3GPP TSG-RAN WG2 #123bis R2-23xxxxx

Xiamen, China, Oct. 9 – 13, 2023 Revision of R2-2311244

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **36.300** | **CR** | **1387** | **rev** | **1** | **Current version:** | **17.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Introduction of IoT NTN enhancements |
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| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | IoT\_NTN\_enh-Core |  | ***Date:*** | 2023-10-17 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Introduction of the Release-18 IoT NTN enhancements in stage 2.  |
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| ***Summary of change:*** | 7.5 Addition of new SIBxx23.21.2.1 Explanation of disabled HARQ feedback and HARQ mode B added. 23.21.2.2 Suspension of RLM and AS during GNSS measurement added. 23.21.4.1 Added that Location and time-based measurements can be used for cell reselection23.21.4.2 Additional triggers for CHO added. New section “23.21.4.X Measurements” added |
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| ***Consequences if not approved:*** | The Relase-18 IoT NTN enhancements are not supported.  |
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| ***Clauses affected:*** | 7.4, 23.21.2.1, 23.21.2.2, 23.21.4.1, 23.21.4.2, 23.21.4.X (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 36.321 CRxxxx,TS 36.331 CRyyyy,TS 36.304 CRzzzz |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R2-2306951: Additions after RAN2#122 included.R2-2308542: Input to RAN2#123: updated to v17.5.0, accepted removal of “Editor’s Note”s that were marked for removal, otherwsie the same as R2-2306951.R2-2309338: Additions after RAN2#123R2-2311244: Input to RAN2#123bis, same as R2-2309338 with updated cover page and document Type CR instead of draftCR, accepted removal of “Editor’s Note” that were marked for removal, and accepted the move of added text about HARQ in 23.21.1 that was moved to 23.21.2.1.R2-23xxxxx: Post RAN2#123bis.  |

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## 7.4 System Information

System information is divided into the *MasterInformationBlock* (MIB) and a number of *SystemInformationBlocks* (SIBs):

*- MasterInformationBlock* defines the most essential physical layer information of the cell required to receive further system information;

- *SystemInformationBlockPos* contains positioning assistance data;

- *SystemInformationBlockType1* and *SystemInformationBlockType1-BR* (for a BL UE or UE in enhanced coverage) contain information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information blocks;

- *SystemInformationBlockType2* contains common and shared channel information;

- *SystemInformationBlockType3* contains cell re-selection information, mainly related to the serving cell;

- *SystemInformationBlockType4* contains information about the serving frequency and intra-frequency neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SystemInformationBlockType5* contains information about other E‑UTRA frequencies and inter-frequency neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters). It can also contain information about E-UTRA and NR idle/inactive measurements;

- *SystemInformationBlockType6* contains information about UTRA frequencies and UTRA neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SystemInformationBlockType7* contains information about GERAN frequencies relevant for cell re-selection (including cell re-selection parameters for each frequency);

- *SystemInformationBlockType8* contains information about CDMA2000 frequencies and CDMA2000 neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SystemInformationBlockType9* contains a home eNB name (HNB name);

- *SystemInformationBlockType10* contains an ETWS primary notification;

- *SystemInformationBlockType11* contains an ETWS secondary notification;

- *SystemInformationBlockType12* contains a CMAS warning notification;

- *SystemInformationBlockType13* contains MBMS-related information;

- *SystemInformationBlockType14* contains information about Extended Access Barring for access control;

- *SystemInformationBlockType15* contains information related to mobility procedures for MBMS reception;

- *SystemInformationBlockType16* contains information related to GPS time and Coordinated Universal Time (UTC);

- *SystemInformationBlockType17* contains information relevant for traffic steering between E-UTRAN and WLAN;

- *SystemInformationBlockType18* contains information related to sidelink communication;

- *SystemInformationBlockType19* contains information related to sidelink discovery;

- *SystemInformationBlockType20* contains information related to SC-PTM;

- *SystemInformationBlockType21* contains information related to V2X sidelink communication;

- *SystemInformationBlockType24* contains information about NR frequencies and NR neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency), which can also be used for NR idle/inactive measurements;

- *SystemInformationBlockType25* contains information about UAC parameters;

