**3GPP TSG RAN Meeting #105 RP-242xxx**

**Melbourne, Australia, September 9-12, 2024** (revision of RP-242336)

**Source: Iridium Satellite**

**Title: New WID on Half Duplex SAN for NB-IoT NTN in new 1.6GHz band**

**Document for: Approval**

**Agenda Item: 10.1.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: **Half Duplex SAN for NB-IoT NTN in new 1.6GHz band**

Acronym: TBD

Unique identifier: TBD

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** | **X** |
| **This WID includes a Performance part** | **X** |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: Rel-19

NOTE: In case of contradiction with the target dates of clause 5, clause 5 determines the target release.

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | X | X |  |  |
| **No** |  |  |  |  | X |
| **Don't know** | X |  |  | X |  |

# 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This description is either a …

|  |  |
| --- | --- |
|  | Study Item |

or a

|  |
| --- |
| Normative Work Item:*tick applicable boxes below* |
|  | Stage 1 |
|  | Stage 2 |
| X | Stage 3 |
|  | Other (e.g. testing) |

### 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| N/A |  |  |  |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore, the table above should include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work Items (if any) |
| Acronym | Unique ID | Title | Nature of relationship |
| FS\_NR\_nonterr\_nw | 750040 | Study on NR to support non-terrestrial networks | The proposed WID will make use of the channel model defined by the FS\_NR\_nonterr\_nw study  |
| FS\_NR\_NTN\_solutions | 800099 | Study on solutions for NR to support non-terrestrial networks | The proposed WID will leverage solutions identified in FS\_NR\_NTN\_solutions to address some of the key issues associated to NTN |
| LTE\_NBIOT\_eMTC\_NTN | 920169 | NB-IoT/eMTC support for Non-Terrestrial Networks | The proposed WID will use the Release 17 specification resulting from this work as a baseline for the evolution |
| [IoT\_NTN\_enh](https://www.3gpp.org/DynaReport/WiSpec--941004.htm#_blank) | 941004 | IoT NTN enhancements | The proposed WID will use the Release 18 specification resulting from this work as a baseline for the evolution |
| IoT\_NTN\_Ph3 | 1020096 | Non-Terrestrial Networks (NTN) for Internet of Things (IoT) Phase 3 | The proposed WID will use the Release 19 specification resulting from this work as a baseline for the evolution |

NOTE: Also related or dependent WIs/SIs in other TSGs shall be indicated here.

# 3 Justification

The intention of this Work Item is to enable NB-IoT NTN service on a current in-orbit LEO constellation (66 active Satellite Vehicles, plus spares) operating in 10MHz spectrum at 1616-1626.5 MHz (ITU-R Mobile Satellite Service allocated band) worldwide, with satellite longevity expected at least until 2035. It intends to operate NB-IoT as dedicated anchor carrier(s) (and possibly also non-anchor carrier(s)) within this spectrum where UL and DL transmissions are on the *same* carrier.

This Work Item Description proposes to allow the operator to configure a specific duty cycle for usage of radio resources on given carriers, consisting of a periodic subset of UL and DL subframes in N radio frames thus limiting power consumption at the satellite while extending applicability of 3GPP NB-IoT NTN to NGSO in the 1616-1626.5 MHz MSS band. This further enables additional lower-complexity satellite payloads, such as implementations without duplexer. With this proposed feature, there is a significant opportunity to further expand global NB-IoT NTN service coverage, including connectivity to polar regions.

The intent is to leverage existing NB-IoT NTN UE design, which today are half-duplex FDD devices.

# 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

The work item aims to specify enhancements for NB-IoT NTN to enable operation in 1616-1626.5 MHz MSS band by configuring the usage of radio resources on given carriers in this band with a specific duty cycle consisting of a periodic subset of the UL and DL subframes in N radio frames, where UL and DL are both on the same carrier. It also aims to specify this new band accordingly.

