3GPP TSG-RAN WG2 Meeting #116bis Electronic R2-220xxxx

Elbonia, January 2022

**Agenda item:**

**Source: Ericsson**

**Title: NTN RRC open issues towards RAN2#117**

**WID/SID: NR\_NTN\_solutions\_Core**

**Document for: Discussion and Decision**

# Introduction

**[Post116bis-e][107][NTN] RRC running CR and list of open issues (Ericsson)**

Scope: Update the RRC running CR and define the list of RRC open issues

Intended outcome: Endorsed RRC running CR and list of open issue

Deadline (for companies' feedback): Friday 2022-01-28 0800 UTC

Deadline (for updated running CR and list of open issues): Friday 2022-01-28 1600 UTC

Status: To be started at the beginning of week2

* **Each open issue** should be associated with **suggested treatment/handling**.
  1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
  2. Company tdocs invited.
  3. CR rapporteur handled issue (CR rapporteur will propose resolution as input to next meeting).
  4. Other, e.g. immature area, reference to dependency, unclear status etc.

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
| ASUSTeK | Erica Huang | Erica\_Huang@asus.com |
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# 3 Connected mode

## 3.1 Location reporting

**Open issue 1:** The report content of location reporting is open and not implemented in RRC

1. Specify that measurement reports can be configured to be piggybacked with location report when location based event triggers it

**Open issue 2:** The definition of the reference location is FFS in in IE ReportConfigNR:

ReferenceLocation-r17 ::= TypeFFS

**Open issue 3:** distanceThresFromReference in the location event is not defined

distanceThresFromReference1-r17 TypeFFS,

distanceThresFromReference2-r17 TypeFFS, OPTIONAL, --Need R

**Open issue 4:** Encoding for hysteresis for location is open and pending on reference location definition.

– *Hysteresis*

The IE *Hysteresis* is a parameter used within the entry and leave condition of an event triggered reporting condition. The actual value is field value \* 0.5 dB. The *HysteresisLocation* is a parameter used within entry condition of a location based event triggered reporting condition. The actual value of field *HysteresisLocation* is FFS.

***Hysteresis* information element**

-- ASN1START

-- TAG-HYSTERESIS-START

Hysteresis ::= INTEGER (0..30)

HysteresisLocation-r17 ::= FFS

-- TAG-HYSTERESIS-STOP

-- ASN1STOP

**Open issue 5:** Leaving condition for location reporting is not discussed

For all of the above either:

1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
2. Company tdocs invited.

## 3.2 CHO

Location based CHO shares some open issues with location reporting. *No specific issues?*

**Open issue 6:** duration is not defined for time based CHO trigger

condEventT1-r17 SEQUENCE {

t1-Threshold-r17 INTEGER (0..549755813887),

duration-r17 INTEGRE (ValueFFS)

}

**Open issue 7:** Procedural text may need to be updated in 5.3.5.13.4 Conditional reconfiguration evaluation

For all of the above either:

1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
2. Company tdocs invited.

# 4 User plane

## 4.1 event triggered TA reporting

## 4.2 Timer values

These timers are missing values and other details:

**Open issue 8:** RAN2 agreed to extend configuredGrantTimer but how and other details FFS

**Open issue 9:** Value for DiscardTimerExt2

DiscardTimerExt2-r17 ::= ENUMERATED {FFS}

**Open issue 10:** Value for sr-ProhibitTimerExt

SchedulingRequestToAddModExt-v17xy ::= SEQUENCE {

sr-ProhibitTimerExt-r17 ENUMERATED {valueFFS} OPTIONAL -- Need S

}

For all of the above either:

1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
2. Company tdocs invited.

# 5 Broadcast

## 5.1 SIB1

**Open issue 11:** What NTN information is present in SIB1 if any?

## 5.2 SIBxx

**Open issue 12:** What information is present in SIBxx? SIBxx always same schedulingtime or?

## 5.3 Neighbour cell related SI

**Open issue 13:** What information is present in in neighborcell related SI? Which SIB contains this?

## 5.4 SI notifications

What all has been agreed and what still needs to be agreed

1. Update of ephemeris and common TA information does not affect the value tag and does not trigger SI modification procedure.
2. The ntnUlSyncValidityDuration applies to the whole SIBX. UE acquires the updated SIBX when the timer expires. FFS whether to also include it in the LS to RAN1. FFS if this applies only to Connected mode or to idle mode UE as well

Open issue 14: Review of how to capture rules for SI notification for different NTN SI and general SI related procedural text

For all of the above either:

1. **Company input into Pre117-e-offline (i.e. no company tdocs)**
2. Company tdocs invited.

