**3GPP T****SG-RAN WG2 Meeting #119-e R2-2208765**

**E-Meeting, Aug 17 – 29, 2022**

**Agenda item:**  **6.10.3.2.1**

**Source: Intel Corporation**

**Title: Report of [AT119-e][102][NR-NTN] SMTC and gaps (Intel) PH2**

**Document for: Discussion and Decision**

# Introduction

This is the report of the following offline discussion phase 2 on remaining SMTC and gap issues:

**[AT119-e][102][NR-NTN] SMTC and gaps (Intel)**

Updated scope: Discuss remaining SMTC and gaps corrections

Updated 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)

Updated deadline (for companies' feedback): Monday 2022-08-22 2200 UTC

Updated deadline (for rapporteur's summary in R2-2208765): Tuesday 2022-08-23 0400 UTC

Proposals marked "for agreement" in R2-2208765 not challenged until Tuesday 2022-08-23 16:00 UTC will be declared as agreed via email by the session chair (for the rest the discussion might continue offline).

|  |
| --- |
| **tdoc list:**R2-2207271 Discussion on RAN4 reply LS on measurement gaps Intel Corporation discussion Rel-17 NR\_NTN \_solutions-Core**=> move from 6.10.1.1**R2-2207268 Draft 331 CR for NR NTN measurement related UE capabilities Intel Corporation draftCR Rel-17 38.331 17.1.0 F NR\_NTN \_solutions-CoreR2-2207269 Draft 306 CR for NR NTN measurement related UE capabilities Intel Corporation draftCR Rel-17 38.306 17.1.0 F NR\_NTN \_solutions-CoreR2-2207270 Discussion on UE capability for 2 SMTC in parallel Intel Corporation discussion Rel-17 NR\_NTN \_solutions-Core**=> move from 6.10.3.2.3**R2-2207149 Remaining issues on SMTCs and gaps Huawei , HiSilicon discussion Rel-17 NR\_NTN \_solutions-CoreR2-2208214 Correction to associate two concurrent measurement gaps to one frequency layer for NR NTN Nokia, Nokia Shanghai Bell CR Rel-18 38.331 17.1.03382 - F NR\_NTN \_solutions-CoreR2-2208466 Correction for measurement gap Xiaomi draftCR Rel-17 38.331 17.1.0 NR\_NTN \_solutions-CoreR2-2207243   Draft 331 CR for NR NTN SMTC   Samsung Research America     draftCR Rel-17           38.331  17.1.0   F          NR\_NTN\_solutions-CoreR2-2207068   Correction on NTN UE capabiltiy   OPPO  CR       Rel-17  38.306  17.1.0   0758     -           F          NR\_NTN\_solutions-Core**additional tdocs in PH2:**Misc 38.306 corrections[R2-2208537](file:///C%3A%5CData%5C3GPP%5CExtracts%5C38.306_CR0794_Rel-17_R2-2208537_CorrectionNTNCapabilities.docx)    Corrections to NTN capabilities     LG Electronics  CR        Rel-17   38.306  17.1.0   0794     -           F   NR\_NTN\_solutions-Core, NR\_redcap-Core[R2-2208679](file:///C%3A%5C%5CData%5C%5C3GPP%5C%5CExtracts%5C%5CR2-2208679%20-%20R17%20NR%20NTN%20UE%20Capability%20issues.docx%22%20%5Co%20%22C%3AData3GPPExtractsR2-2208679%20-%20R17%20NR%20NTN%20UE%20Capability%20issues.docx%22%20%5Ct%20%22_blank)    R17 NR NTN UE Capability issues Ericsson           discussion        Rel-17other tdocs in 6.10.3.2.1[R2-2207242](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2207242%206.10.3.2.1%20SMTC%20discussion.docx)    Discussion on SMTC related issues          Samsung Research America      discussion        Rel-17   NR\_NTN\_solutions-Core[R2-2207344](file:///C%3A%5CData%5C3GPP%5CExtracts%5C38331_CR3251_%28Rel-17%29_R2-2207344%20Boundary%20alignment.docx)    Correction to the frame boundary alignment indication from the source       Qualcomm Incorporated CR   Rel-17   38.331  17.1.0   3251     -           F          NR\_NTN\_solutions-Core[R2-2207345](file:///C%3A%5CData%5C3GPP%5CExtracts%5C38331_CR3252_%28Rel-17%29_R2-2207345%20Report%20SMTC%20error.docx)    Reporting SMTC issue in measurement results       Qualcomm Incorporated CR        Rel-17   38.331  17.1.0   3252     -           F          NR\_NTN\_solutions-Core |

# Discussion in Phase 1

## 2.1 Spec impact of RAN4 reply LS on measurement gaps

For Rel-17 NR NTN, RAN2 received the reply LS [1] from RAN4 on measurement gap enhancements for NTN. The content of this LS is as below:

|  |
| --- |
| **1. Overall Description:**RAN4 thanks RAN2 for the LS sent in R2-2204114 asking about the feasibility for NR NTN when one frequency layer is associated to both concurrent measurement gaps with the same gap type.RAN4 reached consensus in this matter that one frequency layer can be associated to both concurrent measurement gaps with the same gap type. There is no need to define additional NTN UE capability for this association.**2. Actions:****To RAN2****ACTION:** RAN4 kindly asks RAN2 to take the above answers into account. |

There are two pieces of key information for RAN2 to consider:

1. One frequency layer can be associated to both concurrent measurement gaps with the same gap type

2. There is no need to define additional NTN UE capability for this association

Regarding how to capture “One frequency layer can be associated to both concurrent measurement gaps with the same gap type”, the following papers provides the corresponding CR or TP.

|  |  |
| --- | --- |
| R2-2207271  | MeasObjectNR ::= SEQUENCE {…… [[ associatedMeasGapSSB-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS-r17 MeasGapId-r17 OPTIONAL, -- Need R smtc4list-r17 SSB-MTC4List-r17 OPTIONAL, -- Need R measCyclePSCell-r17 ENUMERATED {ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, spare1} OPTIONAL, -- Need R cellsToAddModListExt-v1710 CellsToAddModListExt-v1710 OPTIONAL -- Need N ]], [[ associatedMeasGapSSB2-NTN-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS2-NTN-r17 MeasGapId-r17 OPTIONAL -- Need R ]]} |
| R2-2207149  | MeasObjectNR ::= SEQUENCE { …… [[ associatedMeasGapSSB-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS-r17 MeasGapId-r17 OPTIONAL, -- Need R smtc4list-r17 SSB-MTC4List-r17 OPTIONAL, -- Need R measCyclePSCell-r17 ENUMERATED {ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, spare1} OPTIONAL, -- Need R cellsToAddModListExt-v1710 CellsToAddModListExt-v1710 OPTIONAL -- Need N ]] [[ associatedMeasGapSSB2-v17xy MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS2-v17xy MeasGapId-r17 OPTIONAL, -- Need R ]]} |
| R2-2208214  | MeasObjectNR ::= SEQUENCE { ……  [[ associatedMeasGapSSB-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS-r17 MeasGapId-r17 OPTIONAL, -- Need R smtc4list-r17 SSB-MTC4List-r17 OPTIONAL, -- Need R measCyclePSCell-r17 ENUMERATED {ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, spare1} OPTIONAL, -- Need R cellsToAddModListExt-v1710 CellsToAddModListExt-v1710 OPTIONAL -- Need N ]],[[ associatedMeasGapSSB2-r17 MeasGapId-r17 OPTIONAL, -- Cond NTN]]} |
| R2-2208466  | MeasObjectNR ::= SEQUENCE { …… [[ associatedMeasGapSSB-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGap2SSB-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGapCSIRS-r17 MeasGapId-r17 OPTIONAL, -- Need R associatedMeasGap2CSIRS-r17 MeasGapId-r17 OPTIONAL, -- Need R smtc4list-r17 SSB-MTC4List-r17 OPTIONAL, -- Need R measCyclePSCell-r17 ENUMERATED {ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, spare1} OPTIONAL, -- Need R cellsToAddModListExt-v1710 CellsToAddModListExt-v1710 OPTIONAL -- Need N ]]} |

Based on companies’ papers, companies are aligned to capture the second measurement gap ID within IE *Measobject* NR in RRC spec. The difference is in CR detail. Since different reference signals within the same *MeasObjectNR* mean different measurement frequency layers, we need separate fields for SSB measurement and CSI-RS measurement.

