**3GPP TSG RAN WG2 #121 *draft R2-2301965***

**Athens, Greece, 27 Feb – 03 Mar, 2023**

**Source:** Huawei, HiSilicon

**Title:** [AT121][112][IoT NTN] CP corrections (Huawei)

**Agenda Item:** 7.2.3

**Document for:** Discussion and decision

# Introduction

This document is a report of the following discussion:

* [AT121][112][IoT NTN] CP corrections (Huawei)

Scope: Discuss the CP CRs

Intended outcome: offline summary (and agreeable CRs, if any)

Deadline for companies' feedback: Thursday 2023-03-02 22:00 EET

Deadline for rapporteur's summary (in R2-2301965): Friday 2023-03-03 08:00 EET

# Discussion

## UE capability

R2-2300238 CR to 36.331 on UE capability update Huawei, HiSilicon CR Rel-17 36.331 17.3.0 4904 - F LTE\_NBIOT\_eMTC\_NTN

In RAN2 #120 and the parallel meeting SA2 #154, both RAN2 and SA2 discussed the UE capability update upon TN-NTN mobility. RAN2 agreed the following:

* RAN2 understands that UE in RRC\_IDLE triggers TAU with capability update upon TN-NTN mobility. RAN2 also understands that SA2 is already working on this and will consider updates to our specs, if needed

SA2 approved CRs S2-2211280 and S2-2211430. Based on the approved SA2 CRs, it can be summarized that:

1. For UEs in RRC\_IDLE, it will perform TAU with capability update at every change between a cell that does not broadcast SIB31/SIB31-NB and a cell that broadcasts SIB31/SIB31-NB.
2. For UEs in RRC\_CONNECTED, if the target eNB knows the UE capability has changed, the target node shall trigger the retrieval of the radio capability information from the UE.

The motivation for this CR:

For UEs in RRC\_CONNECTED, there is no RAN2 impact because it is up to target eNB implementation; for UEs in RRC\_IDLE, the corresponding RAN2 impact should be captured in TS 36.331 procedures related to UE capability transfer.

The following change is proposed:

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| If the UE has changed its E-UTRAN radio access capabilities, or if the RRC\_IDLE UE has moved from a cell that does not broadcast S*ystemInformationBlockType31(-NB)* to an E-UTRA cell that broadcasts S*ystemInformationBlockType31(-NB)* and vice versa, the UE shall request higher layers to initiate the necessary NAS procedures (see TS 23.401 [41]) that would result in the update of UE radio access capabilities using a new RRC connection. |

**Q1: Do you agree with the CR R2-2300238?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | There was a comment during previous meeting that the existing “if the UE has changed its E-UTRAN radio access capabilities” already covers the case of TN-NTN mobility, however we hold different opinions on that.  Both TN and NTN belong to E-UTRAN, because RAN2 never considered NTN as a new RAT. Therefore, the “E-UTRAN radio access capabilities” include both TN and NTN capabilities as a whole, which is not changed upon TN-NTN mobility, the only thing that is changed is the network type. Therefore, the new trigger should be added explicitly (similar to the new trigger added in SA2). |
| Qualcomm | No | This is upper layer aspect and CT1 should be clarifying this. Instead, from RAN2 perspective, the correct text should be “if the RRC\_IDLE UE has moved from a TN cell to an NTN cell and vice versa”. |
| OPPO |  | It depends on whether “if the UE has changed its E-UTRAN radio access capabilities” cover the case of TN-NTN mobility.  Even though TN and NTN both belong to E-UTRAN, another understanding is that UE uses E-UTRAN radio access capabilities of TN for TN access, and uses E-UTRAN radio access capabilities of NTN for NTN access. From this perspective, E-UTRAN radio access capabilities has changed during TN-NTN mobility. |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Nokia |  | The proposed text here is already captured in 23.401 for TAU trigger. Need to capture similar text here to be discussed. Simple text as suggested by QC should be OK |
| Apple |  | QC’s suggestion seems OK. |
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## T317

R2-2300237 Remaining issues on T317 Huawei, HiSilicon discussion Rel-17 LTE\_NBIOT\_eMTC\_NTN

1st change:

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| 5.2.2.39 Actions upon reception of *SystemInformationBlockType31*  Upon receiving *SystemInformationBlockType31* (*SystemInformationBlockType31-NB*), the UE in RRC\_CONNECTED shall:  1> start or restart timer T317 with the duration *ul-SyncValidityDuration* from the subframe indicated by *epochTime*.  NOTE: UE should attempt to re-acquire *SystemInformationBlockType31* (*SystemInformationBlockType31-NB*) before the end of the duration indicated by *ul-SyncValidityDuration* and *epochTime* by UE implementation. |

