**3GPP TSG-RAN WG4 Meeting # 116bis R4-2514535**

**Prague, Czech Republic, October 13th ‒ October 17th, 2025**

**Agenda item: 6.23**

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [116bis][328] Rel-19 Demodulation\_Part3

**Document for:** Information

# Introduction

This topic summary treats [116bis][328] BDaT Session AI 6.6.2.3, 6.6.3.1, 6.6.3.3

# Topic #1: SAN demodulation for UE supporting less than 5MHz for NTN (AI 6.6.2.3)

This topic discusses the SAN demodulation requirements for UE supporting less than 5MHz for NTN.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2513403 | Samsung | Simulation results |
| R4-2514019 | Ericsson | Simulation results |
| R4-2514020 | Ericsson | Simulation result summary |

## Open issues summary

### Sub-topic 1-1 PUCCH format 2 demodulation requirements for NTN with 3MHz CBW

**Issue 1-1-1: Final requirements**

In this meeting, Ericsson provided the summary of the simulation results of PUCCH format 2 for 3MHz CBW.

* Recommended WF
  + Decide the final requirements according to the simulation result summary R4-2514020.

**Issue 1-1-2: Draft CRs**

In this meeting, companies provided the draft CRs on PUCCH format 2 demodulation requirements for 3MHz CBW.

* Recommended WF
  + Collect comments of draft CRs
  + Big CR R4-2514018 to be discussed in the post-meeting email process

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| **Topic** | **Tdoc number** | **Source** | **Moderator’s comments** |
| Draft CR to TS 38.108: SAN PUCCH format2 requirements with less than 5MHz | R4-2513408 | Samsung | Need to set the final requirements |
| Draft CR to TS 38.181: Applicability rule of PRACH decoding requirements | R4-2513936 | Nokia |  |
| Draft CR to TS 38.181: SAN PUCCH format2 requirements with less than 5MHz | R4-2514017 | Ericsson | Need to set the final requirements |
| Big CR to TS 38.181 | R4-2514018 | Ericsson | Discuss in the post-meeting process |

# Topic #2: NTN testing for NGSO (AI 6.6.3.1 and 6.6.3.3)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2513630 | Samsung | LS out to RAN5 (Not available) |
| R4-2513922 | Anritsu | **Observation 1**: One of the six orbital elements “Eccentricity” is a measure of how much an orbit deviates from being circular and it defines the shape of the orbit.  **Observation 2:** “Argument of Periapsis” and “Mean Anomaly at time 0” become indeterminate when Eccentricity (e) is zero.  **Proposal 1:** Assume Eccentricity (e) as more than zero, which means the satellite orbit is ellipse in a case of NGSO.  **Proposal 2:** Capture the following sentence to clarify the condition of Eccentricity in descriptions to derive orbital elements in TS 36.102 and TS 38.101-5.   * The method specified in this sub clause is applicable to cases that Eccentricity (e) in Step 1-4 is more than zero. |
| R4-2513402 | Samsung | **Proposal 1:** Introduce an additional margin of 1.5 dB to Rel-17/18 Cat M NTN demodulation requirement for specifying the Cat M NTN demodulation requirement with applying the time-varying doppler shift and propagation delay channel model in Rel-19  **Proposal 2:** Introduce an additional margin of 0.5 dB to Rel-17/18 NB-IoT NTN demodulation requirement for specifying the NB-IoT NTN demodulation requirement with applying the time-varying doppler shift and propagation delay channel model in Rel-19  **Proposal 3:** For Rel-19 UE, the requirement for selected test cases with applying time-varying doppler shift and propagation delay channel model should be meet.  **Proposal 4:** For Rel-17/18 UEs, if the UE can declare to meet the requirements with time-varying doppler shift and propagation delay, the UE can skip the same test case specified in Rel-17/18. Other cases are still be tested pending on UE capability for NR NTN and IoT NTN with the assumption of zero doppler and constant propagation delay condition.  **Observation 1:** Around 1.5dB performance degradation compared with Rel-17/18 Cat M NTN demodulation requirement  **Observation 2:** Around 0.5dB performance degradation compared with Rel-17/18 NB-IoT NTN demodulation requirement |
| R4-2513437 | Huawei, HiSilicon | **Proposal 1:** Add 0.5 dB margin for IoT NTN PDSCH requirements.  **Proposal 2:** The sampling frequency offset impact is up to implementation and can be covered by the 0.5 dB margin added for the time-varying Doppler shift model for NGSO. It is no need to add more margin.  **Proposal 3:** The new NGSO requirements should applied only for Rel-19 UE. If UE can pass new NGSO requirements applying the timing varying new channel model, then it can skip the corresponding NGSO requirements defined in Rel-17/Rel-18. All other test cases defined in Rel-17/18 are only applicable for testing under NTN-TDL channel model.  **Observation 1:** RAN4 needs to re-simulate all Rel-17/18 demodulation requirements with the timing varying channel model that will be very heavy workload for RAN4, with also consideration of the parallel discussion for NR Rel-19/Rel-20 and 6GR study for demodulation requirements.  **Observation 2:** The selected RF frequency error test, RRM UL timing test and limited number of demodulation test cases are enough to verify the UE’s pre-compensation on the frequency offset shift and timing offset shift under timing varying channel model as per the discussion on this WI [2].  **Proposal 4:** Not allow Rel-17/18 UE to test the NGSO requirements under timing varying channel model, considering the heavy workload to re-simulate all test cases for RAN4 demodulation requirements, the selected RF/RRM/Demodulation tests can well meet the test purpose and no technical feasibility issues to conduct the NGSO testing under NTN-TDL as per the Rel-17/18 NTN NGSO testing in the market.  **Observation 3:** Complex test setup should ensure UE to enter into the RRC\_CONNECTED state no later than elevation angle 30°for each subtest to correctly test the UE performance under the largest delay shift at elevation angle 30°as defined in RAN4.  **Proposal 5:** Further discussion is needed on how to ensure the correct testing under timing varying channel model considering that UE needs to perform the initial access procedure and ensures UE to enter into the RRC\_CONNECTED state no later than elevation angle 30°for each subtest during the testing. |
| R4-2513971 | Ericsson | **Observation 1:** The degradation of NPDSCH with residual frequency offset and time delay is about 0.4dB for TS 36.102 Table 8.3.1.1.1.1-2 Test 1.  **Proposal 1:** Define new IoT-NTN UE demodulation requirements with the time-varying Doppler shift and propagation delay by adding 0.5dB to TS 36.102 Table 8.2.1.1.1.1-2 Tests 1/2 and Table 8.3.1.1.1.1-2 Test 1.  **Proposal 2:** Introduce test applicability between Rel-19 tests with the time-varying Doppler shift and propagation delay model and Rel-17/Rel-18 tests without the time-varying Doppler shift and propagation delay model.  **Proposal 3:** Rel-19 tests with the time-varying Doppler shift and propagation delay model are release independence from Rel-17 for NR NTN and from Rel-18 for IoT-NTN.  **Proposal 4:** Rel-17/Rel-18 NTN UEs need to pass either tests with or without the time-varying Doppler shift and propagation delay model. |
| R4-2514483 | Qualcomm | **Observation 1:** Throughput performance remains robust for residual SFO even at 0.2ppm, indicating minimal impact under reasonably high SFO values.  **Proposal 1:** Given the demonstrated robustness to residual SFO, RAN4 may consider omitting SFO-related impact analysis on demodulation performance.  **Proposal 2:** The satellite motion-based time varying channel model can be retroactively applied to pre-Rel-19 test cases subject to DUT declaration.   * Further assess the implications, given that the RF core requirements are currently defined solely based on the Rel-17 channel model. |

