3GPP TSG-RAN WG4 Meeting #112 DraftR4-2413516

**Maastricht, NETHERLANDS, 19th – 23th August, 2024**

**Agenda item:** 8.8.4

**Source:** Samsung

**Title: draft Way Forward** for [112][329] NTN\_testing\_NGSO\_channel\_model

**Document for:** Approval

# Introduction

This t-doc provides WF for [112][329] NTN\_testing\_NGSO\_channel\_model.

# WF

## Sub-topic 1-1 General

**Issue 1-1-1: Work plan on channel model and requirements**

* Offline agreement
  + Focus on TE-emulated channel model in initial stage for NGSO testing
    - Once sufficient progress made for channel model introduction, RAN4 can start the discussion on corresponding requirements and tests according to WI objective.

**Issue 1-1-2: Relation-ship between TE-emulated channel model for satellite motion and fading channel model**

* Offline agreement:
  + Decouple TE-emulated time-varying Doppler (frequency) and delay shifts due to satellite mobility from traditional fading channel

## Sub-topic 1-2 TE emulated channel model for statellite mobility

**Issue 1-2-1 Methodology for Time varying Doppler and Delay shifts modelling**

* Offline agreement
* RAN4 aims to introduce TE-emulated time varying doppler shift and delay shift model for satellite motion with following candidate options:
  + Option 1: Eckstein-Hechler model
  + Option 2: Keplerian model (checking with R&S?)
  + Option 3: Existing model from TR 38.811 5.3.4.3
  + Option 4: Proposal 2 from R4-2412552

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| where   * : Propagation delay of the signal from the satellite at time , * : Doppler (frequency) shift of the signal from the satellite at time * : the horizontal distance between the satellite and UE at time , * : the distance between the satellite and UE at time , * : the maximum horizontal distance between the satellite and UE, i.e., , * : the speed of light, * : Maximum Doppler shift (Hz) |

* + Option 5: Proposal 2 from R4-2412783

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| * The instant satellite speed is given as: * The initial angle of vector geocentric to UE relative to the x axis is given as: * The satellite position is given as: * The UE position is given as: * The Doppler is given as: * The delay is given as:   where is standard gravitational parameter, is earth average radius, is satellite altitude for LEO-600, is initial angle of vector UE to satellite relative to vector UE to clockwise side horizon, is the time, is the speed of light, is the carrier frequency. |

* + *Other options not precluded*

*Note: Companies are encouraged to bring more information for option 1 and option2.*

* Predefined files which generated by GMAT can be considered as reference for the comparison purpose of proposed channel model
  + FFS on the initial ephemeris information and parameters

**Issue 1-2-2 Parameters for TE-emulated channel model**

* Offline agreement
* RAN4 further discuss the necessary parameters with associated channel model, following parameters list for information purpose:
  + Satellite altitude:
    - Option 1: LEO -600km only
  + Option 2: Both LEO-600km and LEO-1200km Elevation angle range
  + UE position
  + Whether to consider a non-zero time-varying feeder link delay
* Other parameters not precluded

**Issue 1-2-3 Test procedure/configuration**

* Offline agreement
  + During test, ephemeris information shall be updated periodically and aligned with TE-emulated channel model ~~which match with satellite motion trajectory~~
  + ~~Further discuss details together with channel modelling~~
  + ~~Further discuss if Ephemeris information is needed for the dynamic channel model.~~ 
    - ~~If complete test of UE behaviour (RAN5), Ephemeris data is required.~~
    - ~~If RAN4 needs only Doppler and Delay channel variation for e.g. frequency error or demodulation (RAN4), Ephemeris data may not be required.~~

## Sub-topic 1-3 RAN4 requirements and tests

**~~Issue 1-3-1 RRM requirements~~**

* ~~Recommended WF~~
  + ~~RAN4 further discuss RRM requirements impact and how to apply TE-emulated channel model for UL timing test cases pending on channel model discussion progress.~~

**Issue 1-3-2 demodulation requirements**

* Offline agreement
  + RAN4 further discuss how to apply the varying Doppler and delay shifts to the UE performance requirements and necessary simulation assumption on UE side pending on channel model discussion progress.
    - UE assumption on propagator model for satellite motion for RAN4 simulation purpose
      * Option 1: Keplerian model
      * other options not precluded
  + RAN4 further discuss test applicability if new PDSCH demodulation requirements introduced pending on channel model discussion progress.

**~~Issue 1-3-3 Frequency error test cases~~**

* ~~Recommended WF~~
  + ~~RAN4 further discuss whether and how to apply the varying Doppler shifts to RAN5 frequency error test cases if needed pending on channel model discussion progress.~~

# Reference

[1] R4-2413429, “Topic summary for [112][329] NTN\_testing\_NGSO\_channel\_model “, Moderator (Samsung)