# 6 Other

Please indicate more open issues

**Q: Please list more open issues**

|  |  |
| --- | --- |
| Company | Issues |
| ASUSTeK | In RAN2#115 offline 102, a working assumption is reached:  Working assumption:   1. Event triggered-based UE location reporting are configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED   The working assumption needs to be confirmed. In addition, the event to trigger the UE location reporting was also discussed in offline 102 (R2-2108898):  Proposal 5 The event triggered-based condition to trigger UE location report is  Oprion#1: Change in UE location by a distance threshold since the last reported UE location.  Option#2: UE moves by a distance threshold from a cell reference location.  Option#3: others (please elaborate in comments).  Option#4: wait until working assumption is confirmed.  And the conclusion was to wait until working assumption is confirmed. So the issue should also be needed to discussed. |
| ASUSTeK | There is an agreement in RAN2#112 that:  Agreements via email - offline 105:   1. The Location-based measurement event, in combination with the existing measurement event in NR, should be supported in NTN for both moving cell and fixed cell scenarios. FFS on how to configure the location based measurement event.   The measurement report triggering with combination of location and radio condition should be captured in running CR. |
| Huawei, HiSilicon | 1: Is the network allowed to configure location-based CHO and time-based CHO simultaneously?  2: Whether the UE should delete the corresponding time-based CHO configuration after T2  3: Details of SMTC configuration. Option 1: based on the existing SMTC1, and add 3 offsets and corresponding PCI lists; Option 2: add a new list of SMTCs  4: Names of IEs related to HARQ state and LCP restriction. E.g. allowedHARQ-DRX-LCP and uplinkHARQ-DRX-LCP-Mode. |
| Ericsson | This is the ASN.1 definition of the offset in *SSB-MTC4-r17* (which is the SMTC added for NTN):  offset-r17                         INTEGER (0..1279)  *SSB-MTC4-r17* does not include any periodicity or duration parameter and one can assume that these values are taken from *SSB-MTC* (i.e. *smtc1*). But the maximum periodicity of the *SSB-MTC* is 160 subframes and the associated offset can thus vary between 0 and 159 subframes. Changing the range of the *offset-r17* parameter to 0..159.  In addition, the procedural text in section 5.5.2 has to be updated to accommodate the *smtc4List*. |
| OPPO | 1. Configuration of TA reporting event and the value range of the offset threshold for TA reporting event |
| Qualcomm | 1. RRC execution delays may be impacted by K\_MAC, this needs to be discussed. For example RRC processing time of 15ms may not be sufficient for network to confirm UE has received/executed RRC successfully. 2. HARQ type for SRBs or RRC message may need to be clarified to guarantee the reliability. |
| Lenovo | 1. Since legacy CHO condition can support the combination of A3&A5, A3&A3 and A5&A5. RAN2 need to further discuss to support the following combination.  For time-based condition, the combination#3, #4#5 should be supported besides #1 and #2.   * Combined condition#1: time&condEventA3 * Combined condition#2: time&condEventA5 * Combined condition#3: time&condEventA3&condEventA3 * Combined condition#4: time&condEventA3&condEventA5 * Combined condition#5: time&condEventA5&condEventA5   For location-based condition, the combination#3, #4#5 should be supported besides #1 and #2.   * Combined condition#1: location&condEventA3 * Combined condition#2: location&condEventA5 * Combined condition#3: location&condEventA3&condEventA3 * Combined condition#4: location&condEventA3&condEventA5 * Combined condition#5: location&condEventA5&condEventA5  1. For time-based condition for CHO,  * Does UE start to evaluate the RRM condition at the beginning of the time range? * Does UE stop evaluating the RRM condition at the end of the time range since CHO cannot be triggered after time window.  1. For location-based condition for CHO  * If CHO can be used for failure recovery similar to legacy, UE can continue to keep CHO configuration at the end of time duration. If CHO cannot be used for failure recovery or other purpose, CHO configuration can be released directly at the end of time duration. * Does UE start to evaluate the measurement-based condition after the location condition is met. Our understanding is that UE starts to evaluate location-based condition but does not evaluate measurement-based condition immediately upon receiving the joint condition of location-based condition and measurement-based condition. |
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# 7 Conclusion

Annex agreements

List of RAN2 agreements that are foreseen as most relevant to this running CR.

RAN2#111

Agreements via email - from offline 107

1. From RAN2 perspective, an offset is applied to the start of ra-ResponseWindow in NTN for both LEO and GEO scenarios.
2. An offset to the start of the ra-ContentionResolutionTimer is introduced for both LEO and GEO scenarios.
3. Modification of drx-LongCycleStartOffset, drx-StartOffset, drx-ShortCycle, drx-ShortCycleTimer, drx-onDurationTimer, drx-SlotOffset and drx-InactivityTimer is not needed in Rel-17 NTN.
4. From a RAN2 perspective, for DL, HARQ feedback can be enabled/disabled in Rel-17 NTN, but HARQ processes remain configured. The criteria and decision to enable/disable HARQ feedback is under network control and is signalled to the UE via RRC in a semi-static manner. FFS for UL

Agreements via email - from offline 107:

1. At least the following methods to enhance UL scheduling are further studied in NTN: configured grant and BSR over 2-step RACH. **(other solutions to enhance UL scheduling are not precluded)**

Agreements:

1. The satellite ephemeris should be provided to UE, at least for Satellite/HAPS ephemeris based cell selection and reselection (FFS what the term satellite/HAPS ephemeris actually means).

Agreements via email - from offline 106:

1. The network type (i.e. TN or NTN) should be known to UE. FFS whether to achieve this in an implicit or explicit way.

RAN2#112

Agreements:

1. RAN2 working assumption (for RRC idle. FFS for Inactive/Connected): Rel-17 UE with pre-compensation capability obtains UE specific UE-gNB RTT based on its GNSS in LEO/GEO. FFS how this is calculated and what/if anything needs to be broadcasted for the different pre-compensation methods (e.g. common TA) to help the UE to obtain the full UE-gNB RTT.
2. If the UE-gNB RTT is pre-compensated, preamble ambiguity is not an issue in Rel-17 NTN (i.e. no enhancements are necessary). FFS how and by whom the possibly multiple components of UE-gNB RTT are pre-compensated
3. From RAN2 perspective, for UE with UE-specific pre-compensation as a baseline it is up to gNB implementation to ensure sufficient time on UE side for the Msg3 transmission.
4. For UE with pre-compensation capability (at least for the HARQ-feedback enabled case. FFS for HARQ-feedback disabled, if supported), drx-HARQ-RTT-TimerDL is offset by UE-specific RTT (UE-gNB delay) in LEO/GEO. FFS if offset is applied to: 1) the start of the timers or 2) the timer value range (i.e. existing values within value range increased by offset)

Agreement from Friday CB session:

1. From RAN2 perspective, for dynamic grant, one possibility for "enabling"/"disabling" HARQ uplink retransmission at UE transmitter is without introducing an additional mechanism (i.e. gNB can send grant with NDI not toggled/toggled without waiting for decoding result of previous PUSCH transmission). FFS on the handling of RTT timers. Other solutions for enabling/disabling HARQ UL reTX are not precluded

Agreements via email - offline 103:

1. If the start of the ra-ResponseWindow and msgB-ResponseWindow is accurately compensated by UE-gNB RTT, ra-ResponseWindow and msgB-ResponseWindow are not extended in LEO/GEO.
2. At least the following are FFS in Rel-17 NTN:

* Report UE-calculated TA in e.g. msg3/msg5/msgA
* Enhancements to RSRP-based selection mechanism of 2-step vs. 4-step RACH
* LCP impact caused by disabling HARQ UL retransmission

Agreements online:

1. RAN2 decision on starting ra-ContentionResolutionTimer, ra-ResponseWindow and msgB-ResponseWindow is postponed until further progress in RAN1 regarding UE pre-compensation method and TA estimation accuracy.