## Open issues summary

### Sub-topic 2-1 Channel models

**Issue 2-1-1: Eccentricity of satellite orbit**

* Observation (Anritsu)
  + “Argument of Periapsis” and “Mean Anomaly at time 0” become indeterminate when Eccentricity (e) is zero.
* Proposal (Anritsu)
  + Assume Eccentricity (e) as more than zero, which means the satellite orbit is ellipse in the case of NGSO.
  + Capture the following sentence to clarify the condition of Eccentricity in descriptions to derive orbital elements in TS 36.102 and TS 38.101-5:
    - The method specified in this sub clause is applicable to cases that Eccentricity (e) in Step 1-4 is more than zero.
* Recommended WF
  + Moderator understands Eccentricity (e) does not become 0 as far as we use the initial ephemeris information agreed in RAN4#116. However, it is safer to capture it in the specification in case new ephemeris information table is added in the future releases.
    - Note this limitation is applied if the Keplerian method is used.

### Sub-topic 2-2 Demodulation requirements

**Issue 2-2-1: Additional margin to IoT-NTN UE demodulation requirements when the time-varying Doppler shift and propagation delay model is applied**

* Observations:
  + Around 1.5dB performance degradation compared with Rel-17/18 Cat M NTN demodulation requirement (Samsung)
  + Around 0.5dB performance degradation compared with Rel-17/18 NB-IoT NTN demodulation requirement (Samsung)
  + The degradation of NPDSCH with residual frequency offset and time delay is about 0.4dB for TS 36.102 Table 8.3.1.1.1.1-2 Test 1 (Ericsson)
* Proposals
  + For Cat-M PDSCH demodulation requirements
    - Option 1: Add 1.5dB
    - Option 2: Add 0.5dB
  + For NB-IoT NPDSCH demodulation requirements
    - Add 0.5dB.
* Recommended WF
  + For Cat-M PDSCH demodulation requirements, discuss the additional margin between 0.5dB to 1.5dB.
  + For NB-IoT, add 0.5dB to the existing NPDSCH requirements.

**Issue 2-2-2: Impact of sampling frequency offset**

* Proposals
  + The sampling frequency offset impact is up to implementation and can be covered by the 0.5 dB margin added for the time-varying Doppler shift model for NGSO. It is no need to add more margin (Huawei, HiSilicon)
  + Given the demonstrated robustness to residual SFO, RAN4 may consider omitting SFO-related impact analysis on demodulation performance (Qualcomm)
* Recommended WF
  + RAN4 does not need to consider the impact of sampling frequency offset for UE demodulation requirements.

