could be discussed in next meeting.  |

**Issue 2-3-2: Channel model for PUCCH requirements**

*Tentative agreements*

* RAN4 to use one NTN-TDL channel model for PUCCH requirements definition

*Candidate options*

* Proposals
	+ Option 1: Select NTN-TDL-A and NTN-TDL-C
	+ Option 2: select one of channel model from NTN-TDL-A and NTN-TDL-C

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | Option 2Since different channel is covered in PUSCH requirement, there is no need to duplicate the channel model for PUCCH requirement. Since only QPSK for PUCCH, we can use the channel model specified for PUSCH |
| Huawei | We are OK with Option 2. NTN-TDL-A can be selected to consider NLOS channel. |
| Ericsson | We suggest to only consider NTN-TDLA.  |

**Issue 2-3-3: SCS/CBW set for PUCCH requirements**

*Tentative agreements*

* To follow the same SCS/CBW set as PUSCH as the start point

*Candidate options*

* Proposals
	+ Option 1: follow the same SCS/CBW set as PUSCH and no need to reduce test
	+ Option 2: follow the same SCS/CBW set as PUSCH and need to reduce test cases (specify if any)

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We are ok with option 1, the frequency hopping is considered, the performance with different CBW may be different |
| Huawei | We prefer Option 1. |
| Ericsson | Support Option 2. For example, only consider the maximum and the minimum BW.  |

**Issue 2-3-4: Antenna configuration for PUCCH**

*Tentative agreements*

* N/A

*Candidate options*

* Proposals
	+ Option 1: UE 1Tx – SAN 1Rx and UE 1Tx – SAN 2Rx
	+ Option 2: UE 1Tx – SAN 2Rx
	+ Option 3: UE 1Tx – SAN 2Rx, UE 1Tx – SAN 4Rx and UE 1Tx – SAN 8Rx
* Moderator’s note: companies can agree with UE with 1Tx? Satellite companies’ input are encouraged.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | Option 2, the test purpose can be fulfilled by 1Tx with 2Rx, there is no requirement for PUCCH with 2Tx |
| Huawei | We prefer Option 3 and manufacture declaration can be defined. |
| Ericsson | Same comments as PUSCH.  |

**Issue 2-3-5: Test parameters for NTN PUCCH format 0/1/2/3/4**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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**Issue 2-3-6: Test parameters for NTN PUCCH multi-slot PUCCH format 1**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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## Issue 2-4: PRACH requirements

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

*Tentative agreements:*

* N/A

*Candidate options*

* Proposals
	+ Option 1: Define NTN SAN PRACH demodulation requirement for AWGN and NLOS multi-path channel.
	+ Option 2: Define NTN SAN PRACH demodulation requirement for one multi-path channel.

*Recommended WF*

* Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Samsung | We can ok with option 1 |
| Huawei | We are OK with Option 1. |
| Ericsson | Prefer Option 1.  |

**Issue 2-4-2: Test parameters for NTN PRACH demodulation requirement**

*Tentative agreements*

* N/A

*Candidate options*

* N/A

*Recommended WF*

* Postpone the discussion until having the conclusion for channel model, MCS, etc.

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| **Company** | **Comments** |
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# Reference

1. R4-2207169, Email discussion summary for [102-e][325] NR\_NTN\_Demod, RAN4#102-e, Qualcomm Incorporated
2. R4-2203043, WF on NTN SAN demodulation requirements, RAN4#101bis-e, Huawei, HiSilicon