Agreements:

1. RLC t-Reassembly timer needs to be extended in NR-NTN.
2. There is no need to extend t-PollRetransmit Timer in NR-NTN.
3. There is no need to extend t-statusProhibit Timer in NR-NTN.
4. There is no need to extend RLC SN length in NR-NTN
5. There is no need to extend PDCP SN length in NR-NTN

Agreements:

1. Existing cell reselection principles are considered as baseline and that information about when a cell is going to stop serving the area and information about new upcoming cell can be further considered. In which form and how this is exactly implemented in the cell reselection principles is FFS.

Agreements

1. Reconfiguration with sync is the baseline for connected mode mobility in NTN (the use of legacy RLF and re-establishment mechanism are not excluded)
2. The CHO can be used in NTN for both moving cell and fixed cell scenarios, and the CHO procedure and execution condition defined in Rel-16 is the baseline for NTN CHO.

3. NTN specific CHO execution condition can be further discussed.

4. The existing measurement framework (e.g. measurement configuration, execution and reporting) is the baseline, and all the existing measurement criteria and event can be used in NTN. Support for new measurement is not excluded.

5. Legacy SSB periods (as in TN) shall be supported in NTN

Agreements via email - offline 105:

1. Time or timer based CHO triggering event, in combination with the existing R16 CHO measurement based event, should be introduced for both moving cell and fixed cell scenario. FFS on how to configure the time or timer based CHO triggering event. Also FFS how to consider the feeder/service link switch timing.
2. DAPS HO for NTN is de-prioritized in this release.
3. Location based CHO triggering event, in combination with the existing R16 CHO measurement based event, should be introduced for both moving cell and fixed cell scenario. FFS on how to configure the location based CHO triggering event. FFS if location based CHO triggering event only (not in combination with other events) can also be considered.
4. The Location-based measurement event, in combination with the existing measurement event in NR, should be supported in NTN for both moving cell and fixed cell scenarios. FFS on how to configure the location based measurement event.

Agreements via email - offline 106:

1. RAN2 understanding that UE shall not be forced to detect the SSB burst outside the corresponding configured SMTC window in NTN, just like the principle in TN.

Agreements:

1. SMTC and gap configuration in NTN are configured based on the timing of PCell
2. RAN2 can first identify the scenarios and discuss how serious the impact is before addressing any enhancement for SMTC configuration in NTN.
3. RAN2 can’t assume that the network will always have UE accurate location info for SMTC window configuration in NTN
4. UE along with the network in NTN should also have the same understanding of the timing, including the timing for measurement gap, to avoid any un-synchronized scheduling between UE and the network, just like the way we have in TN

RAN2#113

Agreements:

1. Both Type 1 and Type 2 configured grant are feasible in NTN.
2. From RAN2’s perspective, no need to modify parameter periodicity of IE ConfiguredGrantConfig to support NTN.
3. No need to modify maxNrofConfiguredGrantConfig-r16 and maxNrofConfiguredGrantConfigMAC-r16 to support NTN.
4. UE in NTN can have both 2-step RACH and configured grant configurations at the same time.

Agreements via email - from offline [103]:

1. For HARQ processes with DL HARQ feedback disabled, drx-HARQ-RTT-TimerDL is not started.
2. FFS: method(s) to support blind retransmission for HARQ processes with HARQ feedback disabled.

Agreements online:

1. From RAN2 perspective, for HARQ processes where gNB can sends UL grant without waiting for decoding result of previous PUSCH transmission, no new network scheduling restrictions are introduced to schedule subsequent grants (i.e. up to network implementation. (Can come back if we don't find an agreement on p8)
2. For HARQ processes with DL HARQ feedback enabled, drx-HARQ-RTT-TimerDL length is increased by offset (i.e. existing values within value range increased by offset). RAN2 working assumption: offset is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it)

Agreements:

1. The NTN ephemeris is divided into serving cell’s ephemeris and neighbour’s ephemeris. FFS how would they differ regarding e.g. the required accuracy or signalling impact.
2. Consider pre-configuration in uSIM, NAS, SIB and RRC signalling for providing the NTN ephemeris. Further discussion depends on the agreed ephemeris contents.

Agreements:

1. RAN2 thinks that a UE needs to know whether the network is a TN or NTN no later than SIB1 reception
2. The information on when a cell is going to stop serving the area and/or the timing information (e.g. timer or absolute time) about new upcoming cell is supported at least in Earth-fixed NTN scenario. FFS if both types of information are needed. FFS if this is known from system information and/or the ephemeris.

Agreements:

1. Support A4 event for NTN CHO. FFS whether other triggers need to be combined with this.

RAN2#113bis

Agreements:

1. Legacy mechanism for RA type selection based on RSRP threshold is the baseline for NTN. Optimizations can still be suggested, showing the gain (in any case, any method needs to be combined with RSRP based approach)
2. Reuse legacy RA type switching mechanism
3. Extend the timer length of sr-ProhibitTimer (FFS on the details)

Agreements:

1. RAN2 wait for RAN1’s feedback on UE obtaining UE-gNB RTT.

Agreements - via email (from offline [103]):

1. RAN2 wait for RAN1’s progress and postpone the discussion on how to broadcast parameters, if any, for TA pre-compensation.
2. RAN2 send an LS to RAN1, focusing on below aspects:

- Ask RAN1 to prioritize the TA pre-compensation work on whether and/or what parameters to broadcast for TA pre-compensation, and when broadcasted, how often the broadcasted parameters are expected to change over time;

- RAN2 has agreed to use UE-gNB RTT as the offset to start some UP timers (e.g. drx-HARQ-RTT-TimerDL). Ask RAN1 to provide inputs on (i) how UE acquires UE-gNB RTT and (ii) what additional information needs to be broadcasted other than that for TA pre-compensation, if any.