1. This work item includes the following objectives:
2. 1) To first study the following:
* Targeted 1616-1626.5 MHz MSS band definition and duplex mode [RAN4, RAN1]
* Identification of the minimum specification changes required to existing NB-IoT NTN design in particular from UE standpoint [RAN1, RAN4, RAN2], including:
* Radio interface design and associated minimum performance requirements (incl. DL synchronization, random access, DRX, #repetitions, etc.)
* Performance impact taking into account the resulting duty cycle of the transmission pattern incl. potential impact to NAS protocols, in coordination with SA2 [RAN1, RAN2, RAN4]
* Assuming a duty cycle with 10 contiguous sub frames in Tx and 10 contiguous sub frames in Rx over N radio frames
* Any necessary constraints on the operation of the above duty cycle (e.g. static, vs. dynamic)

The study above assumes the following:

* LEO @600 km and @1200km orbit respectively with set-1 satellite parameters as reference scenarios (See 3GPP TR 36.763)
* Standalone deployment (i.e. operating in carrier(s) used only for NB-IoT) with anchor and non-anchor carrier(s)
* Reuse existing NB-IoT NTN design (e.g. frame structure, DMRS pattern)
* Leverage existing NB-IoT NTN FDD UE procedures
* Operate with Earth fixed Tracking area, with Earth-fixed and Earth-moving cells
* Allow the duty cycle with a parameter N to take an operator-defined integer value in the range of 4 to 10.

2) Based on the outcome of the above study phase, to specify:

* Support for the new 1616-1626.5 MHz MSS band, corresponding duplex mode as well as SAN and UE RF requirements [RAN4]
* Physical layer support [RAN1]
* Radio protocol support [RAN2]
* RRM core requirements [RAN4]

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

To specify the following

* RRM performance requirementsd [RAN4]
* SAN and UE demodulation requirements [RAN4]
* SAN conformance testing requirements [RAN4]

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

# 5 Expected Output and Time scale

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

| **Impacted existing TS/TR** |
| --- |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| TS 36.211 | LTE; Physical channels and modulation | RAN#108 | Core part |
| TS 36.213 | LTE; Evolved Universal Terrestrial Radio Access (E-UTRA);Physical layer procedures | RAN#108 | Core part |
| TS 36.300 | LTE; Overall description; Stage-2:  | RAN#109 | Core part |
| TS 36.304 | LTE; User Equipment (UE) procedures in idle mode and in RRC Inactive state | RAN#109 | Core part |
| TS 36.306 | LTE; User Equipment (UE) radio access capabilities | RAN#109 | Core part |
| TS 36.321 | LTE; Medium Access Control (MAC) protocol specification:  | RAN#109 | Core part |
| TS 36.331 | LTE; Radio Resource Control (RRC); Protocol specification | RAN#109 | Core part |
| TS 36.133 | LTE; Requirements for support of Radio Resource Management | RAN#109 | Core part |
| TS 36.102 | Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception for satellite access |  |  |
| TS 36.108 | Evolved Universal Terrestrial Radio Access (E-UTRA); Satellite Access Node radio transmission and reception |  |  |
| TS 36.181 | Evolved Universal Terrestrial Radio Access (E-UTRA); Satellite Access Node conformance testing |  |  |
|  |  |  |  |
|  |  |  |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

# 6 Work item Rapporteur(s)

*TBD*

NOTE: The first listed Rapporteur has the overall responsibility for this WI (incl all secondary tasks).

# 7 Work item leadership

RAN1

Secondary responsible Working Group(s): RAN2, RAN4 (if needed)

# 8 Aspects that involve other WGs

None so far.

NOTE: For RAN WIs: Section 8 applies only to WGs outside of TSG RAN because all RAN WG aspects have to be covered in section 4.

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Iridium Satellite |
| CCL (Cambridge Consultants) |
| Continental AG |
| ETRI |
| ESA (European Space Agency) |
| Deutsche Telekom |
| FirstNet |
| Fraunhofer HHI |
| Fraunhofer IIS |
| Gatehouse |
| Google |
| IIT Hyderabad |
| KT (Korea Telecom) |
| Mavenir |
| Midwave Wireless |
| NOKIA |
| Nordic Semi |
| OPPO |
| Qualcomm |
| Sateliot |
| Semtech |
| SES (Société Européenne des Satellites) |
| Sony |
| Telit |
| TELUS |
| Thales |
| TNO (Netherlands Organisation for Applied Scientific Research) |
| TOYOTA InfoTechnology Center |
| VIAVI |