**Question 1: whether the following proposal is agreeable:**

**Proposal: RAN2 to capture in TS 38.331 RAN4 agreement that one frequency layer and two concurrent measurement gaps with the same gap type can be associated, i.e., *associatedMeasGapSSB2* and *associatedMeasGapCSIRS2* within IE *MeasObjectNR*.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | Y |  |
| Ericsson | Y |  |
| Samsung | Y |  |
| Nokia | Y |  |
| Qualcomm | Y |  |
| China Telecom | Y |  |
| Google | Y |  |
| ZTE | Y |  |
| Xiaomi | Y |  |
| Apple | Y |  |
| Turkcell | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

All participant companies agree to this proposal to address RAN4 reply LS on measurement gap.

**Proposal 1: RAN2 to capture in TS 38.331 RAN4 agreement that one frequency layer and two concurrent measurement gaps with the same gap type can be associated, i.e., *associatedMeasGapSSB2* and *associatedMeasGapCSIRS2* within IE *MeasObjectNR*.**

Regarding the UE capability, RAN4 indicates that “There is no need to define additional NTN UE capability for this association”. The following paper suggests to capture the support of this association as “if a UE supports both NTN features and concurrent gap features, it also supports the association between one frequency layer and two concurrent measurement gaps with the same gap type.” The TP is as below:

|  |  |
| --- | --- |
| R2-2207271  | ***nonTerrestrialNetwork-r17***Indicates whether the UE supports NR NTN access. If the UE indicates this capability the UE shall support the following NTN essential features, i.e., timer extension in MAC/RLC/PDCP layers and RACH adaptation to handle long RTT, acquiring NTN specific SIB and more than one TAC per PLMN broadcast in one cell. A UE shall support two concurrent measurement gaps for one measurement object if the UE supports both *concurrentMeasGap-r17* and *nonTerrestrialNetwork-r17*. |
| R2-2207271  | ***concurrentMeasGap-r17***Indicates whether the UE supports the concurrent measurements gaps as specified in TS 38.133 [5]. The capability signalling comprises the following parameters:- *concurrentPerUE-OnlyMeasGap-r17* indicates whether the UE supports more than 1 per-UE measurement gap (i.e. gap combination configuration id = 2 as specified in TS38.133 [5]), or*-* *concurrentPerUE-PerFRCombMeasGap-r17* indicates whether the UE supports all concurrent gap combination configurations as specified in TS 38.133 [5] including support of more than 1 per-UE measurement gap configurations. For UE capable of Rel-15 per-FR gap (*independentGapConfig*), this field indicates whether the UE supports more than 1 per-FR gap measurement gap configurations in an FR, or simultaneous 1 per UE measurement gap plus 1 per-FR measurement gap configurations in an FR, or more than 1 per-UE measurement gap configurations.A UE shall support two concurrent measurement gaps for one measurement object if the UE supports both concurrentMeasGap-r17 and nonTerrestrialNetwork-r17. |

**Question 2: whether the following proposal is agreeable:**

**Proposal: if a UE supports both NTN features and concurrent gap features, it also supports the association between one frequency layer and two concurrent measurement gaps with the same gap type.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | N | NTN features should not be mixed with MGE features, as RAN4 will not define the requirements for joint configuration of NTN and MGE in R17.RAN4 has already introduced a feature for NTN multiple gaps (25-3 in RAN4 feature list):

|  |  |  |  |
| --- | --- | --- | --- |
| 25.NR\_NTN\_solutions | 25-3 | Parallel measurements with multiple measurement gaps | Support of 2 measurement gaps |

In our understanding, “There is no need to define additional NTN UE capability for this association” in the RAN4 LS means that, if the UE supports 25-3, it will support 2 gaps associated with one frequency layer. No additional spec impact is needed. |
| MediaTek | N | Agree with Huawei |
| Lenovo | N | RAN4 indicates that “There is no need to define additional NTN UE capability for this association”, which means that feature for NTN multiple gaps (25-3) is sufficient. |
| OPPO | N | Agree with Huawei |
| Ericsson | N | Agree with HW |
| Samsung | N | Agree with HW’s interpretation |
| Nokia | Y | We do not understand the reasoning brought in the preceding comments on why such additional sentence as proposed in 7271 is not OK? RAN4 suggested there is no need to have a ‘separate capability’, but fine to clarify what is supported if the UE supports NTN and MG.  |
| Qualcomm | Y with comment | Ok to have this clarification somewhere. NO in ***concurrentMeasGap-r17***OK in ***nonTerrestrialNetwork-r17***Indicates whether the UE supports NR NTN access. If the UE indicates this capability the UE shall support the following NTN essential features, i.e., timer extension in MAC/RLC/PDCP layers and RACH adaptation to handle long RTT, acquiring NTN specific SIB and more than one TAC per PLMN broadcast in one cell. A UE shall also support concurrent measurement gaps with two different measurement IDs for the same measurement object if the UE supports both *concurrentMeasGap-r17* and *nonTerrestrialNetwork-r17*. |
| Google | Y | We are okay to have clarification text to make it clear. Qualcomm’s suggestion looks fine to us.  |
| ZTE | N | Agree with HW |
| Xiaomi | N | Agree with HW |
| Apple | Comments | WE prefer to make the clarification under the capability of ***parallelMeasurementGap-r17*** (i.e. RAN4 feature 25-3). |
| Turkcell | N | Agree with Huawei |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

Most companies think when a UE supports the 25-3 UE capability in RAN4 feature list, it also supports 2 gaps associated with one frequency layer. And other companies think it’s still good to make it clear what is supported if the UE supports NTN and MG.

The current field description of R4 25-3 is as below in R2-220726:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelMeasurementGap-r17***Indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports 1 measurement gap for NTN RRM measurements. | UE | No | FDD only | FR1 only |

So, it only indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements, but it’s not clear whether this association to one frequency layer can be supported. So, the following proposals are made according to companies’ views.

**Proposal 2: RAN2 to confirm if a UE supports 25-3 in RAN4 feaure list (i.e., *parallelMeasurementGap-r17*), it also supports the association between one frequency layer and two measurement gaps with the same gap type.**

**Proposal 3: if P2 is agreed, RAN2 to further discuss whether further clarification in TS 38.306 is needed, e.g.,**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelMeasurementGap-r17***Indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports 1 measurement gap for NTN RRM measurements. If this parameter is indicated, a UE shall also support that two parallel measurement gaps with the same gap type can be associated to one frequency layer. | UE | No | FDD only | FR1 only |

## 2.2 UE capability for 2 SMTC in parallel

In RAN2 118e meeting, the following agreement was made.

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

The corresponding UE capability indication is not specified yet, and R2-2207243 proposes to define a UE capability for this feature as below.

|  |  |
| --- | --- |
| R2-2207243 | ntn-SMTC-GSO ENUMERATED {supported} OPTIONAL |

But as explained in R2-2207270, there is a discrepancy for GSO capable UE. In the latest RAN4 feature list [2], NTN “UE is mandatory to support 2 and can optionally support 4 if the feature is supported” as below. In RAN4 feature list, there is no differentiation between GSO and NGSO UEs, i.e., for both of them, it is mandatory to support 2 SMTCs in parallel.

|  |  |  |  |
| --- | --- | --- | --- |
| **Index** | **Feature group** | **Components** | **Note** |
| 25-1 | Parallel measurements on multiple SMTC-s for a single frequency carrier | Support of measurements on target cells belonging to 4 SMTC-s on a single frequency carrier | UE is mandatory to support 2 and can optionally support 4 if the feature is supported |

RAN2 needs to discuss how to handle this discrepancy, i.e., to go with RAN4 feature list or go with RAN2 agreements. For example:

**Option 1) RAN2 agreement is updated to align with RAN4 agreement**

For this option 1), the TP for 25-1 of RAN4 feature list would be as below. In this case “2 SMTC-s on a single frequency carrier” is mandatory for both GSO capable UE and NGSO capable UE.

|  |
| --- |
| ***parallelSMTC-r17***Indicates whether the UE supports NTN RRM measurements on target cells belonging to 4 SMTC-s on a single frequency carrier. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports NTN RRM measurements on target cells belonging to 2 SMTC-s on a single frequency carrier. |