2nd change:

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| T317  NOTE1 | Start or restart from the subframe indicated by *epochTime* upon reception of *SystemInformationBlockType31*, or upon reception of *RRCConnectionReconfiguration* message for the target cell including *mobilityControlInfo*, or upon conditional reconfiguration execution i.e. when applying a stored *RRCConnectionReconfiguration* message for the target cell including *mobilityControlInfo*. | Stop T317, if it is running, for the source cell upon reception of *RRCConnectionReconfiguration* message including *mobilityControlInfo*, or upon conditional reconfiguration execution i.e. when applying a stored *RRCConnectionReconfiguration* message including *mobilityControlInfo*. | Perform the actions as specified in 5.3.18. |

**Q2: Do you agree with the changes in R2-2300237?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | 2nd change is adding the missing descriptions related to HO/CHO, which is also aligned with NR NTN.  Some clarification on the 1st change:  We think for UEs in all RRC states, it is important to maintain a valid NTN-specific SIB. But for UEs in RRC\_IDLE, the maintenance of the validity timer can be left to UE implementation. Note that in the current expiry behaviour of T317 (table above), only “RRC\_CONNECTED” mode is mentioned. So the 1st change is just aligning the descriptions. |
| Qualcomm | No to 1st change  Partially to 2nd change | The first change is not correct. It is different from NR. IoT NTN has timers T317 and T318. The UE should be updating the ephemeris while T318 is running.  For the 2nd change, the change in third column is not needed. |
| OPPO | Yes | OK to align with NR-NTN. |
| MediaTek | No: 1st Change  Yes: 2nd Change | For idle mode measurement, the serving cell ephemeris is not needed. For PUR, SIB31 is only needed to acquire before accessing the cell. |
| Intel | Yes |  |
| Nokia | Not OK for 1st change |  |
| Apple | Yes to 2nd change |  |
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R2-2301050 Correction on handling of T317 timer during HO ZTE Corporation, Sanechips CR Rel-17 36.331 17.3.0 4908 - F LTE\_NBIOT\_eMTC\_NTN-Core

**Problem statement:**

There are two issues in the handover procedure for IoT NTN:

1. In current spec, after UE triggers a handover, there is no process for T317 in source cell. Therefore, T317 in source cell may expire and such expiration of T317 may trigger UE to reacquire SIB31 during handover. This is undesirable behavior. So T317 in source cell needs to be stopped after UE triggers a handover. This process is also aligned with the process on T430 during handover in NR NTN.

2. In current spec, during handover procedure, there is no process for dedicated SIB31 of target cell, that would cause the T317 cannot be started when handover to the target cell.

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| 5.3.5.4 Reception of an *RRCConnectionReconfiguration* including the *mobilityControlInfo* by the UE (handover)  If the *RRCConnectionReconfiguration* message includes the *mobilityControlInfo* and theUE is able to comply with the configuration included in this message, the UE shall:  1> if the *RRCConnectionReconfiguration* is applied due to a conditional reconfiguration execution upon cell selection performed while timer T311 was running, as defined in 5.3.7.3:  2> remove all the entries within *VarConditionalReconfiguration*, if any;  [Unrelated text Omitted]  1> stop timer T312, if running;  1> start timer T304 with the timer value set to *t304,* as included in the *mobilityControlInfo*;  1> stop timer T370, if running;  1> stop timer T317, if running;  1> if the *carrierFreq* is included:  2> consider the target PCell to be one on the frequency indicated by the *carrierFreq* with a physical cell identity indicated by the *targetPhysCellId*;  1> else:  2> consider the target PCell to be one on the frequency of the source PCell with a physical cell identity indicated by the *targetPhysCellId*;  [Unrelated text Omitted]  1> if the received *RRCConnectionReconfiguration* includes the *sCellGroupToAddModList*:  2> perform SCell group addition or modification as specified in 5.3.10.3e;  1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType1Dedicated*:  2> perfom the actions upon reception of the *SystemInformationBlockType1* message as specified in 5.2.2.7;  1> if the received *RRCConnectionReconfiguration* includes the *systemInformationBlockType31Dedicated*:  2> perform the actions upon reception of the *SystemInformationBlockType31* message as specified in 5.2.2.39;  1> perform the measurement related actions as specified in 5.5.6.1;  [Unrelated text Omitted] |