Agreements:

1. At least for uplink scheduling adaptations, the UE may report information about the UE specific TA pre-compensation. The exact information and frequency of reports depend on RAN1 outcome. FFS on when/how to report.
2. ~~The UE reports the UE specific TA pre-compensation during RACH procedure using MAC CE (FFS if this needs to be configured). Actual content is FFS and also depends on further RAN1 input.~~
3. It is FFS whether the UE reports the UE specific TA pre-compensation at the RACH procedure (MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input. Configurability is FFS

Agreements:

1. It is NW scheduling strategy to avoid NTN UE in HARQ stalling state. From RAN2 perspective, the NW can continuously schedule the UE using one or a combination of scheduling strategies, such as without HARQ retransmissions, or with blind retransmissions, or with HARQ retransmissions based on DL HARQ feedback (or UL decoding result).
2. RAN2 confirms that in NTN if the UE is in DRX Active Time for any reason, the UE should monitor the PDCCH regardless of whether drx-HARQ-RTT-TimerUL or drx-HARQ-RTT-TimerDL is running or not. No specification change is needed.
3. RAN2 confirms that in NTN using the value= “zero” for drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL is possible. No specification change is needed.

4. In NTN, The drx-HARQ-RTT-TimerUL is configured per UE DRX group and the behaviour can be configured per HARQ process. FFS the different behaviours and how to indicate the behaviour to the UE and the number of behaviours (e.g., two or more behaviours).

5. LCP restrictions should be further considered for an UL HARQ process in NTN. FFS if no further LCP restrictions are needed, or if (R16) existing LCP restrictions can be re-used or if new LCP restriction shall be defined for this purpose.

Agreements:

1. The UE utilizes the t-Reassembly timer value that does not depend on the time-varying UE-gNB delay.
2. The value range of t-Reassembly shall be extended. The following set of values are possibly added for t-Reassembly timer: {ms210, ms220, ms340, ms350, ms550, ms1100, ms1650, ms2200}. Any other values are FFS.
3. The network can configure the values of PDCP discardTimer and PDCP t-Reordering timer greater than the RLC t-Reassembly timer.
4. Extend the range of the PDCP discardTimer and the PDCP t-reordering timer. One option is to enlarge the set of allowed values for the PDCP discardTimer and the PDCP t-reordering timer. The exact values FFS

Agreements:

1. When the network stops broadcasting a TAC, the UE needs to know it (FFS on further details)

Agreements:

1. For Rel-17 NTN, Rel-17 NR operation is enhanced (e.g. the SMTC configuration and UE measurement gap onfiguration) aiming to address the issues associated with the different/larger propagation delays, and the satellites (considering e.g. their deployment, mobility, height, minimum elevation and prioritizing typical NTN scenarios).
2. Rel-17 NTN will not rely only on network implementation to address the issue explained in agreement 1.
3. Enhancements of the SMTC configuration is supported for Rel-17 NTN.
4. Optional new UE assistance is defined in Rel-17 NTN for network to properly (re)configure the SMTC and/or measurement gap

Agreements - via email (from offline [106])

1. For Rel-17 NTN, one or more SMTC configuration(s) associated to one frequency can be configured. FFS solution details.

- The SMTC configuration can be associated with a set of cells (e.g., per satellite or any other suitable set per gNB determination).

- The multiple SMTC configurations are enabled by introducing different new offsets in addition to the legacy SMTC configuration. FFS how the offsets will be managed/signalled.

FFS the following open questions:

(a) can the UE be configured with multiple SMTCs per carrier and use them all in parallel?

(b) How the NW knows which SMTC (incl. offsets/periodicity, etc.) is relevant for a particular UE?

(c) Is there any validity: in time or for certain location only, foreseen in such multiple SMTC configuration?

(d) What is the potential impact on the signalling, assuming this delay is a dynamic value?

(e) What about the feeder link delay? Is it considered anywhere?

1. The configuration of one or multiple offsets is left up to the network implementation.
2. It is up to network to update the SMTC configuration of the UE to accommodate the different propagation delays.

Agreements online:

1. Measurement gaps enhancements should be supported. FFS on the details

Agreements:

1. Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell.

2. Working assumption: the timing information for CHO execution triggering in NTN is defined in the form of a timer/timers. This can be revised and a solution based on UTC/system frame number can be considered if problems are found (e.g. if the timer lacks accuracy due to RTT in NTN).

3. The location in location-based CHO execution triggering for NTN describes the distance between the UE and the reference location of the cell (serving cell or the target cell). FFS what the reference location of the cell is (e.g cell center or other) and how this is provided to the UE

RAN2#114

Agreement:

1. If enabled by the network, the UE reports information about UE specific TA pre-compensation at the random access procedure (MSGA/MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input (we can revise this whole agreement if RAN1 come to a different conclusion in terms of what needs to be conveyed to the NW)

Agreements:

1. The following options are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer set to zero and/or 3) Timer disabled (i.e. not started). FFS if this is based on explicit configuration or not. We can also come back to see whether both 2 and 3 are needed.

Agreements via email (from offline 103):

1. RAN2 working assumption: Offset for drx-HARQ-RTT-TimerUL is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it).
2. drx-RetransmissionTimerDL timer length is not extended in NTN

Agreements online:

1. The drx-HARQ-RTT-TimerUL behaviour applied for each HARQ process is up to the network (e.g. to support NW scheduling strategy to avoid HARQ stalling).
2. RAN2 Working Assumption: No new CG-specific LCP restriction is introduced for NTN. If a new LCP restriction is agreed for dynamic grant, the proposal does not preclude future discussion on whether it may also apply to configured grant
3. Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated per HARQ process via DCI (as in legacy).
4. At least the following options for LCP in NTN are further studied: 1) allowedPHY-PriorityIndex is re-used; and 2) A new LCP restriction is introduced to map LCH to one or more HARQ process(es). FFS if HARQ processes can be classified as having retransmission “enabled” or “disabled” in this case.