**Option 2) RAN2 agreement is kept (and RAN4 is informed to update their specification)**

For this option 2), we need to define a separate UE capability for the support of NTN RRM measurements on target cells belonging to 2 SMTC-s on a single frequency carrier and to 4 SMTC-s on a single frequency carrier. In addition, for the 2 SMTC-s on a single frequency carrier, it is defined that it is mandatory to report for NGSO capable UE (and optional for GSO capable UE). The corresponding TPs for the new UE capabilities for both 4 SMTC-s and 2 SMTC-s is as shown below as an example:

|  |
| --- |
| ***parallelFourSMTC-r17***Indicates whether the UE supports NTN RRM measurements on target cells belonging to 4 SMTC-s on a single frequency carrier.  |

|  |
| --- |
| ***parallelTwoSMTC-r17***Indicates whether the UE supports NTN RRM measurements on target cells belonging to 2 SMTC-s on a single frequency carrier. It is mandatory to report for UE which supports the NTN features in NGSO scenario. |

**Question 3: regarding the UE capability for 2 SMTC in parallel, which option can be agreeable:**

**Option 1: RAN2 agreement is updated to align with RAN4 agreement, i.e., “2 SMTC-s on a single frequency carrier” is mandatory for both GSO capable UE and NGSO capable UE.**

**Option 2: RAN2 agreement is kept and RAN4 is informed to update their specification, i.e., it’s mandatory for NGSO capable UE but optional for GSO capable UE to support “2 SMTC-s on a single frequency carrier”.**

|  |  |  |
| --- | --- | --- |
| **Company** | **which option is agreeable?** | **Additional comments** |
| Huawei, HiSilicon | No strong view | Both options are ok for us.The reason for not mandating the support of multiple SMTCs for GSO is that, GSO satellites are stationery, and will not cause the SMTC offset to change. But if GSO-NGSO mobility is considered, UEs will need to measure NGSO neighbours even if it is served by a GSO. In this sense, it is also reasonable for the UE to support multiple SMTCs. |
| MediaTek | No strong view |  |
| Lenovo | both acceptable | We slightly prefer Option 1 as there is no restriction of GSO-NGSO mobility for now. |
| OPPO | Option 2 |  |
| Ericsson | Option 1 | This is more straightforward and has less impact in the sense that it does not impact RAN4. |
| Nokia | Option 1 | We have a slight preference towards Option 1 as it does not introduce further UE capability differentiation. |
| Qualcomm | Option 1 | Option 1 is simple. |
| China Telecom | Option1 |  |
| Google | Option 1 | Slightly prefer option 1.  |
| ZTE | Option 1 |  |
| Xiaomi | Option 1 |  |
| Apple | Option 1 |  |
| Turkcell | Option 1 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

Most companies agree that option 1 is more straightforward, and we could go with option 1. Since the following UE capability has been captured in the latest mega CR R2-2207276 as below, there is no need to make additional change.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelSMTC-r17***Indicates whether the UE supports NTN RRM measurements on target cells belonging to 4 SMTC-s on a single frequency carrier. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports NTN RRM measurements on target cells belonging to 2 SMTC-s on a single frequency carrier. | UE | No | FDD only | FR1 only |

**Proposal 4: RAN2 agreement is updated to align with RAN4 agreement, i.e., “2 SMTC-s on a single frequency carrier” is mandatory for both GSO capable UE and NGSO capable UE. No additional spec change is needed as it has been captured in the latest mega UE capability CR R2-2207276.**

## 2.3 UE capability for service link propagation delay difference report

To capture the UE capability for service link propagation delay difference report, the corresponding CR or TP are provided by papers as below:

|  |  |
| --- | --- |
| R2-2207268 | MeasAndMobParametersCommon ::= SEQUENCE {……[[serviceLinkPropDelayDiffReporting-r17 ENUMERATED {supported} OPTIONAL]]} |
| R2-2207269 |  |
| R2-2207068 |  |

The difference between them is in the 38.306 wording aspect. Since in RAN2#117 RAN2 agreed that “The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are essential for NGSO capable UEs”, it seems R2-2207269 can be adopted as the baseline for final CR.

**Question 4: whether** **the draft CR R2-2207268 and R2-2207269 can be adopted as baseline for specifying the UE capability for service link propagation delay difference report:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | N | In RAN2#118e, it is agreed to be an optional feature.Agreements:1. RAN2 adopts the following solution, as an optional feature, for assisting the NW in adjusting SMTCs in CONNECTED mode: service link propagation delay difference between the serving and each configured neighbour NTN cell is reported via UE Assistance Information. The reporting occurs when the propagation delay difference between the serving and any configured neighbour NTN cell becomes by offset smaller/larger than the value reported previously. Further Stage-3 details to be discussed based on what provided by OPPO to Q7.1 in R2-2206505.
 |
| Ericsson | Y |  |
| Samsung | See comment | There seems a contradiction in RAN2 agreements: in RAN2#117 RAN2 agreed that “The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are essential for NGSO capable UEs”; in RAN2#118 RAN2 agreed service link propagation delay difference report is an optional feature. We prefer to stick with the former agreement that it’s an essential feature. |
| Nokia | Y |  |
| Qualcomm | Y |  |
| China Telecom | Y |  |
| Google | Y |  |
| ZTE | Y |  |
| Xiaomi | Y |  |
| Apple | Y |  |
| Turkcell | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

Most companies agree to follow the agreements made in RAN2#117 in which “The SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel) are essential for NGSO capable UEs”. So, the draft CR R2-2207268 and R2-2207269 can be adopted as baseline for specifying the UE capability for service link propagation delay difference report.

**Proposal 5: the draft CR R2-2207268 and R2-2207269 can be adopted as baseline for specifying the UE capability for service link propagation delay difference report.**

## 2.4 Corrections on NTN SMTC enhancements

As spotted by R2-2207149 and R2-2207243, “In IE *SSB-MTC4*, *pci-List* and *offset* are specified, and the periodicity and duration parameters have to be derived from *smtc1* configuration”, and current description in clause 5.5.2.10 of 38.331 is not aligned with this design. So, the following changes are proposed:

|  |  |
| --- | --- |
| R2-2207149 | If *smtc4list* is present, for cells indicated in the *pci-List* parameter in each *SSB-MTC4* element of the list in the same *MeasObjectNR*, the UE shall setup an additional SS /PBCH block measurement timing configuration (SMTC) in accordance with the received received *periodicity* and *duration* parameter in the *smtc1* configuration and use the *Offset* (derived from parameter *periodicityAndOffset*) from each *SSB-MTC4* configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the above condition. |
| R2-2207243 | If *smtc4list* is present, for cells indicated in the *pci-List* parameter in each *SSB-MTC4* element of the list in the same *MeasObjectNR*, the UE shall setup an additional SS/PBCH block measurement timing configuration (SMTC) in accordance with the received *offset* parameter in the *SSB-MTC4* configuration and use the *periodicity* (derived from parameter *periodicityAndOffset*) and *duration* parameter from the *smtc1* configuration. The first subframe of each SMTC occasion occurs at an SFN and subframe of the NR SpCell meeting the above condition. |

The intention of these two papers is the same, but with different CR wordings. Considering the *offset-r17* in IE *SSB-MTC4* is provided directly, i.e., NOT “derived from parameter *periodicityAndOffset”*, R2-2207243 seems more accurate. And since the change is for wording correction, the agreed change can be merged to NR NTN RRC Rapporteur correction CR.

**Question 5: whether the spec change on** ***smtc4list*** **related** **description in clause 5.5.2.10 of 38.331 in CR R2-2207243 can be agreed, and merged into** **NR NTN RRC Rapporteur correction CR?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | Y |  |
| Ericsson | Y, but | This is already in the rapporteur CR |
| Samsung | Y |  |
| Nokia | Y |  |
| Qualcomm | Y | Yes it is already in rapporteur CR. We should try to include such editorial correction in Rapporteur CR. |
| China Telecom | Y |  |
| Google | Y |  |
| ZTE | Y, but | Already included in the rapporteur CR, we could merge instead of agreeing two separate CRs. |
| Xiaomi | Y |  |
| Apple | Y |  |
| Turkcell | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

All participant companies agree that the spec change on *smtc4list* related description in clause 5.5.2.10 of 38.331 in CR R2-2207243 can be agreed. Since it is already captured in the rapporteur CR, no additional spec change is needed.

