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

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

**Title: WF on general and NTN UE demodulation requirements**

**Source: Qualcomm Incorporated**

**Agenda Item: 10.13.6.1& 6.13.6.3& 10.13.6.4**

**Document for: Approval**

# Introduction

According to the email discussion summary in [1], this document is to capture the WF on general and NTN UE demodulation requirements.

# WF on general aspects

**Issue 1-1-1: Power control model**

* Agreement:
	+ Only consider fixed SNR at the UE or BS side to facilitate testing even if the SNR may be changed in the real network

**Issue 1-1-2: UE speed**

* Agreement:
	+ Do not consider explicit model UE speed into channel model for NTN demodulation requirements.
	+ Companies are encouraged to check the impact of different UE speed on the simulation results.

# WF NTN UE demodulation and CSI reporting requirements

## 3.1 WF on general assumptions

**Issue 3-1-1: Channel model**

* Agreement:
	+ Select NTN-TDL-A and NTN-TDL-C for NTN UE demodulation requirements

**Issue 3-1-2a: Doppler shift model-UE pre-compensation**

* Proposals
	+ Option 1: Consider the UE pre-compensation for DL demodulation, i.e., the maximum doppler shift is residual frequency offset with a small value, e.g., 0.1ppm
	+ Option 2: Do not consider the UE pre-compensation for DL demodulation, i.e., the maximum doppler shift is total frequency offset (without Doppler compensation at the satellite), e.g., 24ppm
* Recommended WF
	+ Companies are encouraged to provide their views on this issue.

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| **Company** | **Comments** |
| Apple | We support option 1. Could proponents of option 2 please clarify what the purpose is to combine the DL pre-compensation into the demod requirements ? The purpose is to verify UE processing and reception of the DL channels in our understanding.  |

**Issue 3-1-2b: Doppler shift model- Frequency drift**

* Proposals
	+ Option 1: Consider the frequency drift for DL demodulation
	+ Option 2: Do not consider the frequency drift for DL demodulation
* Recommended WF
	+ Companies are encouraged to provide their views on this issue.

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| **Company** | **Comments** |
| Apple | We support Option 2. We assume that the Frequency drift/ Doppler shift is pre-compensated prior to UE baseband processing.  |

**Issue 3-1-3a: Delay spread model-maximum delay spread**

* 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** |
| Apple | Is this max delay spread or RMS delay spread? We should consider 2 different delay spread values.  |

**Issue 3-1-3b: Delay spread model-Sampling frequency offset**

* Proposals
	+ Option 1: Consider sampling frequency offset for DL demodulation
	+ Option 2: Not consider sampling frequency offset for DL demodulation
* Recommended WF
	+ Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Apple | We support option 2. Are we assuming that there will be a time varying propagation delay that is not compensated prior to baseband processing. Similar to the Doppler shift modeling, we should de couple this from demod requirements. Could proponents please clarify?  |

**Issue 3-1-4: Antenna configuration**

* Proposals
	+ Option 1: Only consider SAN 2Tx – UE 2Rx
	+ Option 2: In addition to SAN 2Tx – UE 2Rx, further consider SAN 1Tx – UE 2Rx and SAN 1Tx – UE 4Rx
* Recommended WF
	+ Consider SAN 2Tx-UE 2Rx as the baseline.
	+ FFS on whether to consider SAN 1Tx – UE 2Rx and SAN 1Tx – UE 4Rx.

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| **Company** | **Comments** |
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## 3.2 WF on PDSCH requirements

**Issue 3-2-1: How to define the PDSCH requirements for GEO and LEO**

* Proposals
	+ Option 1: Only define requirements for LEO
	+ Option 2: Define requirements for GEO and LEO separately
	+ Option 3: Define one set requirements which are applicable for LEO and GEO (Moderator’s note: please explain how to define one requirement to apply for LEO and GEO if select this option)
* Recommended WF
	+ Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
| Apple | We can first define requirements for LEO and see how they can be applicable to GEO if needed. We don’t prefer 2 sets of requirements for GEO and LEO.  |

**Issue 3-2-2:** **Enhancement on time relationship**

* Proposals
	+ Option 1: Provide the input for K\_offset values for GEO and LEO

Moderator’s note: It depends on issue 3-2-1.

* Recommended WF
	+ Select the K\_offset value equal to or a little greater than the satellite-UE one-way delay. The detailed value should be selected after the channel model has been selected.
	+ FFS on the K\_offset values for GEO and LEO

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| **Company** | **Comments** |
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**Issue 3-2-3: Enhancement on HARQ**

* Proposals: Do you agree to just verify the functionality with disabled HARQ, e.g., schedule a low code rate
	+ Option 1: Yes
	+ Option 2: No (please specify the reasons if any)
* Recommended WF
	+ Disable HARQ with number of re-Tx set to 1 to avoid defining a special test as the start point
	+ Companies are encouraged to provide the views on this issue.

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| **Company** | **Comments** |
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**Issue 3-2-4: SCS/CBW set for PDSCH requirements**

* Proposals
	+ Option 1: Only consider 15kHz SCS/10MHz
	+ Option 2: In addition to 15kHz SCS/10MHz, need to further consider 30kHz SCS: 20MHz

Moderator’s note: Do we need to align the SCS/CBW set for UL and DL?

* Recommended WF
	+ Select 15kHz SCS/10MHz, further discuss whether to consider 30kHz SCS/ 20MHz

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| **Company** | **Comments** |
| Huawei | We still prefer Option 1. We think FDD 30kHz with 20MHz is also important. |
| Apple | Option 1 is preferred to use same assumptions as normal PDSCH requirements. Does Huawei mean option 2? |

**Issue 3-2-5: Modulation order for PDSCH requirements**

* Proposals
	+ Option 1: Only consider QPSK and 16QAM
	+ Option 2: In addition to QPSK and 16QAM, need to further 64QAM
* Recommended WF
	+ Consider QPSK and 16QAM, further discuss whether to consider 64QAM.

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| **Company** | **Comments** |
| Huawei | We still prefer Option 1. It is feasible for downlink 64QAM from the link budget point of view. |
| Apple | We support option 1. We don’t think 64QAM is practical given low SNR conditions for NTN UE. Does Huawei mean option 2? |

## 3.3 WF on PDCCH/PBCH assumptions

**Issue 3-3-1: Whether to define the PBCH requirements**

* Agreement: Do not define PBCH requirements

**Issue 3-3-2: Whether to define the PDCCH requirements**

* Agreement: Do not define PDCCH requirements

## 3.3 WF on CSI reporting assumptions

**Issue 3-4-1: CSI reporting requirements**

* Agreement: Do not define CSI reporting requirements

# Reference

[1] R4-22xxxx, Email discussion summary for [102][325] NR\_NTN\_Demod