Agreements:

1. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is needed to assist cell reselection in NTN for earth fixed scenario.
2. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is used to decide when to perform measurement on neighbor cells.
3. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area for earth fixed scenario is broadcast to UE via system information.

Agreements via email (from offline 104):

1. Support CHO location trigger as the distance between UE and a reference location which may be configured as the serving cell reference location or the candidate target cell reference location. FFS if combination can be allowed.
2. The reference location for the event description is defined as cell center.

Agreements online:

1. For CHO, joint configuration of location and RSRP as well as time and RSRP triggers are supported.
2. For idle mode reselection, based on configuration NTN UE can prioritise TN over NTN. Configuration details FFS

Agreements via email (from offline 104 - second round):

1. CHO time trigger event is defined as time duration [t1, t2] associated for each CHO candidate cell. The UE shall execute CHO to that candidate cell during the time duration, if all other configured CHO execution conditions will apply and there is only one triggered candidate cell.
2. Same CHO trigger conditions and RRM events can be used within NTN and NTN-TN mobility provided these are supported by the UE. NTN-TN means both “from NTN to TN (hand-in)” and “from NTN to TN (hand-in) and from TN to NTN (hand-out)". FFS for enhancements.

Agreements via email - from offline 108:

1. RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN corresponds to a fixed geographical area with a size comparable with a cell for TN including connected mode and initial access.

Agreements via email (from offline 108 - second round)

1. RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN can correspond to a fixed geographical area comparable with a TN cell with a radius of ~2km or more.

RAN2#115

Agreements:

1. UE specific TA reporting during RACH procedure is enabled/disabled by SI (FFS for RACH in connected mode)

Agreements:

1. In the MAC specification section 5.1.5, delay the start of ra-ContentionResolutionTimer by the UE-gNB RTT (i.e. sum of UE's TA and K\_mac)

Agreements via email - from offline 106:

1. The content of UE specific TA pre-compensation reported in RA procedure using MAC CE is UE specific TA (this can be revisited after receiving RAN1 response).
2. Reporting on the information about UE specific TA in connected mode is supported, FFS via RRC signalling or MAC CE
3. Event-triggers for reporting on the information about UE specific TA in connected mode is supported. FFS on the details. Confirmation by RAN1 is also needed
4. If configured, the UE shall report information of the UE specific TA pre-compensation to the target cell during the random access. FFS if a new indication in RRC reconfiguration with sync is needed or not (besides the SIB indication carried in HO command on whether TA report is enabled/disabled in the target cell).
5. Information about UE specific TA pre-compensation is not reported in RA procedures triggered due to “Request for Other SI”

Agreements via email - from offline 106 second round:

1. The event-triggers for reporting information about UE specific TA are based on TA values (confirmation from RAN1 is needed)
2. A TA offset threshold can be used for event-triggered reporting, at least the offset threshold can be between current information about UE specific TA and the last successfully reported information about UE specific TA
3. The event-triggers for reporting information about UE specific TA based on time threshold is not supported in NTN.
4. No new indication in RRC reconfiguration with sync is needed to configure the UE to report information about UE specific TA in handover procedure (besides the SIB indication carried in HO command on whether TA report is enabled/disabled in the target cell).

Agreements via email - from offline 106 third round:

1. Under the work assumption "the UE location information cannot be reported in connected mode", the content of UE specific TA reported in connected mode is UE specific TA pre-compensation(for the details of the TA value, confirmation from RAN1 is needed).
2. If the reported content of information about UE specific TA is UE location information in connected mode, RRC signalling is used to report.

Agreements online:

1. Under the work assumption "the UE location information can be reported in connected mode", for TA reporting purposes in connected mode, the network can configure the UE to send either the UE specific TA pre-compensation (for the details of the TA value, confirmation from RAN1 is needed) or the UE location information

Working Assumption:

1. If the reported content of information about UE specific TA is TA pre-compensation value in connected mode, MAC CE is used to report

Agreements:

1. Confirm the RAN2 working assumption that offset to drx-HARQ-RTT-TimerUL length is equal to UE-gNB RTT (i.e. sum on UE's TA and K\_mac).
2. Confirm the RAN2 working assumption that for HARQ processes with DL HARQ feedback enabled, the drx-HARQ-RTT-TimerDL length is increased by an offset equal to UE-gNB RTT (i.e. sum on UE's TA and K\_mac).
3. No new LCP restrictions are introduced for exisiting UL MAC CEs (if new MAC CEs will be introduced we can revisit this)
4. For dynamic grants, each LCH can optionally be semi statically configured (by RRC) to be mapped to one or more HARQ processes (FFS if it's possible to map to more than one HARQ process/ process type. FFS on mapping method). If there is no RRC configuration for this, this mapping has no effect (legacy behaviour applies).
5. Agreements via email - from offline 101:
6. 1a. For at least dynamic grants, the network may optionally configure an UL HARQ retransmission state per HARQ process. Two UL HARQ retransmission states are defined in NTN: HARQ state A and HARQ state B (FFS whether "HARQ state A" and "HARQ state B" should be renamed)
7. 1b. HARQ state A/B are defined as follows:
8. - HARQ state A: length of drx-HARQ-RTT-TimerUL is extended by UE-gNB RTT (i.e. UE PDCCH monitoring is optimized to support UL retransmission grant based on UL decoding result).
9. - HARQ state B: drx-HARQ-RTT-TimerUL is not started.
10. 2. Configuration of UL HARQ retransmission state is semi-static, signalled via RRC, and the decision and criteria to configure UL HARQ retransmission state is under network control.
11. 3. For dynamic grants, each LCH can be optionally mapped to an UL HARQ retransmission state via semi-static RRC configuration. If there is no configuration, the mapping has no effect (legacy behaviour applies).
12. 4. If HARQ process has not been configured with an UL HARQ retransmission state, new LCH mapping rule has no effect (i.e. UE applies legacy behaviour).
13. 5. The following behaviours are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer disabled (i.e. not started)
14. 6. UE determines drx-HARQ-RTT-TimerUL behaviour per HARQ process based on configured UL HARQ retransmission state.
15. 7. For HARQ process(es) not configured with an UL HARQ retransmission state, drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL behave as per legacy.