**Proposal 6: the spec change on *smtc4list* related description in clause 5.5.2.10 of 38.331 in CR R2-2207243 is merged to NR NTN RRC Rapporteur CR.**

Regarding further clarification on SMTC related NW/UE behaviour, the following proposals are made in R2-2207149. Since no other papers have the similar proposals or focus on the same issue, these proposals could be discussed one by one.

|  |
| --- |
| **Proposal 1: For UEs in RRC\_CONNECTED, the SMTC configured by the NW can be directly used by the UE, i.e., no need to add the PDD to the configured offset.****Proposal 2: For UEs in RRC\_CONNECTED, to assist the NW adjust SMTC, clarify the intended UE behavior:*** **Option 1: UE reports SFTD in an event-triggered manner, or the NW configures the UE to (re-)report SFTD once in a while. PDD reporting is not needed.**
* **Option 2: UE reports SFTD only once, and report PDD in an event-triggered manner subsequently.**

**Proposal 3: In SIB2/SIB4, the NW can broadcast at most 2 SMTCs per frequency.****Proposal 4: The SMTC in SIB2/4 is based on a common understanding, and RAN2 chooses from the following:*** **Option 1: The broadcast SMTC assumes PDD = X ms. The PDD in Idle/Inactive includes both service link and feeder link. (applicable for intra-NTN)**
* **Option 2: The broadcast SMTC assumes the UE is located at the reference location. (applicable for intra-NTN)**
* **Option 3: UE ignores the offset of SMTC, and determines the SMTC offset by blind detection. (applicable for both intra-NTN and NTN-TN)**

**Proposal 5: The UE reports the calculated SMTC offset upon entering RRC\_CONNCTED.** |

**Question 6: whether P1 in R2-2207149 is agreeable?**

**Proposal 1: For UEs in RRC\_CONNECTED, the SMTC configured by the NW can be directly used by the UE, i.e., no need to add the PDD to the configured offset.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y | We think it’s useful to figure out which interpretation is correct:* **Understanding 1**: The SMTC configured by the NW assumes PDD = 0. When using the SMTC, the actual offset equals to the configured offset plus the PDD.
* **Understanding 2**: The SMTC configured by the NW can be directly used by the UE. If the PDD changes later, the UE reports the new PDD, and NW adjusts accordingly.

The first understanding brings extra complexity at the UE side, as the SMTC involves multiple neighbor cells on the same frequency, and each of them has a different PDD. Understanding 2 is simpler, and can guarantee the NW and UE are aligned. |
| MediaTek | Y |  |
| Lenovo | Y with comments | A pre-condition is that NW has received a reported PDD from the UE. As long as the NW has a reported PDD before the configuration, UE can assume that NW calculation is accurate and directly use the configuration. New PDD can be reported if there is further change. |
| OPPO | Y |  |
| Ericsson | Y | The main argument in favour of this proposal is it (i.e. “understanding 2”) allows the UE and the serving gNB to be aligned with regards to the SMTC timing (i.e. the UE and the serving gNB have a common perception of the timing of the SMTC window), which facilitates accurate configuration of measurement gaps. |
| Samsung | Y | NW configuration should already take into account reported PDD. |
| Nokia | Y | Agree with Lenovo, if the UE has reported PDD, the NW configures SMTC appropriately and the UE does not have to execute further adjustments.  |
| Qualcomm | Y |  |
| China Telecom | Y | Agree with Samsung |
| Google | Y |  |
| ZTE | Y |  |
| Xiaomi | Y |  |
| Apple | Y |  |
| Turkcell | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

All participant companies think P1 in R2-2207149 is agreeable.

**Proposal 7: For UEs in RRC\_CONNECTED, the SMTC configured by the NW can be directly used by the UE, i.e., no need to add the PDD (service link propagation delay difference) to the configured offset.**

**Question 7: regarding P2 in R2-2207149, which option is agreeable?**

**Proposal 2: For UEs in RRC\_CONNECTED, to assist the NW adjust SMTC, clarify the intended UE behavior:**

* **Option 1: UE reports SFTD in an event-triggered manner, or the NW configures the UE to (re-)report SFTD once in a while. PDD reporting is not needed.**
* **Option 2:** **UE reports SFTD only once, and report PDD in an event-triggered manner subsequently.**

|  |  |  |
| --- | --- | --- |
| **Company** | **which option is agreeable?** | **Additional comments** |
| Huawei, HiSilicon | Both are ok | The intention is that, SFTD is essential for the NW to configured SMTC, but is has not been discussed in NTN.Besides, the PDD agreed in the previous meeting refers to the timing difference between serving cell and neighbor cell, which is exactly the role of SFTD. Therefore, RAN2 should at least figure out the relationship between PDD and SFTD.Below are some further clarifications:To configure the SMTC for neighbor cell measurements correctly, the serving cell needs to obtain the following information:1. The SSB transmission pattern of neighbor cell, which is included in the inter-node message *MeasurementTimingConfiguration*. However, the timing of the SSB configuration in *MeasurementTimingConfiguration* is based on the cell for which the message is included. So an additional information is also needed (as in ②).
2. The timing difference between serving cell and neighbor cell, i.e., SFTD.

These information are enough for terrestrial network, but in NTN, there are some other considerations. Firstly, in terrestrial network, the SFTD is per cell. However, the NTN cell has a large coverage, and the SFTD value for each UE is various, so the SFTD measured and reported by one UE cannot be applicable to all UEs in the cell. Moreover, the satellite is moving continuously, causing the timing difference between the serving cell and neighbor cell to change.Among the two options listed, Option 2 has fewer spec impact as PDD reporting is already captured in the spec, but Option 1 is actually simpler because the UE only needs to report SFTD, no need to report PDD. |
| MediaTek | No strong view |  |
| Lenovo | Option 2 | Reporting new PDD upon change is sufficient and has fewer spec impact. |
| OPPO | No | We already have the propagation delay different reporting and the existing PDD reporting (using UAI) procedure already can solve the first-time reporting, i.e. reporting upon NW configuring the PDD reporting (in OtherConfig). No need for over-optimization. |
| Ericsson | Option 2 | The choice between reporting SFTD and PDD is not critical, but reporting PDD is slightly better, since the UE does not have to receive any signal to determine the PDD (it can calculate it based on the ephemeris of the two satellites and its own location), while SFTD requires the UE to receive and detect frames borders for the two cells. |
| Samsung | No, see comment | For NTN, NW should reply on PDD report to adjust SMTC. SFTD has not been discussed in NTN. The intention and function between PDD and SFTD are the same, but they require different UE capabilities. SFTD is an optional feature and may require UE uses separate RF to detect neighbour cell SSB. PDD is essential for NGSO.  |
| Nokia | Option 2, if any | We understand the purpose of PDD was similar to SFTD, but with specific applicability to NTN. Then we think periodic or event-triggered reporting of SFTD is not essential.  |
| Qualcomm | No | We are not aware when did we discuss such SFTD. What we have now in place is PDD report, that should be enough. |
| China Telecom | Option 2 | Reporting either SFTD or PDD can work. We prefer Option2 for less spec impact. |
| Google | No | PDD reporting is sufficient. We prefer NOT to further optimize it using SFTD.  |
| ZTE | No | We do not think such clarification is needed. SFTD and PDD reporting are both supported in spec and it is up to NW to configure what to report for UE and NW can use the information reported from UE (SFTD or PDD) to adjust its configuration and there is no need to further clarify or over specify this. |
| Xiaomi | No | PDD reporting is sufficient. |
| Apple | No | Current PDD reporting is sufficient.  |
| Turkcell | Option 2 |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

The slight majority view is that the current PDD reporting is sufficient, and no further optimization is necessary. Several companies prefer option 2, i.e., UE reports SFTD only once, and report PDD in an event-triggered manner subsequently. Since there is no clear consensus, we could continue discussion on this point in PH2.