- *SystemInformationBlockType26* contains additional information related to V2X sidelink communication;

- *SystemInformationBlockType26a* contains information related to NR bands list which can be used for EN-DC operation with the serving cell;

- *SystemInformationBlockType27* contains assistance information for inter-RAT cell selection to NB-IoT;

- *SystemInformationBlockType28* contains information related to NR sidelink communication;

- *SystemInformationBlockType29* contains information related to common resource reservation;

- *SystemInformationBlockType30* contains information related to disaster roaming;

- *SystemInformationBlockType31* contains information required for accessing an NTN cell;

- *SystemInformationBlockType32* contains assistance information for discontinuous coverage in NTN;

- *SystemInformationBlockTypeXX* contains assistance information for neighbouring cells in NTN.

System information for NB-IoT is divided into the *MasterInformationBlock-NB* (MIB-NB) and a number of *SystemInformationBlocks-NB* (SIBs-NB):

- *MasterInformationBlock-NB* defines the most essential information of the cell required to receive further system information;

- *SystemInformationBlockType1-NB* contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information blocks;

- *SystemInformationBlockType2-NB* contains common radio resource configuration information;

- *SystemInformationBlockType3-NB* contains cell re-selection information for intra-frequency, inter-frequency;

- *SystemInformationBlockType4-NB* contains neighboring cell related information relevant for intra-frequency cell re-selection;

- *SystemInformationBlockType5-NB* contains neighboring cell related information relevant for inter-frequency cell re-selection;

- *SystemInformationBlockType14-NB* contains information about access barring;

- *SystemInformationBlockType15-NB* contains information related to mobility procedures for MBMS reception;

- *SystemInformationBlockType16-NB* contains information related to GPS time and Coordinated Universal Time (UTC);

- *SystemInformationBlockType20-NB* contains information related to SC-PTM;

- *SystemInformationBlockType22-NB* contains common radio resource configuration information for paging and random access procedure on non-anchor carriers;

- *SystemInformationBlockType23-NB* contains common additional radio resource configuration information for random access procedure on anchor and non-anchor carriers;

- *SystemInformationBlockType27-NB* contains assistance information for inter-RAT cell selection to E-UTRAN and/or GERAN;

- *SystemInformationBlockType31-NB* contains information required for accessing an NTN cell;

- *SystemInformationBlockType32-NB* contains assistance information for discontinuous coverage in NTN;

- *SystemInformationBlockTypeXX-NB* contains assistance information for neighbouring cells in NTN.

On MBMS-dedicated cell, only system information relevant for receiving MBMS service is broadcasted. *MasterInformationBlock-MBMS* (MIB-MBMS) and *SystemInformationBlockType1-MBMS* (SIB1-MBMS) are used instead of MIB and SIB1 respectively:

*- MasterInformationBlock-MBMS* defines the most essential physical layer information of the cell required to receive further system information on MBMS-dedicated cell;

*- SystemInformationBlockType1-MBMS* contains information relevant for receiving MBMS service and defines the scheduling of other system information blocks on MBMS-dedicated cell;

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH and BR-BCCH, and carried on DL-SCH. Except for BL UEs, UEs in enhanced coverage and NB-IoT UEs, all other SI messages than the MIB which are dynamically carried on DL-SCH, can be identified through the SI-RNTI (System Information RNTI). Both the MIB and *SystemInformationBlockType1* (*SystemInformationBlockType1-BR* for BL UEs and UEs in enhanced coverage) use a fixed schedule with a periodicity of 40 and 80 ms respectively. The scheduling of other SI messages is flexible and indicated by *SystemInformationBlockType1* (*SystemInformationBlockType1-BR* for BL UEs and UEs in enhanced coverage, and *SystemInformationBlockType1-NB* for NB-IoT). For NB-IoT, the MIB-NB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH and carried on DL-SCH. Both the MIB-NB and *SystemInformationBlockType1-NB* use a fixed schedule with a periodicity of 640 and 2560 ms respectively. The MIB-NB contains all information required to acquire SIB1-NB and SIB1-NB contains all information required to acquire other SI messages.

On MBMS-dedicated cell, the MIB-MBMS and SIB1-MBMSuse a fixed schedule with a periodicity of 160 ms. Additionally, SIB1-MBMS may be scheduled in additional non-MBSFN subframes indicated in MIB-MBMS.

