**3GPP T****SG-RAN WG2 Meeting #118-e R2-220xxxx**

**E-Meeting, May 09th – May 20th, 2022**

**Agenda item:**  **6.10.4.1**

**Source: Intel Corporation**

**Title: Report of email discussion [AT118-e][108][NTN] UE capabilities (Intel)**

**Document for: Discussion**

# Introduction

This is the report of the following email discussion:

**\* [AT118-e][108][NTN] UE capabilities (Intel)**

Initial scope: discuss UE capabilities based on contributions in 6.10.4

Initial intended outcome: Summary of the offline discussion with e.g.:

·         List of proposals for agreement (if any)

·         List of proposals that require online discussions

·         List of proposals that should not be pursued (if any)

Deadline (for companies' feedback): Tuesday 2022-05-10 0800 UTC

Deadline (for rapporteur's summary in R2-22XXXXX): Tuesday 2022-05-10 1000 UTC

# Discussion

## Known remaining issue 1: IoT bits for TN UE capabilities

In 6.10.4, the following papers have proposals for this issue:

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| tdoc number | Proposals |
| R2-2205572 Ericsson | Proposal 2 Separate Interoperability Test bits for IoT NTN might be added if cases were TN features would not apply to NTN are found.Proposal 3 RAN2 to discuss adding IoT bits to the TN identified capabilities that would not work in NTN. |
| R2-2204662Qualcomm Inc. | Add new Rel-17 non-critical extension to convey a subset of UE Radio Access Capability Parameters differently for NR NTN.– *NTN-Parameters*The IE *NTN-Parameters* is used to convey the subset of UE Radio Access Capability Parameters differently for NR NTN, see TS 38.306 [26]. This IE is not used if the subset of UE Radio Access Capability Parameters is same for both NR TN and NR NTN.***NTN-Parameters* information element**-- ASN1START-- TAG-NTNPARAMETERS-STARTNTN-Parameters-r17 ::= SEQUENCE { inactiveState-r17 ENUMERATED {supported} OPTIONAL, delayBudgetReporting-r17 ENUMERATED {supported} OPTIONAL, overheatingInd-r17 ENUMERATED {supported} OPTIONAL, bh-RLF-Indication-r17 ENUMERATED {supported} OPTIONAL, referenceTimeProvision-r17 ENUMERATED {supported} OPTIONAL, onDemandSIB-Connected-r17 ENUMERATED {supported} OPTIONAL, redirectAtResumeByNAS-r17 ENUMERATED {supported} OPTIONAL, mpsPriorityIndication-r17 ENUMERATED {supported} OPTIONAL, ra-SDT-r17 ENUMERATED {supported} OPTIONAL, srb-SDT-r17 ENUMERATED {supported} OPTIONAL, gNB-SideRTT-BasedPDC-r17 ENUMERATED {supported} OPTIONAL, bh-RLF-RecoveryDetection-Indication-r17 ENUMERATED {supported} OPTIONAL, mbs-ParametersNTN-r17 MBS-Parameters-r17 OPTIONAL sliceInfoforCellReselection-r17 ENUMERATED {supported} OPTIONAL, measAndMobParametersNTN-r17 MeasAndMobParametersNTN-r17 OPTIONAL, mac-ParametersNTN-r17 MAC-ParametersNTN-r17 OPTIONAL, phy-ParametersNTN-r17 Phy-ParametersNTN-r17 OPTIONAL, nonCriticalExtension SEQUENCE {} OPTIONAL}-- TAG-NTNPARAMETERS-STOP-- ASN1STOP |
| R2-2204843Intel, THALES | Proposal 1: when UE reports nonTerrestrialNetwork-r17, all the per-UE capabilities UE indicates apply to both TN and NTN operations. |
| R2-2205306Huawei, HiSilicon | Proposal 1: The discussion on whether existing TN capabilities need separate NTN capabilities or IoT bits is focused on per-UE capabilities.Proposal 2: UE capabilities in the following parameters can be duplicated to indicate the support in NTN:1) mac-Parameters; 2) phy-Parameters; 3) measAndMobParameters; 4) fdd-Add-UE-NR-Capabilities; 5) fr1-Add-UE-NR-Capabilities.UE capabilities in the following parameters do not need to differentiate between TN and NTN:1) sdap-Parameters; 2) pdcp-Parameters; 3) rlc-Parameters; 4) interRAT-Parameters; 5) rf-Parameters; 6) featureSets; 7) featureSetCombinations; 8) tdd-Add-UE-NR-Capabilities; fr2-Add-UE-NR-Capabilities.Proposal 3: Introduce separated capabilities regarding SON/MDT for NTN. The capabilities related to NR-DC, overheating, power saving and IMS do not need to differentiate between TN and NTN. |

Based on companies’ proposals, this remaining issue can be discussed in three steps:

**Step 1**: RAN2 to confirm that “The discussion on whether existing TN capabilities need separate NTN capabilities or IoT bits is focused on per-UE capabilities”.