**Proposal 8: For UEs in RRC\_CONNECTED, to assist the NW adjust SMTC, which option can be agreeable:**

**- Option 1: PDD reporting is sufficient, and no need to further optimize.**

**- Option 2: UE reports SFTD only once, and report PDD in an event-triggered manner subsequently.**

**Question 8: whether P3 in R2-2207149 is agreeable?**

**Proposal 3: In SIB2/SIB4,** **the NW can broadcast at most 2 SMTCs per frequency.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | Y |  |
| Ericsson | N | There is no reason to restrict the network’s possibility to configure up to 4 SMTCs (of type SSB-MTC4) per carrier frequency, just as the network can configure up to 4 SMTCs (of type SSB-MTC4) in a measurement object (*MeasObjectNR*) for a UE in RRC\_CONNECTED state. A UE that does not support 4 parallel SMTCs (e.g. supports only 2 parallel SMTCs) can employ implementation specific strategies to deal with the situation, e.g. time-sharing between two pairs of parallel SMTCs. |
| Samsung | N | Up to NW configuration. As UE in idle/inactive autonomously adjust SMTC, UE can also just use the offset in smtc in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells. The number of SMTC offsets configured in SIB2/SIB4 does not matter. |
| Nokia | N | Agree with Ericsson. |
| Qualcomm | Y |  |
| Google | N | Agree with Ericsson. |
| ZTE | N | Agree with Ericsson |
| Xiaomi | Y |  |
| Apple | Y |  |
| Turkcell | N | Agree with Ericsson |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

The slight majority view is to support this network restriction, meanwhile other companies point out it’s also possible to configure up to 4 SMTCs per carrier, so there is no need to have this restriction. Or current *smtc* in SIB2/4 is sufficient, “UE can also just use the offset in smtc in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells”. Since there is no clear consensus, we could continue discussion on this point in PH2.

**Proposal 9: for the number of SMTC configured in SIB2/4, which option can be agreeable:**

**- Option 1: the NW can broadcast at most 2 SMTCs per frequency.**

**- Option 2: it’s possible to configure up to 4 SMTCs per frequency.**

**- Option 3: one SMTC is sufficient, as UE can just use the offset in *smtc* in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells.**

**Question 9: regarding P4 in R2-2207149, which option is agreeable?**

**Proposal 4: The SMTC in SIB2/4 is based on a common understanding, and RAN2 chooses from the following:**

* **Option 1: The broadcast SMTC assumes PDD = X ms. The PDD in Idle/Inactive includes both service link and feeder link. (applicable for intra-NTN)**
* **Option 2: The broadcast SMTC assumes the UE is located at the reference location. (applicable for intra-NTN)**
* **Option 3: UE ignores the offset of SMTC, and determines the SMTC offset by blind detection. (applicable for both intra-NTN and NTN-TN)**

|  |  |  |
| --- | --- | --- |
| **Company** | **which option is agreeable?** | **Additional comments** |
| Huawei, HiSilicon | Slightly prefer Option 1 | The issue is that, UEs at different locations have different PDD, while the SMTC in SIB is a cell-specific information. So the NW and UE needs to have an aligned understanding of the SMTC.The baseline should be the TN operation.In TN, there is no PDD, so the broadcast SMTC assumes PDD = 0 ms. Similar assumption should be made in NTN.Otherwise the NW does not know how to configure the SMTC. |
| MediaTek | Option 1 |  |
| Lenovo | Option 1 | For broadcast NW can assume PDD=0 or X (e.g. PDD at ref location). |
| OPPO | Option 1 |  |
| Ericsson | Option 2 | Or Option 3 if offset is not signalled. UE ignoring the offset is not preferred |
| Samsung | Option 1 |  |
| Nokia |  | Agree with Huawei, that is why we have argued for a couple of meetings the UE in IDLE/Inactive should be allowed to perform individual, semi-autonomous shift of received, cell-specific SMTC. |
| Qualcomm | Option 2 | What is reasonable to do is the network provides the SMTC based on reference location. All the UEs then can estimate the relative distance from the reference location to adjust SMTC. |
| China Telecom | Option 2 |  |
| Google | Option 2 |  |
| ZTE | Option 2 |  |
| Xiaomi | Option 1 |  |
| Apple | Option 1 |  |
| Turkcell | Option 2 |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

All participant companies agree to clarify the common understanding of the SMTC in SIB2/4. But there is no consensus on which option can be adopted.

**Proposal 10: the broadcast SMTC in SIB2/4 assumes PDD = X ms. The exact value of X is FFS, e.g., PDD=0 or PDD at reference location.**

**Question 10: whether** **P5 in R2-2207149 is agreeable?**

**Proposal 5: The UE reports the calculated SMTC offset upon entering RRC\_CONNCTED.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y | If not reported, the NW needs to configure the UE to report SFTD and then configure the SMTC to the UE for measurements.Since the UE already has the estimated value, the SFTD reporting procedure can be omitted if the value is reported to the NW. |
| MediaTek | Y |  |
| Lenovo |  | UE can calculate and report PDD as assistance information after entering CONNECTED, and we think it would be sufficient. |
| OPPO | N |  |
| Ericsson | No strong view. | Maybe somewhat useful, but, on the other hand not so much, since the UE subsequently anyway will follow another principle, i.e. with PDD reporting, to facilitate for the serving gNB to keep the SMTCs updated. |
| Samsung | N | Current RRC specifies UE report PDD if it’s configured when entering connected mode, NW can adjust accordingly. |
| Nokia |  | No strong view, for simplicity it can report upon being configured to do so.  |
| Qualcomm | N |  |
| China Telecom | Y |  |
| Google | No strong view |  |
| ZTE | N | UE report PDD upon configuration.  |
| Xiaomi | N |  |
| Apple | N |  |
| Turkcell |  | No strong view. |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

Regarding this P5 in R2-2207149, companies point out this optimization is not really needed, as in current spec UE reports PDD when it’s configured or when the change of PDD is larger than an offset, so current mechanism is sufficient.

**Proposal 11: “The UE reports the calculated SMTC offset upon entering RRC\_CONNCTED” is not pursued.**

##  2.5 Conclusion of phase 1

In this offline discussion, the following proposals are made according to companies’ views:

**• List of proposals for agreement**

**Related to RRC spec:**

**Proposal 1: RAN2 to capture in TS 38.331 RAN4 agreement that one frequency layer and two concurrent measurement gaps with the same gap type can be associated, i.e., *associatedMeasGapSSB2* and *associatedMeasGapCSIRS2* within IE *MeasObjectNR*.**

**Proposal 6: the spec change on *smtc4list* related description in clause 5.5.2.10 of 38.331 in CR R2-2207243 is merged to NR NTN RRC Rapporteur CR.**

**Proposal 7: For UEs in RRC\_CONNECTED, the SMTC configured by the NW can be directly used by the UE, i.e., no need to add the PDD (service link propagation delay difference) to the configured offset.**

**Related to UE capability:**

**Proposal 2: RAN2 to confirm if a UE supports 25-3 in RAN4 feature list (i.e., *parallelMeasurementGap-r17*), it also supports the association between one frequency layer and two measurement gaps with the same gap type.**

**Proposal 4: RAN2 agreement is updated to align with RAN4 agreement, i.e., “2 SMTC-s on a single frequency carrier” is mandatory for both GSO capable UE and NGSO capable UE. No additional spec change is needed as it has been captured in the latest mega UE capability CR R2-2207276.**

**Proposal 5: the draft CR R2-2207268 and R2-2207269 can be adopted as baseline for specifying the UE capability for service link propagation delay difference report.**

**• List of proposals that require online discussions**

**Proposal 3: if P2 is agreed, RAN2 to further discuss whether further clarification in TS 38.306 is needed, e.g.,**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelMeasurementGap-r17***Indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports 1 measurement gap for NTN RRM measurements. If this parameter is indicated, a UE shall also support that two parallel measurement gaps with the same gap type can be associated to one frequency layer. | UE | No | FDD only | FR1 only |

**Proposal 8: For UEs in RRC\_CONNECTED, to assist the NW adjust SMTC, which option can be agreeable:**

**- Option 1: PDD reporting is sufficient, and no need to further optimize.**

**- Option 2: UE reports SFTD only once, and report PDD in an event-triggered manner subsequently.**

**Proposal 9: for the number of SMTC configured in SIB2/4, which option can be agreeable:**

**- Option 1: the NW can broadcast at most 2 SMTCs per frequency.**

**- Option 2: it’s possible to configure up to 4 SMTCs per frequency.**

**- Option 3: one SMTC is sufficient, as UE can just use the offset in *smtc* in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells.**

**Proposal 10: the broadcast SMTC in SIB2/4 assumes PDD = X ms. The exact value of X is FFS, e.g., PDD=0 or PDD at reference location.**