**Issue 2-2-3: Applicability of Rel-19 tests with time-varying Doppler shift and propagation delay model for pre-Rel-19 UEs**

* Proposals
  + Option 1 (Samsung):
    - For Rel-19 UE, the requirement for selected test cases with applying time-varying doppler shift and propagation delay channel model should be met.
    - For Rel-17/18 UEs, if the UE can declare to meet the requirements with time-varying doppler shift and propagation delay, the UE can skip the same test case specified in Rel-17/18. Other cases are still be tested pending on UE capability for NR NTN and IoT NTN with the assumption of zero doppler and constant propagation delay condition.
  + Option 2 (Huawei, HiSilicon):
    - The new NGSO requirements should applied only for Rel-19 UE. If UE can pass new NGSO requirements applying the timing varying new channel model, then it can skip the corresponding NGSO requirements defined in Rel-17/Rel-18. All other test cases defined in Rel-17/18 are only applicable for testing under NTN-TDL channel model.
    - Not allow Rel-17/18 UE to test the NGSO requirements under timing varying channel model, considering the heavy workload to re-simulate all test cases for RAN4 demodulation requirements, the selected RF/RRM/Demodulation tests can well meet the test purpose and no technical feasibility issues to conduct the NGSO testing under NTN-TDL as per the Rel-17/18 NTN NGSO testing in the market.
  + Option 2 (Ericsson):
    - Introduce test applicability between Rel-19 tests with the time-varying Doppler shift and propagation delay model and Rel-17/Rel-18 tests without the time-varying Doppler shift and propagation delay model.
    - Rel-19 tests with the time-varying Doppler shift and propagation delay model are release independence from Rel-17 for NR NTN and from Rel-18 for IoT-NTN.
    - Rel-17/Rel-18 NTN UEs need to pass either tests with or without the time-varying Doppler shift and propagation delay model.
  + Option 3 (Qualcomm):
    - The satellite motion-based time varying channel model can be retroactively applied to pre-Rel-19 test cases subject to DUT declaration.
* Recommended WF
  + Introduce test applicability between Rel-19 tests with the time-varying Doppler shift/propagation delay model and the corresponding Rel-17/18 tests without the time-varying Doppler shift/propagation delay model.
  + For Rel-19 UE,
    - If UE can pass new UE demodulation requirements with the time-varying Doppler shift and propagation delay model, then it can skip the corresponding requirements defined in Rel-17/18.
  + For Rel-17/18 UEs
    - Option 1: If UE declares to meet the requirements with time-varying Doppler shift and propagation delay, the UE can skip the corresponding requirements without time-varying Doppler shift and propagation delay defined in Rel-17/18.
      * Rel-19 tests with the time-varying Doppler shift and propagation delay model are release independence from Rel-17 for NR NTN and from Rel-18 for IoT-NTN.
    - Option 2: The new UE demodulation requirements with time-varying Doppler shift and propagation delay are not applicable for Rel-17/18 UEs.

**Issue 2-2-4: How to ensure the satellite elevation angles more than 30 degrees during the test**

* Observations (Huawei)
  + Complex test setup should ensure UE to enter into the RRC\_CONNECTED state no later than elevation angle 30°for each subtest to correctly test the UE performance under the largest delay shift at elevation angle 30°as defined in RAN4
* Proposals (Huawei)
  + Further discussion is needed on how to ensure the correct testing under timing varying channel model considering that UE needs to perform the initial access procedure and ensures UE to enter into the RRC\_CONNECTED state no later than elevation angle 30°for each subtest during the testing.
* Recommended WF
  + Need discussion.
  + The moderator is wondering if this issue is discussed in RAN5.

### Sub-topic 2-3 Draft CRs

**Issue 2-3-1: Draft CRs**

* Recommended WF
  + Collect comments of draft CRs
  + Aling the reference numbers
  + Update the requirements if necessary
  + Big CRs to be discussed in the post-meeting email process

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| **Topic** | **Tdoc number** | **Source** | **Moderator’s comments** |
| Draft CR to TS 36.102: PDSCH and NPDSCH demodulation requirements | R4-2513972 | Ericsson | Need revision. |
| Draft CR to TS 38.101-5: PDSCH demodulation requirements | R4-2514484 | Qualcomm | Need revision. |
| Draft CR to TS 36.102: Testing related to satellite access and applicability of requirements | R4-2513945 | MediaTek | Need revision. |
| Draft CR to TS 38.101-5: Testing related to satellite access and applicability of requirements | R4-2513438 | Huawei, HiSilicon | Need revision. |
| Draft CR to TS 36.102: Channel model | R4-2513920 | Anritsu | Need to check with the secretary Annex E can be changed to Annex F. |
| Draft CR to TS 38.101-5: Channel model | R4-2513921 | Anritsu | Need to check with the secretary Annex G can be changed to Annex H. |
| Big CR to TS 36.102 | R4-2513628 | Samsung | Discuss in the post-meeting process |
| Big CR to TS 38.101-5 | R4-2513627 | Samsung | Discuss in the post-meeting process |