**Q3: Do you agree with the CR R2-2301050?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| OPPO | Yes | Similar to NR NTN. |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes |  |
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## Epoch time

R2-2300927 Analysis on Reference time estimation issues of implicit Epoch time Nokia, Nokia Shanghai Bell discussion Rel-17

*Observation 1: RAN2 has agreed the Epoch time in SIB31 can be signaled implicitly.*

*Observation 2: RAN1 has concluded the UE is allowed to accumulate SIBs across SI windows.*

*Observation 3: The UE cannot determine the Epoch time based on implicit signaling if the UE accumulates SIB31 across SI windows.*

*Observation 4: The UE can determine the Epoch time based on explicit signaling if the UE accumulates SIB31 across SI windows because the explicit signaling is based on SFN.*

*Proposal 1: RAN2 to address the issue of SIB31 accumulation by making a note for network implementation or by defining a boundary for the SIB31 accumulation.*

**Q4: Considering the issue described above, do you agree with adding a note for NW implementation or defining a boundary for the SIB31 accumulation?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | RAN1 has already clarified this should not have additional UE impact. RAN2 specification already supports SIB accumulation. |
| OPPO | No | For SIB31 accumulation, it is up to NW implementation that NW should always use explicit signalling to configure the Epoch time.  But we think we may not need to add a note to specify this. |
| MediaTek | No | The proposal violates the following RAN1 agreement that no specification impact is expected. Besides, RAN1 is discussing this issue, we can left to RAN1.  RAN1#111 agreement：SIB accumulation across SI windows for IoT NTN may be optionally supported by UE implementation without specification impact and without UE capability discussion. |
| Intel | No |  |
| Nokia | Yes (Proponent) | To avoid the possibility of misunderstanding due to the optional UE behaviour, if NW intends to maintain the same contents across SI-windows for coverage purpose, it should at least set the explicit EPOCH time to avoid the mismatch. So NOTE for implementation in preferred to avoid the wrong setting. |
| Apple | No | Accumulation issue should be addressed by RAN1.  Simple solution is we rely on explicit signaling. |
| Huawei, HiSilicon | No | This was proposed in RAN1, and leaving it to implementation is already a compromise, RAN1 agreed that no spec impact is introduced. |
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R2-2301390 Discussion on epoch time Mediatek Inc. discussion

*Observation 1: UEs decode SI message in different positions of SI window can have different interpretations of serving cell epoch time.*

*Proposal 1: Change the serving cell epoch time description to:” For serving cell, the startSFN indicates the current SFN or the next upcoming SFN after the last frame of SI window where the message indicating the epochTime is received.”*

*Observation 2: UEs decode SI message in different positions of SI window can have different interpretations of neighbor cell epoch time.*

*Proposal 2: Change the neighbor cell epoch time description to: “For neighbor cell if EpochTime is indicated explicitly by a SFN and subframe number, the UE considers this frame to be the frame nearest to the last frame of SI window where the message indicating the Epoch time is received.”*

*Observation 3: UE can have different interpretations of neighbor cell epoch time in HO/CHO message due to different reception time.*

*Proposal 3: It is up to NW implementation to fix different interpretations of neighbor cell epoch time in HO/CHO message due to different reception time.*

**Q5: Do you agree with the changes in P1 and P2?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | We are not clear issue with current explicit indication. It is +/- 5.12s. |
| OPPO | No | In our understanding, it could be up to NW implementation to avoid UE having different interpretations of serving cell epoch time. |
| MediaTek | Yes |  |
| Intel | No |  |
| Nokia | No |  |
| Apple | No | The issue happens only when the epochTime (SFN) is in the middle of SI window. It can be resolved as long as the epochTime refers to a SFN after the SI window. |
| Huawei, HiSilicon | Yes but | We think the issue is valid, and common for both IoT NTN and NR NTN.  The proposed change is not the only solution, e.g. it can also be “the first frame of SI window” rather than “last frame”. Anyway the issue should be brought to RAN1, as the initial description/agreement comes from RAN1. |
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## Pre-compensation gap configuration

R2-2300928 RRC parameter alignment with RAN1 specification for pre-compensation gap configuration Nokia, Nokia Shanghai Bell discussion Rel-17

*Observation 1: The RRC configuration parameter uplinkSegmentedPrecompensationGap does not include option of dropping samples that Network may want to configure. As per RAN1 specification, UE behaviour on the gap is explicitly controlled by this parameter.*