**Proposal 11: “The UE reports the calculated SMTC offset upon entering RRC\_CONNCTED” is not pursued.**

# Discussion in Phase 2

## 3.1 Continuation of PH1 remaining issues

As the outcome of phase 1 discussion, the following agreements were achieved:

Agreements:

1. RAN2 to capture in TS 38.331 RAN4 agreement that one frequency layer and two concurrent measurement gaps with the same gap type can be associated, i.e., associatedMeasGapSSB2 and associatedMeasGapCSIRS2 within IE MeasObjectNR.
2. the spec change on smtc4list related description in clause 5.5.2.10 of 38.331 in CR R2-2207243 is merged to NR NTN RRC Rapporteur CR.
3. For UEs in RRC\_CONNECTED, the SMTC configured by the NW can be directly used by the UE, i.e., no need to add the PDD (service link propagation delay difference) to the configured offset.
4. RAN2 to confirm if a UE supports 25-3 in RAN4 feature list (i.e., parallelMeasurementGap-r17), it also supports the association between one frequency layer and two measurement gaps with the same gap type.
5. RAN2 agreement is updated to align with RAN4 agreement, i.e., “2 SMTC-s on a single frequency carrier” is mandatory for both GSO capable UE and NGSO capable UE. No additional spec change is needed as it has been captured in the latest mega UE capability CR R2-2207276.
6. the draft CR R2-2207268 and R2-2207269 can be adopted as baseline for specifying the UE capability for service link propagation delay difference report.

And we still have some issues for further discussion in phase 2.

Regarding whether some clarification is needed in spec to highlight “if a UE supports 25-3 in RAN4 feature list (i.e., parallelMeasurementGap-r17), it also supports the association between one frequency layer and two measurement gaps with the same gap type”, companies still have different views. The suggested TP is as below, we could try one more round to see whether some agreement can be made.

**Question 1: regarding “if a UE supports 25-3 in RAN4 feature list (i.e., parallelMeasurementGap-r17), it also supports the association between one frequency layer and two measurement gaps with the same gap type”, whether the following clarification in TS 38.306 is needed,**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelMeasurementGap-r17***Indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements. If a UE does not include this field but includes *nonTerrestrialNetwork-r17*, the UE supports 1 measurement gap for NTN RRM measurements. If this parameter is indicated, a UE shall also support that two parallel measurement gaps with the same gap type can be associated to one frequency layer. | UE | No | FDD only | FR1 only |

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | Y | Ok to clarify, even though we think there’s no misunderstanding without it. |
| Samsung | Y |  |
| MediaTek | Y | This is implicitly understood though. |
| Lenovo | Y |  |
| OPPO | Y |  |
| Turkcell | Y |  |
| Xiaomi | Y |  |
| Qualcomm | Y |  |
| CATT | Y |  |
| Google | Y |  |
| Apple | Y |  |
| Nokia | Y | OK to add this. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Regarding P2 in R2-2207149, the original option 1 was excluded in the phase 1, and the slight majority view is no further optimization is needed. In phase 2 we could further discuss which way to go.

**Question 2: For UEs in RRC\_CONNECTED, to assist the NW adjust SMTC, which option can be agreeable:**

**- Option 1: PDD reporting is sufficient, and no need to further optimize.**

**- Option 2: UE reports SFTD only once, and report PDD in an event-triggered manner subsequently.**

|  |  |  |
| --- | --- | --- |
| **Company** | **which option is agreeable?** | **Additional comments** |
| Huawei, HiSilicon | Option 2 | Option 1 does not work. For instance, Cell 1 configures its served UEs (UE 1 and UE 2) to measure the neighbour cell (Cell2).Before configuring SMTC, Cell 1 firstly needs to know the time occasions when the Cell 2 transmits SSB. However, when the SSB information is exchanged to Cell 1, it is based on Cell 2’s own timing. (In 38.3331:***ssb-MeasurementTimingConfiguration***Indicates the SMTC which can be used to search for SSB of the cell for which the message is included. When the message is included in "Served NR Cell Information" (see TS 36.423 [37]), "Served Cell Information NR" (see TS 38.423 [35]), or "Served Cell Information" (see TS 38.473 [36]), the timing is based on the cell for which the message is included. When the message is included in "NR Neighbour Information" (see TS 36.423 [37]), or "Served Cell Information" (see TS 38.423 [35]), the timing is based on the cell indicated in the "Served NR Cell Information" or "Served Cell Information NR" with which the "NR Neighbour Information" or "Neighbour Information NR" is provided. When the message is included in "CU to DU RRC Information", the timing is based on the cell indicated by SpCell ID with which the message is included.)Therefore, Cell 1 needs to know the timing difference between Cell 1 and Cell 2, otherwise Cell 1 does not know when exactly Cell 2 will transmit SSB.However, unlike TN where SFTD is per cell and can even be known by OAM, in NTN the SFTD is different for UEs located at different locations, say UE1 and UE2.PDD is calculated by the UE location and ephemeris, which means the UE will not read the MIB of Cell 2, so UE does not know the SFN of Cell 2, therefore unable to provide the initial timing difference between Cell 1 and Cell 2.That’s why we think SFTD at least needs to be reported once. |
| Samsung | Option 1 | The serving gNB can know the SFN and SSB pattern of a neighbour cell. Further taking into account the reported PDD, NW can configure SMTC for neighbour cell measurement. We have concern that Option 2 implies SFTD has to be mandatory for UE in NTN.[HW2] The SFN in “SFN and SSB pattern of a neighbour cell” is the SFN of neighbour cell, how can the serving cell translate it into its own SFN?The serving cell can only achieve that through SFTD. And note that the SFTD is different for UEs located at different places, so it cannot be known by OAM or NW implementation. |
| MediaTek | Option 1 | Option 1 seems enough in Rel-17. |
| Lenovo | Option 1 | We share Samsung’s view that the SFN and SSB pattern of a neighbour cell could be known by the serving gNB. By UE reported PDD it is sufficient for the serving gNB to derive the timing difference between cells. |
| OPPO | Option 1 | The existing PDD reporting (using UAI) procedure already can solve the first-time reporting, i.e. reporting upon NW configuring the PDD reporting (in OtherConfig). No need for over-optimization and PDD reporting is sufficient. |
| Turkcell | Option 1 | We don’t need further optimization in Rel-17.  |
| Xiaomi | Option 1 | Option 1 is enough. |
| Qualcomm | Option 1 |  |
| CATT | Option 1 |  |
| Google | Option 1 | Option 1 seems to be sufficient in Rel-17. |
| Apple | Option 1 | We share Samsung’s view that NWimplementation and coordination can solve the SFN and SSB pattern issue.  |
| Nokia |  | We somewhat share Huawei’s concerns and think the NW will not always know all the details of the SFN and SSB of the neighbour cells. But maybe this can be adjusted when UE reports PDD, whose purpose is similar to SFTD.  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Regarding P3 in R2-2207149, the slight majority view is to support this network restriction, meanwhile other companies point out it’s also possible to configure up to 4 SMTCs per carrier, so there is no need to have this restriction. Or current *smtc* in SIB2/4 is sufficient, “UE can also just use the offset in smtc in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells”. Since there is no clear consensus, we could continue discussion on this point in PH2.

**Question 3: for the number of SMTC configured in SIB2/4, which option can be agreeable:**

**- Option 1: the NW can broadcast at most 2 SMTCs per frequency.**

**- Option 2: No restriction, as it’s possible to configure up to 4 SMTCs per frequency.**

**- Option 3: one SMTC is sufficient, as UE can just use the offset in *smtc* in SIB2/SIB4 as default value, and derive UE specific SMTC offsets for different neighbour cells.**

|  |  |  |
| --- | --- | --- |
| **Company** | **which option is agreeable?** | **Additional comments** |
| Huawei, HiSilicon | Option 1 | On Option 2, currently “4 SMTCs per frequency” are not in the ASN.1 of SIB2/SIB4, so it should not be “no restriction”.On Option 3, one SMTC is a bit restrictive as the maximum length is 5ms and may not be enough to cover SSBs of all neighbour cells. |
| Samsung | Option 2 | To align with up to 4 SMTCs in measurement configuration. |
| MediaTek | Option 1 | Agree with Huawei |
| Lenovo | Option 1 |  |
| OPPO | Option 1 |  |
| Turkcell | Option 1 |  |
| Xiaomi | Option 1 |  |
| Qualcomm | Option 1 |  |
| CATT | Option 1 |  |
| Google | Option 2 |  |
| Apple | Option 1 |  |
| Nokia | Option 2 | The discussion is slightly weird, it is obvious it should be 4, as that is the maximum supported number - so where, if not in SIB2/SIB4, the remaining SMTCs are to be signalled? |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Regarding P4 in R2-2207149, all participant companies agree to clarify the common understanding of the SMTC in SIB2/4. But there is no consensus on what the default PDD value is.