**Step 2**: two options for consideration:

Option 1: Add separate IoT bits to convey a subset of UE Radio Access Capability Parameters differently for NR NTN. It also implies that other per-UE UE capabilities not within this list are applicable to both TN and NTN.

Option 2: when UE reports *nonTerrestrialNetwork-r17*, all the per-UE capabilities UE indicates apply to both TN and NTN operations

**Step 3**: if we go with option 1, which existing TN UE capabilities need separate IoT bits for NTN.

The following questions are for these 3 steps respectively to collect companies’ views.

**Question 1: whether it’s agreeable to confirm “The discussion on whether existing TN capabilities need separate NTN capabilities or IoT bits is focused on per-UE capabilities”?**

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| **Company** | **Y or N** | **Additional comments** |
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**Question 2: to address this IoT bits issue, which option is preferred?**

**Option 1:** Add separate IoT bits to convey a subset of UE Radio Access Capability Parameters differently for NR NTN. It also implies that other per-UE UE capabilities not within this list are applicable to both TN and NTN.

**Option 2:** when UE reports *nonTerrestrialNetwork-r17*, all the per-UE capabilities UE indicates apply to both TN and NTN operations.

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| **Company** | **Option 1 or 2** | **Additional comments** |
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**Question 3: if we go with option 1, which existing TN UE capabilities need separate IoT bits for NTN?**

**Candidate list 1:**

***NTN-Parameters* information element**

-- ASN1START

-- TAG-NTNPARAMETERS-START

NTN-Parameters-r17 ::= SEQUENCE {

 inactiveState-r17 ENUMERATED {supported} OPTIONAL,

 delayBudgetReporting-r17 ENUMERATED {supported} OPTIONAL,

 overheatingInd-r17 ENUMERATED {supported} OPTIONAL,

 bh-RLF-Indication-r17 ENUMERATED {supported} OPTIONAL,

 referenceTimeProvision-r17 ENUMERATED {supported} OPTIONAL,

 onDemandSIB-Connected-r17 ENUMERATED {supported} OPTIONAL,

 redirectAtResumeByNAS-r17 ENUMERATED {supported} OPTIONAL,

 mpsPriorityIndication-r17 ENUMERATED {supported} OPTIONAL,

 ra-SDT-r17 ENUMERATED {supported} OPTIONAL,

 srb-SDT-r17 ENUMERATED {supported} OPTIONAL,

 gNB-SideRTT-BasedPDC-r17 ENUMERATED {supported} OPTIONAL,

 bh-RLF-RecoveryDetection-Indication-r17 ENUMERATED {supported} OPTIONAL,

 mbs-ParametersNTN-r17 MBS-Parameters-r17 OPTIONAL

 sliceInfoforCellReselection-r17 ENUMERATED {supported} OPTIONAL,

 measAndMobParametersNTN-r17 MeasAndMobParametersNTN-r17 OPTIONAL,

 mac-ParametersNTN-r17 MAC-ParametersNTN-r17 OPTIONAL,

 phy-ParametersNTN-r17 Phy-ParametersNTN-r17 OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-NTNPARAMETERS-STOP

-- ASN1STOP

**Candidate list 2:**

1) mac-Parameters;

2) phy-Parameters;

3) measAndMobParameters;

4) fdd-Add-UE-NR-Capabilities;

5) fr1-Add-UE-NR-Capabilities

6) SON/MDT related capabilities.

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| **Company** | **Candidate list 1 or 2** | **Additional comments** |
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**Summary:**

## Known remaining issue 2: interpretation of *ntn-ScenarioSupport-r17*

In 6.10.4, the following papers have proposals for this issue:

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| tdoc number | Proposals |
| R2-2205572 Ericsson | Proposal 1 ntn-ScenarioSupport-r17 should be used for both essential and optional NTN capabilities. |
| R2-2204843Intel, THALES | Proposal 2: ntn-ScenarioSupport-r17 also applies to optional NTN UE capabilities. |
| R2-2205701Samsung | Proposal 2: Define IoT bit for the support of {GSO, NGSO, both}, and this indication means all Rel-17 NTN essential features and optional features UE indicates have been tested in the corresponding scenario(s). |

Companies’ views are aligned according to the proposals above, and other companies are invited to provide views on the proposals.

**Question 4: whether it’s agreeable that “*ntn-ScenarioSupport-r17* is used for both essential and optional NTN capabilities”?**

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| **Company** | **Y or N** | **Additional comments** |
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**Summary:**

## Known remaining issue 3: Fixed Dish type UE

In 6.10.4, the following papers have proposals for this issue:

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| tdoc number | Proposals |
| R2-2205572 Ericsson | Proposal 4 Postpone the discussion on UEs without GNSS receiver to Release 18. |
| R2-2204843Intel, THALES | Proposal 3: RAN2 to confirm that static “VSAT” type NTN capable UE without GNSS module but with GNSS coordinates can report gnss-Location-r16 UE capability. |

Since the views are different, companies are invited to choose which one is preferred.