*Proposal 1: RAN2 to down-select between introduction of new code point uplinkSegmentedPrecompensationGap in the parameter or additional note to clarify the UE behaviour in the field description*

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| **Text Proposal for Option 1:**          uplinkSegmentedPrecompensationGap-r17  ENUMERATED {sym1,sl1,sf1,samples }        OPTIONAL  -- Need OR  ***uplinkSegmentedPrecompensationGap***  Indicates the gap value between segments for PUSCH and PUCCH for TA pre-compensation. Value sym1 corresponds to 1 symbol, value sl1 corresponds to 1 slot, value sf1 corresponds to 1 subframe. Value samples corresponds to legacy behaviour of dropping samples during gap.  **Text Proposal for Option 2:**          uplinkSegmentedPrecompensationGap-r17  ENUMERATED {sym1,sl1,sf1 }        OPTIONAL  -- Need OR  ***uplinkSegmentedPrecompensationGap***  Indicates the gap value between segments for PUSCH and PUCCH for TA pre-compensation. Value sym1 corresponds to 1 symbol, value sl1 corresponds to 1 slot, value sf1 corresponds to 1 subframe. If this parameter is not configured UE will continue with legacy behaviour of dropping the samples during the gap. |

**Q6: Do you agree with the above Option1/2 as in R2-2300928?**

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| **Company** | **Yes(Option 1/2) /No** | **Comments** |
| Qualcomm | No | If UE reports capability it supports gap of 1 symbol, that means it is expected that the network provides the configuration according to UE capability, otherwise there will be problem that UE may not work and will be kicked out of NTN. |
| OPPO | Option 2 | Option 1 is NBC.  For Option 2, usually we should avoid to use “legacy” to describe a behaviour in spec. Maybe further check on the wording with RAN1 is needed. |
| MediaTek | Option 2 | An additional note to clarify the UE behaviour in the field description according to RAN1 agreement, actually there is already description in 36.306  RAN1 Agreement: When capability is NOT signalled: UE follows legacy behaviour at slot boundaries due to TA adjustment  36.306 :" If a UE does not include this field but includes ntn-Connectivity-EPC-r17, in case of overlapped transmission between successive uplink segments, UE shall follow the procedure specified in TS 36.213 [22]." |
| Intel | No | Agree with QC |
| Nokia |  | As indicated in the paper RAN1 spec refers to RRC parameter on how to handle the gaps for pre-compensation. The action is expected to be based on one of the values. The parameter now misses the value for legacy behaviour. So clarification to say that if not signalled UE should follow legacy behaviour is needed. This is for the UE which supports new options for gaps including legacy behaviour. |
| Apple | See comments | If the parameter is absent, naturally UE will follow legacy behavior.  Nothing needs to be added. |
| Huawei, HiSilicon | No | I don’t think “dropping samples” is a legacy behaviour, rather, it is exactly what gaps are for. During the gap, samples can be dropped. |
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## SIB32 acquisition in idle mode

R2-2301492 UE supporting discontinuous coverage acquiring SIB32 in idle mode Samsung Electronics Benelux BV CR Rel-17 36.331 17.3.0 4918 - F LTE\_NBIOT\_eMTC\_NTN

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| 1. 5.2.2.3 System information required by the UE   The UE shall:  1> ensure having a valid version, as defined below, of (at least) the following system information, also referred to as the 'required' system information:  2> if in RRC\_IDLE:  3> if the UE is a NB-IoT UE:  4> the *MasterInformationBlock-NB/ MasterInformationBlock-TDD-NB* and *SystemInformationBlockType1-NB* as well as *SystemInformationBlockType2-NB* through *SystemInformationBlockType5-NB, SystemInformationBlockType22-NB, SystemInformationBlockType32* (only for NB-IoT UE supporting discontinuous coverage);  3> else:  4> the *MasterInformationBlock* and *SystemInformationBlockType1* (or *SystemInformationBlockType1-BR* depending on whether the UE is a BL UE or the UE in CE) as well as *SystemInformationBlockType2* through *SystemInformationBlockType8* and *SystemInformationBlockType24* (depending on support of the concerned RATs), *SystemInformationBlockType17* (depending on support of RAN-assisted WLAN interworking when the UE is connected to EPC), *SystemInformationBlockType25* (depending on support of E-UTRA/5GC), *SystemInformationBlockType29* (only for BL UE or the UE in CE depending on support of resource reservation), *SystemInformationBlockType21*, *SystemInformationBlockType26* (if UE is capable of V2X sidelink communication and is configured by upper layers to receive or transmit V2X sidelink communication),and *SystemInformationBlockType28* (if UE is capable of NR sidelink communication and is configured by upper layers to receive or transmit NR sidelink communication), *SystemInformationBlockType30* (if UE is configured by upper layers to report disaster roaming related information), *SystemInformationBlockType32* (only for BL UE or the UE in CE UE supporting discontinuous coverage);  [Unrelated text Omitted] |