**Question 4: the broadcast SMTC in SIB2/4 assumes PDD = X ms, what the exact value of X could be? E.g., PDD=0 or PDD at reference location.**

|  |  |  |
| --- | --- | --- |
| **Company** | **preferred X** | **Additional comments** |
| Huawei, HiSilicon | PDD=0 or PDD at reference location | Both works, as long as UE and the NW have the same understanding. |
| Samsung | PDD=0 | PDD at reference location requires reference location to be specified. |
| MediaTek | PDD = 0 |  |
| Lenovo | PDD=0 or PDD at reference location | Both can work. |
| OPPO | PDD=0 |  |
| Turkcell | PDD = 0 |  |
| Xiaomi | PDD=0 |  |
| Qualcomm | PDD at reference location |  |
| CATT | PDD = 0 |  |
| Google | PDD at reference location | Both can work, but slightly prefer the PDD at the reference location. |
| Apple | PDD=0 |  |
| Nokia | PDD=0 | This is a SIB, common signalling, so PDD (which is UE specific) cannot have any solid value assigned, other than 0. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Regarding P5 in R2-2207149, the majority view is that it’s not agreeable, since we didn’t have sufficient time to discuss online, we have to confirm this view in phase 2.

**Question 5: whether the following proposal is agreeable:**

**Proposal: “The UE reports the calculated SMTC offset upon entering RRC\_CONNCTED” is not pursued in Rel-17.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Huawei, HiSilicon | N | If not reported, the NW needs to configure the UE to report SFTD and then configure the SMTC to the UE for measurements.Since the UE already has the estimated value, the SFTD reporting procedure can be omitted if the value is reported to the NW. |
| Samsung | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | Y |  |
| Turkcell | Y |  |
| Xiaomi | Y |  |
| Qualcomm | Y |  |
| CATT | Y |  |
| Google | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.2 Corrections on UE capability

Since the outcome of offine-102 includes the draft CRs on UE capabilities, and according to chairman’s guidance on “endorsed WI specific UE capability CRs will be merged into the mega CRs”, it would be good to incorporate other UE capability CRs in this offline.

In R2-2208537, the following changes are proposed:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| #1. In the description of *nonTerrestrialNetwork*-r17, “i.e.,” is replaced by “e.g.,” to make the listed capabilities following the “i.e.,” non-exaustive. #2. In the description of *parallelMeasurementGap-r17,* it is added that UE supporting this feature shall also indicate the support of nonTerrestrialNetwork-r17.#3. It is clarified that NTN is not supported by RedCap UE. *START OF 1st CHANGE*4.2.2 General parameters<unaffected part omitted>

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***nonTerrestrialNetwork-r17***Indicates whether the UE supports NR NTN access. If the UE indicates this capability the UE shall support the following NTN essential features, e.g., timer extension in MAC/RLC/PDCP layers and RACH adaptation to handle long RTT, acquiring NTN specific SIB and more than one TAC per PLMN broadcast in one cell. | UE | No | No | No |

*END OF 1st CHANGE**START OF 2nd CHANGE*4.2.9 *MeasAndMobParameters*<unaffected part omitted>

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***parallelMeasurementGap-r17***Indicates whether the UE supports 2 parallel measurement gaps for NTN RRM measurements. If the capability is not reported, the UE supports 1 measurement gap for NTN RRM measurements. A UE supporting this feature shall also indicate the support of nonTerrestrialNetwork-r17. | UE | No | FDD only | FR1 only |

*END OF 2nd CHANGE**START OF 3rd CHANGE*4.2.21.1 Definition of RedCap UERedCap UE is the UE with reduced capability:- The maximum bandwidth is 20 MHz for FR1, and is 100 MHz for FR2. UE features and corresponding capabilities related to UE bandwidths wider than 20 MHz in FR1 or wider than 100 MHz in FR2 are not supported by RedCap UEs;- The maximum mandatory supported DRB number is 8;- The mandatory supported PDCP SN length is 12 bits while 18 bits being optional;- The mandatory supported RLC AM SN length is 12 bits while 18 bits being optional;- For FR 1, 1 DL MIMO layer if 1 Rx branch is supported, and 2 DL MIMO layers if 2 Rx branches are supported; for FR2, either 1 or 2 DL MIMO layers can be supported, while 2 Rx branches are always supported. For FR1 and FR2, UE features and corresponding capabilities related to more than 2 UE Rx branches or more than 2 DL MIMO layers, as well as UE features and capabilities related to more than 2 UE Tx branches or more than 2 UL MIMO layers are not supported by RedCap UEs;- CA, MR-DC, DAPS, CPAC, NTN and IAB (i.e., the RedCap UE is not expected to act as IAB node) related UE features and corresponding capabilities are not supported by RedCap UEs. All other feature groups or components of the feature groups as captured in TR 38.822 [24] as well as capabilities specified in this specification remain applicable for RedCap UEs same as non-RedCap UEs, unless indicated otherwise.*END OF 3rd CHANGE* |

**Question 6: which change proposed by R2-2208537 is agreeable:**

|  |  |  |
| --- | --- | --- |
| **Company** | **which change is agreeable, 1 or 2 or 3?** | **Additional comments** |
| Samsung | 1,2,3 |  |
| MediaTek | 1, 3 | Changes in 2 is not necessary |
| Lenovo | 1, 2, 3 |  |
| OPPO | 1, 3 | 2 is not essential since “NTN RRM measurements” is already mentioned. |
| Turkcell | 1, 2, 3 |  |
| Xiaomi | 1, 3 |  |
| Huawei, HiSilicon | 1,2 | Change 3 needs to be discussed in RedCap session because it’s in “4.2.21.1 Definition of RedCap UE” |
| Qualcomm | 1,2 | Other relevant working group should take this decision on 3. |
| CATT | 1,2,3 |  |
| Google | 1, 2, 3 |  |
| Apple | 1,3 |  |
| Nokia | 1, 2, 3 | OK with all. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

In R2-2208679, the proposed change is as below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. Introduce an optional capability without signalling for location-based measurement initiation.

The reason is in current TS 38.304, the application condition is clear that “If *distanceThresh* is broadcasted in SIB19, and if UE supports location-based measurement initiation and has valid UE location information:”Start of change5.6 RRM measurement features

| Definitions for feature |
| --- |
| **High speed inter-frequency IDLE/INACTIVE measurements**It is optional for UE to support high speed inter-frequency measurements in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.133 [5]. |
| **Location-based measurement**It is optional for the UE to support location based RRM measurements of neighbor cells in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.304 [21]. |
| **Relaxed measurement**It is optional for UE to support relaxed RRM measurements of neighbour cells in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.304 [21]. |
| **Rel-17 relaxed measurement for RRC\_IDLE/RRC\_INACTIVE**It is optional for RedCap UE to support Rel-17 relaxed RRM measurements of neighbour cells in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.304 [21]. |
| **Enhanced RRM requirements for measurements in IDLE and INACTIVE modes**It is optional for UE to support enhanced RRM requirements for measurements for NTN bands (FR1 only and FDD only) in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.133 [5]. If UE does not support this feature, legacy TN non-HST measurement requirements are applied for both LEO and GEO. |