Agreements via email - from offline 101 second round:

1. An UL HARQ retransmission state is configured per HARQ process to support new LCH mapping restriction and proper configuration of drx-HARQ-RTT-TimerUL behaviour.

2. The network may consider delay and reliability characteristics of ongoing services when choosing to configure an UL HARQ retransmission state.

3. Alternative naming for HARQ state A/B can be further considered during stage 3, however UE behaviour in each state should be defined in specification.

4. RAN2 understanding is that UE behaviour in HARQ state A (i.e. extending the drx-HARQ-RTT-TimerUL by UE-gNB RTT) best supports reception of UL retransmission grant based on UL decoding result. (No RAN2 specification impact)

5. RAN2 understanding is that UE behaviour in HARQ state B (i.e. not starting drx-HARQ-RTT-TimerUL) best supports no UL retransmission and/or blind UL retransmission. (No RAN2 specification impact)

Agreements online:

1. For HARQ state B, FFS to run drx-RetransmissionTimerUL for blind UL retransmission
2. UE configured with an UL HARQ retransmission state (i.e. A or B) will always act as indicated in a grant/assignment provided during a valid occasion (i.e. subject to legacy restrictions in e.g. MAC and RAN1 specifications). (No RAN2 specification impact)

Agreements:

1. Introduce a new t-ReassemblyExt-r17 IE, which is optional present for NTN network scenario.
2. Introduce a new discardTimerExt-r17 IE with a new value ms2000 and several spare bits for future extension.
3. RAN2 consider not to extend PDCP t-Reordering timer or use several spare bits in legacy IE to add several greater values up to 4400ms.

Agreements:

1. If SA3 replies with concern on reporting UE location with any granularity during initial access, RAN2 will revisit agreement/solution for reporting UE location during initial access.
2. UE coarse location information refers to coarse GNSS coordinates (FFS on the details, e.g. X MSB bits out of 24 bits of longitude/latitude or GNSS coordinates with ~2km accuracy). FFS if any enhancements to validate the UE’s coarse location information is needed. FFS whether this is only used in initial access or also in connected

Agreements via email - via offline 102:

1. If SA3 has no concern reporting coarse location during initial access, the coarse location information is reported in Msg5, i.e., via RRCSetupComplete/RRCResumeComplete message.
2. For coarse UE location reporting during initial access, the location granularity is not indicated to UE via SIB
3. Enhancements to validate the UE ’s coarse location information is not needed from RAN2 perspective. Whether this is needed by the network is up to other WGs.
4. After AS security is established, gNB can obtain a GNSS-based location information from the UE using existing signalling method, i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig. It is up to SA3 to decide whether User Consent is required before NW acquires location information from the UE in NTN. RAN2 discuss whether to send LS to SA3
5. Aperiodic location reporting (e.g., via DCI) is not supported.

Working assumption:

1. Event triggered-based UE location reporting are configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED

Agreements via email - from offline 102 second round:

1. Send new LS to SA3 for the need of NTN specific user consent for obtaining UE location by gNB."

Agreements online:

1. If accepted by SA3, if the gNB has user consent to obtain UE location in NTN, reporting of finer location information/full GNSS coordinates in RRC\_CONNECTED can be supported after AS security is enabled
2. Periodic location reporting can also be configured by gNB to obtain UE location update of mobile UEs in RRC\_CONNECTED. RAN2 discuss whether it is part of existing periodic measurement report configuration or a new configuration for periodic reporting of UE location.

Agreements via email - from offline 107:

1. RAN2 confirms AS indicates to NAS layer all received TACs per PLMN.
2. RAN2 responds to CT1 and SA2 with the confirmation that AS indicates to NAS layer all received TACs per PLMN. In addition it is stated that TACs in NTN are fixed to geographical location on Earth and UE’s location information can be used for TAI selection. Final decision on which criteria to apply (e.g. UE location information or other) is anyway up to CT1 and SA2 judgement

Agreements via email - from offline 108:

1. Broadcast of cell stop time in SIB is only applicable to quasi earth fixed cell (not to moving cell). No further work in this release to address any moving cell specific details on using the cell stop time to assist measurements or cell reselection
2. For quasi-earth fixed cell, the reference location of the cell (serving cell or the neighbor cells) is broadcast in system information

Agreements via email - from offline 108 third round:

1. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area.
2. For quasi-earth fixed cell, the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.
3. For quasi-earth fixed cell, specify that UE should start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation.

Working Assumption:

1. Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information, which means location acquisition will not be triggered at UE side only for location assisted cell reselection. FFS on the details.

Working Assumptions:

1. Combination of serving and target cell reference location is supported for location report trigger event and for CHO location trigger
2. Specify that measurement reports can be configured to be piggybacked with location report when location based event triggers it

Agreements via email - from offline 103:

1. The following event is supported: condEvent L4: Distance between UE and the PCell’s reference location becomes larger than absolute threshold1 AND the distance between UE and the Conditional reconfiguration candidate becomes shorter than absolute threshold2.

