**3GPP RAN WG4 Meeting #113 R4-2420509**

**Orlando, Fl, USA 18th – 22nd November, 2024 Revision of R4-2420502**

**Agenda item:** 5.9.1

**Source:** EchoStar

**Title:** Way Forward on IoT-NTN in-band

**Document for:** Approval

# Background

* NTN NB-IoT standalone operation was introduced from Rel-17 .
* NTN NB-IoT inband operation has not been introduced in specification till now and important for satellite operators.
* It was agreed in the March RAN plenary to address the NB-IoT NTN in-band/guardband operation as TEI-18 in RAN4.
* Contributions were submitted based on agreed WF from 112bis meeting that identified the issues to be resolved
* Based on contributions to this meeting, an offline discussion was held on 11/20 to reach agreement on issues related to NB-IoT NTN IB/GB operation (Topic 5, Sub-topic 1-1) listed in [1].

# WF on NB-IoT NTN IB/GB operation

Topic 5, sub-topic 1-1, Issue 5.2, 5.6 – 3GPP Release Support

Agreements:

* RAN4 agrees to complete work under TEI-18 with Rel-18 CRs to be agreed to at the February meeting
  + Optional in Rel-18, Mandatory in Rel-19
  + Rel-18 Cat-B CR for approval in the February meeting
  + Rel-19 Cat-F CR for approval in the April/May meeting

* A separate WID is not required for completing this work
* Work distribution in terms of CR development for RAN4#114 meeting

o    TS 36.102 – Mediatek

o    TS 36.108 - Thales

o    TS 38.108 - Inmarsat

o    TS 38.181 - EchoStar

Topic 5, sub-topic 1-1, Issues 5-3, 5.4– Signaling aspects and impact to other WGs

Agreements:

* Use operation of IB/GB NB-IoT in NR TN as baseline, i.e., utilize setting of operationModeInfo IE setting of “guardband-r13” to indicated IB/GB operation of NB-IoT in NR NTN channel
* Describe the signaling  to indicated IB/GB operation explicitly in TS 36.102 in a new sub-clause
* No impact to other WGs

Topic 5, sub-topic 1-1, Issues 5-5 – FDL/MDL determination

* + Option 1 (R4-2419537):
    - FDL = FDL\_low + 0.1(NDL – NOffs-DL) + 0.0025\*(2MDL+1); for the carrier including NPSS/NSSS for in-band operation, MDL is selected from {-2,- 1,0,1}.
  + Option 2 (Option 1a in R4-2149639):

NOTE 2:             For the carrier supporting in-band operation, the following equation is used.

FDL = FDL\_low + 0.1(NDL – NOffs-DL) + 0.0025\*(2MDL+1)

FUL = FUL\_low + 0.1(NUL – NOffs-UL) + 0.0025\*(2MUL+1)

NOTE 3               For the carrier supporting in-band operation, MDL= -0.5 is not applicable for in-band operation.

NOTE 4               For the carrier including NPSS/NSSS for in-band operation, MDL is selected from {-2, -1, 0, 1}.

NOTE 5               Additional UE capability report for in-band operation would be required and introduced.

Option 3 ( Option 2a in R4-2149639):

NOTE 2:             For the carrier supporting in-band operation, in-band MDL = MDL + 0.5 and MUL = MUL + 0.5.

NOTE 3               For the carrier supporting in-band operation, MDL= -0.5 is not applicable for in-band operation.

NOTE 4               For the carrier including NPSS/NSSS for in-band operation, MDL is selected from {-2, -1, 0, 1}.

NOTE 5               Additional UE capability report for in-band operation would be required and introduced.

Option 4 (Option 1 in R4-2419583):

NOTE 1:             For the carrier including NPSS/NSSS for stand-alone operation, MDL = 0.

NOTE 2:             For the carrier supporting in-band [and guard-band] operation, the following equation is used.

FDL = FDL\_low + 0.1(NDL – NOffs-DL) + 0.0025\*(2MDL+1)

FUL = FUL\_low + 0.1(NUL – NOffs-UL) + 0.0025\*(2MUL+1)

NOTE 3               For the carrier supporting in-band [and guard-band] operation, MDL= -0.5 is not applicable for in-band[/guard-band] operation.

NOTE 4               For the carrier including NPSS/NSSS for in-band [and guard band] operation, MDL is selected from {-2, -1, 0, 1}.

NOTE 5               Additional UE capability for in-band operation would be required and introduced accordingly.

Option 4 (Option 2 in R4-2419583):

NOTE 1:             For the carrier supporting in-band [and guard band] operation, in-band[/guard-band] MDL = MDL + 0.5 and MUL = MUL + 0.5

NOTE 2:             For FDD MDL= 0 is not applicable for in-band [and guard band] operation.

NOTE 3:             For the carrier including NPSS/NSSS for in-band [and guard band] operation, in-band[/guard-band] MDL is selected from {-1.5, -0.5, 0.5, 1.5}.

NOTE 4:             For the carrier including NPSS/NSSS for stand-alone operation, MDL = 0.

NOTE 5               Additional UE capability for in-band operation would be required and introduced accordingly.

Agreements:

* Capture the modification to the MDL/MUL for in-band operation using a separate sub-clause or a paragraph rather than through NOTEs
  + Final agreement to be paraphrased in a paragraph or a new sub-clause
* Additional UE capability report is not required
* Companies will work offline before the February meeting to finalize the solution for the FDL/MDL/FUL/MUL determination so that the CR package can be formulated and submitted for agreement at the RAN4#114 meeting in February, 2025.

Topic 5, sub-topic 1-1, Issues 5-1: Inclusion of guard-band support

Discuss the proposed text in the CR in R4-2419583 to specify support for both in-band and , guardband since there is no signaling impact

Agreements:

* Since there is no signaling impact, agree to specify guardband as a UE implementation option

# Reference

[1] R4-2418124 Topic summary for [113][102] R18\_UERF\_maintenance\_Part1\_v0