**Question 5: regarding how to handle “Fixed Dish type UE without GNSS module but with GNSS coordinates”, which option is preferred?**

**Option 1:** postpone the discussion on UEs without GNSS receiver to Release 18

**Option 2:** static “VSAT” type NTN capable UE without GNSS module but with GNSS coordinates can report gnss-Location-r16 UE capability

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| **Company** | **option 1 or 2** | **Additional comments** |
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**Summary:**

## Other issue 1: NTN only UE

In 6.10.4, the following paper has proposals for this issue:

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| tdoc number | Proposals |
| R2-2205593Interdigital, Inc. | Proposal 1: RAN2 to discuss and decide whether NTN-only UE needs to be supported. Proposal 2: If NTN-only UE is not supported then no special handling is needed. This is already implied by existing NTN capabilities.Proposal 3: If NTN-only UE is supported then, for this type of device, SIB19 is considered as essential system information and the cell is treated as barred if missing.Proposal 4: If NTN-only UE is supported then introduce a new capability “ntn-Only”. |

As part of the discussion on handling of cell barring, the concept of NTN-only UE is raised. And the corresponding impact on UE capabilities needs to be addressed.

**Question 6: whether NTN-only UE needs to be supported?**

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| **Company** | **Y or N** | **Additional comments** |
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**Question 7: if the answer to Q6 is no, do you further agree to the following proposals?**

**Proposal 2**: If NTN-only UE is not supported then no special handling is needed. This is already implied by existing NTN capabilities.

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| **Company** | **Y or N** | **Additional comments** |
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**Question 8: if the answer to Q6 is yes, do you further agree to the following proposals?**

**Proposal 3**: If NTN-only UE is supported then, for this type of device, SIB19 is considered as essential system information and the cell is treated as barred if missing.

**Proposal 4**: If NTN-only UE is supported then introduce a new capability “ntn-Only”.

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| **Company** | **Y or N** | **Additional comments** |
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**Summary:**

## Other issue 2: SMTC enhancements for GSO

In 6.10.4, the following paper has proposals for this issue:

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| tdoc number | Proposals |
| R2-2205701Samsung | Proposal 1: The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are optional for GSO capable UE. |

In RAN2#117-e meeting, RAN2 made the following agreement regarding SMTC enhancements:

1. The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are essential for NGSO capable UEs.

And for GSO capable UEs, it is still an FFS.

**Question 9: whether the following proposal is agreeable?**

**Proposal 1:** The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are optional for GSO capable UE.

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| **Company** | **Y or N** | **Additional comments** |
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**Summary:**

## Other issue 3: Clarification on TA reporting UE capability

In 6.10.4, the following paper has proposals for this issue:

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| tdoc number | Proposals |
| R2-2204842Intel | Incorporate event-triggered TA reporting feature into TA reporting UE capability.***uplink-TA-Reporting-r17***Indicates whether the UE supports UE reporting of information related to TA pre-compensation, i.e., event-triggered TA reporting in RRC connected mode and system information triggered TA reporting during initial access*.* UE indicating support of this feature shall also indicate support of *uplinkPreCompensation-r17* for this band. |

TA reporting UE capability based on the RAN1 UE feature list (R1-2202928) was captured in R2-2204304 (Draft mega CR), and one RAN2 agreement “Incorporate event-triggered TA reporting feature into TA reporting UE capability defined in RAN1 feature list” needs to be captured based on it.

**Question 10: whether the following implementation to capture “Incorporate event-triggered TA reporting feature into TA reporting UE capability defined in RAN1 feature list” is agreeable?**

***uplink-TA-Reporting-r17***

Indicates whether the UE supports UE reporting of information related to TA pre-compensation, i.e., event-triggered TA reporting in RRC connected mode and system information triggered TA reporting during initial access*.* UE indicating support of this feature shall also indicate support of *uplinkPreCompensation-r17* for this band.

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| **Company** | **Y or N** | **Additional comments** |
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**Summary:**

# Conclusion

Based on this offline discussion on UE capabilities, the following proposals are made:

** List of proposals for agreement:**

** List of proposals that require online discussions:**

# References

1. R2-2205572 On NTN capabilities Ericsson
2. R2-2204662 NTN UE capability signalling Qualcomm Incorporated
3. R2-2204843 Discussion on remaining issues on NTN UE capabilities Intel Corporation,

THALES

1. R2-2205306 Discussion on UE capabilities for NTN Huawei, HiSilicon
2. R2-2205593 NTN-only UE Interdigital, Inc.
3. R2-2205701 Open issues on UE capabilities Samsung Research America
4. R2-2204842 Clarification on TA reporting UE capability Intel Corporation