FFS other options

1. Specify hysteresis and time to trigger for the location event for RRM and CHO
2. Timing information from RRCReconfiguration message in RRC running CR is removed
3. UE is allowed to perform HO only during T1 to T2
4. Agree to limit to A or B and continue discussion between options A and B

Option A: UTC time + duration/timer, e.g. 00:00:01 + 40s

Option B: Two UTC time to indicate the start (T1) and end time (T2) of the candidate cell, e.g. 00:00:01 + 00:00:41

Agreements via email - from offline 103 second round:

1. RAN2 adopts Option 1: UTC time + duration/timer, e.g. 00:00:01 + 40s for representing T1 and T2 for CHO time event.

2. RAN2 adopts options C: location and RRM and D: time and RRM to be configuration options for CHO

3. RAN2 down priorities further enhacnements for connected mode for Rel-17 for TN-NTN mobility

4. RAN2 continue discussing the exact solution for TN priorization over NTN for idle mode

Agreements via email - from offline 112:

1. The specific maximum number of SMTC configuration in one measurement object with the same ssbFrequency can be 4. And a LS will be sent to RAN4 to confirm the conclusion.
2. In NTN, NW-based solution is supported, i.e. the final SMTC/measurement gap configuration is generated and provided by NW in NTN to a given UE (based on the propagation delay difference between at least one target cell and the serving cell of a given UE). FFS whether UE-based solution is supported or not.
3. In NTN, it is necessary of the UE to report assistant information to the NW (which can be configured by NW or upon NW’s request) to assist NW calculating the offset for SMTC/GAP configurations. FFS the detailed information.

Agreements:

1. The UE can be configured with multiple SMTCs per carrier. FFS if the UE can use only a partial set or all of them in parallel, and in case FFS whether based on network configuration or UE implementation

RAN2#116

Agreements:

1. Enhancements for RA type selection in NTN will not be pursued in Rel-17. FFS for BSR

Agreements via email - from offline 106:

1. Do not mandate Msg3/MsgA or Msg5 to include TA report MAC CE, and whether it can be included depends on the TB size of Msg3/MsgA or Msg5. No spec change is needed for this
2. Reserved LCID is used for the TA report MAC CE.
3. Postpone the discussion on the size of the TA report MAC CE until RAN2 concludes on the content of TA report.
4. RAN2 do not pursue any enhancements to allow inclusion of TA information without extending Msg3 size.
5. Logical channel priority of the TA report MAC CE should be lower than that of “C-RNTI MAC CE or data from UL-CCCH” and higher than that of “data from any Logical Channel, except data from UL-CCCH”.

Agreements via email - from offline 106 (second round):

1. Do not introduce additional enhancement on BSR over 2-step RACH in Rel-17.

Agreements online:

1. RAN2 further discuss the exact priority of the TA report MAC CE between “C-RNTI MAC CE or data from UL-CCCH” and “MAC CE for BSR, with exception of BSR included for padding
2. If the reported content of information about UE specific TA is TA pre-compensation value in connected mode, MAC CE is used to report
3. In case UE location information can be reported to network, dedicated signaling is used to configure UE to report the UE location and/or the UE specific TA information for the purpose of TA reporting in connected mode. FFS if both mechanisms are needed in parallel

Agreements:

1. The extended values for sr-ProhibitTimer in NTN can include values less than UE-gNB RTT (as in legacy). FFS on the actual values and how this is extended
2. RRC parameter “allowedHARQ-DRX-LCP” is included in LogicalChannelConfig (FFS on the actual name of the parameter)
3. configuredGrantTimer can be extended in NTN. FFS details of when extension is applicable and method of extention.
4. The ConfiguredGrantConfiguration shall allow for up to 32 in nrofHARQ-Processes, and up to 31 in harq-ProcID-Offset and harq-ProcID-Offset2.
5. The SPS-Config shall allow up to 32 for nrofHARQ-Processes, and up to 31 in harq-ProcID-Offset.
6. HARQ feedback shall always be sent for SPS deactivation (i.e. regardless of HARQ feedback enabled/disabled).

Agreements via email - from offline 101:

1. For HARQ process(es) not configured with DL HARQ feedback enabled/disabled, drx-HARQ-RTT-TimerDL behaves as per legacy.
2. Introduce a new sr-ProhibitTimerExt-r17 IE. Values FFS
3. If uplinkHARQ-DRX-LCP-Mode-r17 is configured, a HARQ process may be mapped to either ‘HARQ mode A’ or ‘HARQ mode B’.
4. uplinkHARQ-DRX-Mode shall be included in PUSCH-ServingCellConfig.

* Agreements via email - from offline 101 (second round):
* 1. If uplinkHARQ-DRX-LCP-Mode-r17 is configured, the following LCH to HARQ process mapping rules are supported:
* 1) LCH is mapped only to a HARQ process configured with HARQ mode A;
* 2) LCH is mapped only to a HARQ process configured with HARQ mode B;
* 3) If an LCH is not configured with a mapping rule, it may be mapped to any HARQ process (HARQ mode A or B).
* 2. downlinkHARQ-FeedbackDisabled shall be included in PDSCH-ServingCellConfig.

RAN2 assumption:

1. There will be max 12 TACs per NR NTN cell, including same or different PLMNs.

Agreements:

1. Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell. FFS on how UE performs location acquisition.

Agreements via email - from offline 102:

1. When UE uses location based cell reselection enhancements, it's up to UE implementation to guarantee that a valid location information is available
2. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the distance between UE and serving cell reference location.

Agreements via email - from offline 102 - second round:

1. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area, regardless of (the distance between UE and serving cell reference location) or (if legacy Srxlev/Squal condition is met, i.e., serving cell’s Srxlev/Squal is better than a threshold).