**Q7: Do you agree with the changes in R2-2301492?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | SIB32 is not required system information. Discontinuous coverage is optional feature and hence SIB32. |
| OPPO | No | Even for SIB31, it is still not specified as the system information required by idle mode UE, so it should be up to implementation to keep the valid SIB32. |
| MediaTek | Neutral |  |
| Intel | No |  |
| Nokia | No |  |
| Apple | No strong view |  |
| Huawei, HiSilicon | No strong view |  |
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## 2.6 Misc

R2-2300259 Miscellaneous corrections to TS 36.331 for IoT NTN MediaTek Inc. CR Rel-17 36.331 17.3.0 4900 - A LTE\_NBIOT\_eMTC\_NTN-Core

**Problem statement**:

1. RAN2-116bis has made an agreement: “UE acquires the NTN specific SIB before accessing the cell.”, but NTN SIB acquisition is not specified before EDT and PUR transmission.

2. As the 36.102 has been released for IoT NTN specific parameters, some references for IoT NTN need to be updated accordingly.

**Q8: Do you agree with the changes in R2-2300259?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes |  |
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R2-2301389 Miscellaneous correction for IoT-NTN Nokia, Nokia Shanghai Bell CR Rel-17 36.331 17.3.0 4913 - F LTE\_NBIOT\_eMTC\_NTN

This CR includes clarification of SIB32 field descriptions and correction of NPRACH preamble transmission durations.

**Q9: Do you agree with the changes in R2-2301389?**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | We do not think change in validity duration is needed. It should be clear from procedural text. Also not clear what is issue with current text in nprach-TxDurationFmt01, as n1 is actually 1\*4 preambles. |
| OPPO | No for change 1 | The behaviour that UE start using ephemeris information before epochTime for ul-SyncValidityDuration has already be supported implicitly in the current description. |
| MediaTek | No | The name of satelliteId explained itself, the description is not needed. |
| Intel | No |  |
| Nokia |  | Change 1: It is clarification of actual validity or the time for which UE maintain the sync without new SIB inline with the update to spec text.  Change 2 : Satellite ID – If this is parameter related to satellite descriprion is needed. |
| Apple | No strong view |  |
| Huawei, HiSilicon | No | The corrections to NPRACH preamble Tx duration are reverting something we agreed in the previous meeting. Other changes are not essential. |
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## 2.7 References

R2-2301049 Clarification on reference to TS 36.108 for IoT NTN ZTE Corporation, Sanechips CR Rel-17 36.331 17.3.0 4907 - F LTE\_NBIOT\_eMTC\_NTN-Core

This CR adds some references to RAN4 spec (36.108). Some similar changes are proposed in R2-2300259 discussed in “2.6 Misc”, but the referenced spec in R2-2300259 is 36.102.

The moderator’s understanding is that 36.102 is for UE RF, 36.108 is for BS RF.

**Q10: Do you agree with the changes in R2-2301049?**

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| **Company** | **Yes/No** | **Comments** |
| OPPO | Yes with comment | We share the same views that 36102 is the requirement for NTN UE, and 36108 is the requirement for NTN eNB.  Therefore, we should add the reference to 36102, since it is similar to 36101 that is already referred for TN in the related clauses. |
| MediaTek | No | It should be 36.102 for UE rather than 36.108 for network (eNB) |
| Intel | No | Agree with MTK |
| Nokia | No |  |
| Apple | No |  |
| Huawei, HiSilicon | No | Agree with OPPO and MTK. |
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R2-2301391 Reference Correction for IoT NTN in 36.306 Mediatek Inc. CR Rel-17 36.306 17.3.0 1867 - A LTE\_NBIOT\_eMTC\_NTN-Core

This CR adds some references to 36.102.

**Q11: Do you agree with the changes in R2-2301391?**

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| **Company** | **Yes/No** | **Comments** |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Nokia | Yes |  |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes |  |
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# 3 Conclusion

To be completed