For NB-IoT, in TDD mode, the MIB-TDD-NB is transmitted on the same NB-IoT carrier as NPSS/NSSS, *SystemInformationBlockType1-NB* can be transmitted on NB-IoT carrier other than the MIB-NB, and the SI messages can be transmitted on a NB-IoT carrier other than the MIB-NB. At most two NB-IoT carriers are used to transmit the MIB-NB, *SystemInformationBlockType1-NB* and the SI messages.

Except for NB-IoT, the eNB may schedule DL-SCH transmissions concerning logical channels other than BCCH or BR-BCCH in the same subframe as used for BCCH or BR-BCCH. The minimum UE capability restricts the BCCH or BR-BCCH mapped to DL-SCH e.g. regarding the maximum rate.

The Paging message is used to inform UEs in RRC\_IDLE and UEs in RRC\_CONNECTED about a system information change. For NB-IoT UEs, BL UEs, and UEs in CE, the UE is not required to detect SIB changes when in RRC\_CONNECTED, and the network may release the NB-IoT UE, BL UE or UE in CE to RRC\_IDLE if it wants the NB-IoT UE, BL UE or UE in CE to acquire changed SIB(s).

Except for NB-IoT, system information may also be provided to the UE by means of dedicated signalling e.g. upon handover.

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## 4.12 Support of Non-Terrestrial Networks

E-UTRAN supports radio access over non-terrestrial networks for BL UEs, UEs in enhanced coverage and NB-IoT UEs. Support for non-terrestrial networks encompasses platforms that provide radio access through Geosynchronous orbits (GSO), Non-Geosynchronous Orbit (NGSO), which includes Low-Earth Orbit (LEO) and Medium Earth Orbit (MEO) or High Altitude Platform Systems (HAPS).

The Figure 4.12-1 below illustrates an example of a Non-Terrestrial Network (NTN) providing non-terrestrial access by means of an NTN payload and an NTN Gateway, depicting a service link between the NTN payload and a UE, and a feeder link between the NTN Gateway and the NTN payload.



Figure 4.12-1: Overall illustration of an NTN

NOTE: Figure 4.12-1 illustrates an NTN; RAN4 aspects are out of scope.

The NTN payload transparently forwards the radio protocol received from the UE (via the service link) to the NTN Gateway (via the feeder link) and vice-versa. The following connectivity is supported by the NTN payload:

- An eNB may serve multiple NTN payloads;

- An NTN payload may be served by multiple eNBs.

NOTE: In this release, the NTN-payload may change the carrier frequency, before re-transmitting it on the service link, and vice versa (respectively on the feeder link).

For NTN, the following applies in addition to Network entity related Identities as described in clause 8.2:

- A Tracking Area corresponds to a fixed geographical area. Any respective mapping is configured in the RAN;

- A Mapped Cell ID as specified in clause 23.21.5.

Three types of service links are supported:

- Earth-fixed: provisioned by beam(s) continuously covering the same geographical areas all the time (e.g., the case of GSO satellites);

- Quasi-Earth-fixed: provisioned by beam(s) covering one geographic area for a limited period of time and a different geographic area during another period of time (e.g., the case of NGSO satellites generating steerable beams);

- Earth-moving: provisioned by beam(s) whose coverage area slides over the Earth surface (e.g., the case of NGSO satellites generating fixed or non-steerable beams).

With NGSO satellites, the eNB can provide either quasi-Earth-fixed cell coverage or Earth-moving cell coverage, while eNB operating with GSO satellites can provide Earth fixed cell coverage or quasi-Earth-fixed cell coverage.

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## 23.21 Support for BL UEs, UEs in enhanced coverage and NB-IoT UEs over Non-Terrestrial Networks

### 23.21.1 General

Support for BL UEs, UEs in enhanced coverage and NB-IoT UEs over Non-Terrestrial Networks (see clause 4.12) is only applicable to E-UTRA connected to EPC. UEs not supporting NTN are barred from accessing an NTN cell.

In NTN, only BL UEs, UEs in enhanced coverage and NB-IoT UEs with GNSS capability are supported in this release of the specification.