End of change |

**Question 7: whether the change proposed by R2-2208679 is agreeable:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Samsung | Y |  |
| MediaTek | Y |  |
| Lenovo | Y |  |
| OPPO | Y |  |
| Turkcell | Y |  |
| Xiaomi | Y |  |
| Huawei, HiSilicon | Y |  |
| Qualcomm | Y |  |
| CATT | Y |  |
| Google | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.3 Corrections/optimizations on SMTC

|  |  |  |
| --- | --- | --- |
| **tdoc** | **technical issue** | **proposal** |
| R2-2207242 | **performance optimization**the UE has to maintain multiple timers in parallel for the validity of serving cell and neighbor cells assistance information according to different epoch times and validity durations | Proposal 1: The same epoch time and the same validity duration can be applied for the serving cell and neighbor cell assistance information. If the fields epochTime and ntn-UlSyncValidityDuration are absent in ntn-Config included in NTN-NeighCellConfig, the UE uses epochTime and ntn-UlSyncValidityDuration from the serving satellite ephemeris. |
| **redundant configuration**The configuration for propagation delay difference report *propDelayDiffReportConfig* is included in *OtherConfig*, with a list of neighbor cells and the corresponding epoch time and ephemeris information. However, in SIB19, the information of a list of neighbor cells is also included. | Proposal 2: For propagation delay difference report configuration, specify ephemerisInfo as optional fields and introduce neighbor cell PCI in propDelayDiffReportConfig included in OtherConfig. |
| **complementary configuration for assistance information reporting**However, in the current RRC specification, validity duration is not included in *propDelayDiffReportConfig*. | Proposal 3: For neighbor cells for propagation delay difference report configuration, validity duration associated with the ephemeris of the neighbor cell needs to be provided in propDelayDiffReportConfig included in OtherConfig. |
| **clarification on UE behaviour**When epoch time and validity duration are not provided in *propDelayDiffReportConfig*, the UE can apply the same epoch time and validity duration as the serving cell provided in SIB19. TP is provided in Appendix as baseline. | Proposal 4: For neighbor cells for propagation delay difference report configuration, if epoch time and validity duration are not provided in propDelayDiffReportConfig, the UE applies the same epoch time and validity duration as the serving cell. |

Regarding the technical issues and the corresponding proposals in R2-2207242, companies are invited to provide your views.

**Question 8: which proposal in R2-2207242 is agreeable:**

|  |  |  |
| --- | --- | --- |
| **Company** | **which proposal is agreeable?** | **Additional comments** |
| Samsung | 2,3,4 | Proponent. P1 is being discussed in another offline discussion. For P2, P3, P4, the intention is that it’s highly possible that NW needs to configure UE to report PDD for one neighbour cell whose satellite information is already included in SIB19, then there is no need to duplicate epoch time and ephemeris for the neighbour cell in otherConfig in dedicated RRC message. |
| Lenovo | 1 | For now we see no essential need to provide epoch time or validity duration for PDD report, considering that the PDD is calculated based one ephemeris and NW is aware of the current ephemeris epoch time or validity duration. |
| OPPO | 1 | For PDD report, we don’t need to further optimize the signalling. In dedicated signalling, we can rely on NW to ensure that neighbour cell’s ephemeris is valid. |
| Turkcell | 1 |  |
| Huawei, HiSilicon | 1 but | Change 1 seems related to the outcome of [Offline-103].Changes to PDD reporting are not backward compatible. |
| Qualcomm | 1,2 with modification | For 2, it is better to introduce the index of satellite list from SIB19. |
| CATT | 1,2 | For proposal 3/4, there is no need to contain validity duration in propDelayDiffReportConfig included in OtherConfig. NW can ensure the ephemeris information is valid.We think these two questions should be discussed together with the offline discussion #103.Additionally, for P2, we think besides the PCI of neighbour cell, the frequency of neighbour cell is also needed to be included. |
| Google | 1 |  |
| Apple | 1 |  |
| Nokia | None | Agree with preceding comments, P1 is in the scope of ][103], while the changes for PDD are not needed and will be ASN.1 NBC. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

The following change is proposed by R2-2207344.

|  |
| --- |
| **Summary of change:**Clarification is added to field description of *deriveSSB-IndexFromCellInter* to clarify the boundary alignment is at the uplink timing synchronization reference point (ULTSRP) and UE requires ephemeris and common TA parameters to derive the index of target cell SSB. |

**Question 9: whether the change proposed by R2-2207344 is agreeable:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y or N** | **Additional comments** |
| Samsung | N | This field indicates whether SFN and frame boundary is aligned between the reference serving cell and neighbour cells. Due to propagation delay difference between serving cell and neighbour cells, the SFN and frame boundary is hardly aligned and thus this field is basically not applicable to NTN. The proposed additional description seems trying to reuse this field for another indication which is not discussed before. |
| Lenovo | N | NW can decide whether to present this field. |
| OPPO | N |  |
| Turkcell | N |  |
| Xiaomi | N | For NTN, if SFN and frame boundary are aligned between the reference serving cell and all neighbour cells in MeasObjectNR, deriveSSB-IndexFromCellInter is provided by NTN network. There is no need to describe all the information which are used for UE to derive the index of SS block, so the change is not needed. |
| Huawei, HiSilicon | N | Same view as Lenovo. |
| Qualcomm | Y | Otherwise, it has to be clarified that this field is ignored, if present in NTN cell. |
| CATT | N | Agree with Samsung, the propagation delay difference can’t be neglected.Maybe only the first change is needed, i.e. the deriveSSB-IndexFromCellInter can only be configured for TN. |
| Apple | N |  |
| Nokia | N |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

The following changes are proposed by R2-2207345.

|  |
| --- |
| **Summary of change:**1. Add indication in the measurement result that which SMTC offset the UE is able to use.
2. Add indication in the measurement result that no SSB the UE is able to detect.

MeasResults ::= SEQUENCE { measId MeasId, measResultServingMOList MeasResultServMOList, measResultNeighCells CHOICE { measResultListNR MeasResultListNR, ..., measResultListEUTRA MeasResultListEUTRA, measResultListUTRA-FDD-r16 MeasResultListUTRA-FDD-r16 } OPTIONAL, ..., [[ measResultServFreqListEUTRA-SCG MeasResultServFreqListEUTRA-SCG OPTIONAL, measResultServFreqListNR-SCG MeasResultServFreqListNR-SCG OPTIONAL, measResultSFTD-EUTRA MeasResultSFTD-EUTRA OPTIONAL, measResultSFTD-NR MeasResultCellSFTD-NR OPTIONAL ]], [[ measResultCellListSFTD-NR MeasResultCellListSFTD-NR OPTIONAL ]], [[ measResultForRSSI-r16 MeasResultForRSSI-r16 OPTIONAL, locationInfo-r16 LocationInfo-r16 OPTIONAL, ul-PDCP-DelayValueResultList-r16 UL-PDCP-DelayValueResultList-r16 OPTIONAL, measResultsSL-r16 MeasResultsSL-r16 OPTIONAL, measResultCLI-r16 MeasResultCLI-r16 OPTIONAL ]], [[ noSSB-r17 ENUMERATED {true} OPTIONAL ]]}MeasResultServMOList ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF MeasResultServMOMeasResultServMO ::= SEQUENCE { servCellId ServCellIndex, measResultServingCell MeasResultNR, measResultBestNeighCell MeasResultNR OPTIONAL, ...}MeasResultListNR ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNRMeasResultNR ::= SEQUENCE { physCellId PhysCellId OPTIONAL, measResult SEQUENCE { cellResults SEQUENCE{ resultsSSB-Cell MeasQuantityResults OPTIONAL, resultsCSI-RS-Cell MeasQuantityResults OPTIONAL }, rsIndexResults SEQUENCE{ resultsSSB-Indexes ResultsPerSSB-IndexList OPTIONAL, resultsCSI-RS-Indexes ResultsPerCSI-RS-IndexList OPTIONAL } OPTIONAL }, ..., [[ cgi-Info CGI-InfoNR OPTIONAL ]], [[ smtcOffset-r17 INTEGER (0..159) OPTIONAL ]]} |

**Question 10: which change proposed by R2-2207345 is agreeable:**

|  |  |  |
| --- | --- | --- |
| **Company** | **which change is agreeable?** | **Additional comments** |
| Samsung | none | propagation delay difference report should be sufficient for NW to adjust SMTC configuration. |
| Lenovo | none | None of the indications is necessary. |
| OPPO | none |  |
| Turkcell | none |  |
| Xiaomi | none |  |
| Huawei, HiSilicon | none |  |
| Qualcomm | Both | It is important feedback for network to make proper adjustment of SMTC configuration. |
| CATT | No need |  |
| Google | none | Not clear what are the extra benefits compared to that brought by the PDD report.  |
| Apple | none |  |
| Nokia | None |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Conclusion

# References

[1] R4-2210611 Reply LS on measurement gap enhancements for NTN

[2] R4-2211189 Rel-17 RAN4 UE feature list for NR CMCC