Agreements online:

1. Distance based cell reselection criteria for quasi-earth fixed cell is supported
2. For quasi-earth fixed cell, the cell stop time of neighbour cell(s) is NOT broadcast

Agreements:

1. We don't introduce new mechanisms (e.g. based on MAC CE) to activate/deactivate SMTCs for NTN neighbour measurements. Which SMTCs the UE will consider is only based on RRC configuration (UE based solutions are not excluded by this)

Agreements via email - from offline 103:

1. RAN2 will decide which option to choose for NTN assistance information for SMTC/MG once SA3 feedback on user consent is received.
2. If propagation delay based UE assistance information for NTN SMTC is agreed, it is defined in the form of propagation delay difference.
3. RAN2 assumes FL delay is known to and compensated by the network. RAN2 also assumes the UE needs to have neighbour cell ephemeris for the propagation delay estimation.
4. In NW-based SMTC solution the UE is not allowed to apply shifts to configured SMTCs.
5. Measurement gap related aspects for Rel-17 NTN will be addressed in Rel-17 NTN WI. Coordination and avoiding overlap with other WIs and WGs is recommended.
6. RAN2 will reuse at least the SMTC agreements made for UE assistance information reporting also in the area of measurement gaps for NTN

Agreements via email - from offline 103 (second round):

1. UE assistance information for NTN SMTC adjustments is event-triggered. Details of the triggering event are FFS (pending the decision on supported assistance information type).
2. RAN2 aims to minimize the number of configurable measurement gaps required for monitoring configured SMTCs in NTN. At least gap length and UE capabilities impact the number of required measurement gaps.
3. UE-based solution for SMTC adjustments in NTN is supported for IDLE/INACTIVE UEs. FFS how does the UE perform the necessary shifts in SMTC.

Agreements:

1. In NW-based solution, the network can configure up to 2 SMTCs in parallel and the UE uses all of them, i.e. there is no switching between or activation/deactivation of configured SMTCs. FFS whether this (UE support for 2 SMTCs) requires a UE capability. A UE can optionally indicate support for 4 SMTCs (in this case the NW can configure up to 4 SMTCs in parallel)

RAN2#116bis

Agreements:

1. Do not support allocating dedicated RA preamble for the RACH procedure triggered by TA reporting.
2. UE does not start or restart the timeAlignmentTimer after the UE reports its TA.
3. NTN specific parameters, e.g. ephemeris, K\_mac, common TA, cell-specific Koffset, network enable/disable TA report, etc., are provided in the new NTN-specific SIB.
4. The MAC CE for differential UE-specific K\_offset has a fixed size of a single octet.
5. Use an eLCID for the MAC CE for differential UE-specific K\_offset

Agreements via email - from offline 101 - second round:

1. priority of the TA report MAC CE is lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized.
2. UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event if the UE has not reported TA before.
3. Other than event-triggered TA reporting, no more triggers are introduced for TA reporting in connected mode.

Agreements via email - from offline 107:

1. uplinkHARQ-DRX-Mode-r17 controls the DRX behaviour of HARQ processes in the same way for configured grants as for dynamic grants.

Agreements online:

1. It is up to network implementation to ensure proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ processes used by an SPS configuration (no Stage 3 specification impact). FFS if a note in Stage 2 is needed
2. It is up to network implementation to ensure proper configuration of HARQ mode for HARQ processes used by a CG configuration (no Stage 3 specification impact). FFS if a note in Stage 2 is needed
3. For HARQ process(es) configured with HARQ Mode B, blind retransmission relies on UE being in DRX Active Time via other means (i.e. drx-RetransmissionTimerUL is not started).
4. For HARQ process(es) configured with disabled HARQ feedback, blind retransmission relies on UE being in DRX Active Time via other means (i.e. drx-RetransmissionTimerDL is not started).

RAN2 understanding:

1. RAN2 understanding is that: in general, all HARQ processes used by an SPS configuration are configured with the same HARQ feedback enabled/disabled state. No specification impact.
2. RAN2 understanding is that: in general, all HARQ processes used by a CG configuration are configured with the same HARQ state (e.g. A or B). No specification impact

Agreements:

1. A new NTN-specific SIB is introduced (SIBx), scheduled by SIB1
2. Introduce the following serving cell information to the corresponding SIBx (scheduled by SIB1):

- Ephemeris;

- common TA parameters;

- validity duration for UL sync information;

- t-Service;

- cell reference location;

- Epoch time.

Also send a LS to RAN1 asking whether some parameters might be sent more frequently

1. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the remaining serving time
2. RRC\_INACTIVE mode is supported for NTN

Agreements via email - from offline 102 - second round:

1. Regarding UE-based solution for SMTC adjustments, UE autonomously adjust the SMTCs based on location and ephemeris. FFS whether NW assistance information is provided.
2. UE can know the NW type implicitly no later than SIB1 reception, there is no explicit NW type indication in SIB1.
3. No LS is sent to RAN3 on the support of RRC\_INACTIVE.

Agreements:

1. define one single NR NTN UE capability to encompass essential features to support NTN, and UE can further indicate other optional capabilities.
2. gnss-Location-r16 is conditionally mandatory when UE indicates the support of NR NTN access, and update the field description to cover NTN case.
3. consider the following differentiation of user plane enhancements as baseline:

Essential sub-features include:

1) the adaptations of RACH;

2) DRX HARQ RTT timer extension;

3) the timer extension to accommodate long RTT for other MAC timers (e.g., extended sr-ProhibitTimer);

4) the timer extension to accommodate long RTT in RLC and PDCP layers (FFS for LEO)

Optional sub-features include:

1) TA reporting (TA reporting during RACH using MAC CE, and Event-triggers for TA reporting in connected mode);

2) disabling HARQ feedback for downlink transmission;

3) new HARQ state for uplink transmission and the corresponding new LCP mapping rule for dynamic grants.

4. consider the following differentiation of control plane enhancements as baseline:

Essential sub-features include (for NGSO, FFS for GEO):

1) soft TAC update;

2) SMTC enhancements (event-triggered assistance information reporting, 2 SMTC in parallel);

Optional sub-features include:

1) cell stop-time based neighbour cell measurements;

2) location based cell reselection criteria;

3) SMTC enhancements (4 SMTC in parallel and UE based solution in idle/inactive);

4) CHO enhancements (location based CHO).

FFS if CHO enhancements (time based and Event A4 based CHO) is essential or optional

1. Postpone the UE capability discussion on location reporting

Working Assumption (further check if anything can be per band):

1. the granularities of all the optional RAN2 determined sub-features with capability signalling are per UE.