To accommodate long propagation delays in NTN, increased timer values and window sizes, or delayed starting times are supported for the physical layer and for higher layers.

UL segmented transmission is supported for UL transmission with repetitions. The UE shall apply UE pre-compensation per segment of UL transmission of PUSCH/PUCCH/PRACH for BL UEs or UEs in enhanced coverage and NPUSCH/NPRACH for NB-IoT UEs from one segment to the next segment.

In this release of the specification, NTN is only applicable to FDD system.

### 23.21.2 Timing and synchronization

#### 23.21.2.1 Scheduling timing

DL and UL are frame aligned at the uplink time synchronization reference point (RP) with an offset given by $N\_{TA,offset} $(see clause 8 of TS 36.211 [4]).

To accommodate the long propagation delays in NTN, several timing relationships are enhanced by a Common Timing Advance (Common TA) and two offsets: $K\_{offset}$ and $K\_{mac}$:

- $Common TA$ is a configured timing offset that is equal to the RTT between the RP and the NTN payload.

- $K\_{offset}$ is a configured scheduling offset that needs to be larger or equal to the sum of the service link RTT and the Common TA.

- $K\_{mac}$ is a configured offset that is approximately equal to the RTT between the RP and the eNB.

The scheduling offset $K\_{offset}$ is used to allow the UE sufficient processing time between a downlink reception and an uplink transmission, see TS 36.213 [6].

The offset $K\_{mac}$ is used to delay the application of a downlink configuration indicated by a MAC CE received on NPDSCH/PDSCH, see TS 36.213 [6], and to determine the UE-eNB RTT, see TS 36.321 [13]. It may be provided by the network when downlink and uplink frame timing are not aligned at eNB. The $K\_{mac}$ is also used in the random access procedure, to determine the start time of random access response window after a random access preamble transmission (see TS 36.213 [6]).

The Service link RTT, Feeder link RTT, the RP, the Common TA, $K\_{mac}$ and TTA (see clause 23.21.2.2) are illustrated in Figure 23.21.2.1-1.



Figure 23.21.2.1-1: Illustration of timing relationship (for collocated eNB and NTN Gateway)

The network may configure the HARQ operation as follows:

- For downlink, HARQ feedback can be enabled or disabled per HARQ process (by dedicated RRC signalling and/or DCI based indication). Disabling HARQ feedback allows scheduling a HARQ process before one HARQ RTT has elapsed since last scheduled.

- For uplink, HARQ mode (i.e. HARQ mode A or HARQ mode B) can be configured per HARQ process (as specified in clause 5.4.3.1 and clause 5.7 of TS 36.321 [13]). HARQ mode B allows scheduling a HARQ process before one HARQ RTT has elapsed since last scheduled. HARQ mode B is not applicable for PUR transmissions.

NOTE: For the HARQ processes configured with HARQ feedback enabled/disabled, it is up to network implementation to ensure a proper configuration of HARQ feedback (e.g., either all enabled or all disabled) for HARQ processes used by a downlink SPS configuration. For the HARQ processes configured with HARQ mode, it is up to network implementation to ensure a proper configuration of HARQ mode (e.g., either all HARQ mode A or all HARQ mode B) for HARQ processes used by an uplink SPS configuration.

#### 23.21.2.2 Timing Advance and Frequency Pre-compensation

For the serving cell, the network broadcast ephemeris information and common Timing Advance (common TA) parameters.

The UE shall have valid GNSS position as well as the ephemeris and common TA before connecting to an NTN cell. To achieve synchronisation, before and during connection to a cell, the UE shall pre-compensate the Timing Advance (TTA, see TS 36.211 [4] clause 8.1), see Figure 23.21.2.2-1, by considering the common TA, UE position and the NTN payload position through the ephemeris.

The UE computes the frequency Doppler shift of the service link, and pre-compensates for it in the uplink transmissions, by considering UE position and the ephemeris. If the UE does not have a valid GNSS position and/or valid ephemeris and Common TA, it shall not transmit until they are regained.

In connected mode, the UE shall continuously update the Timing Advance and frequency pre-compensation. The UE can be triggered to, or configured to autonomously, perform GNSS acquisition. While the UE is performing GNSS acquisition, RLM is suspended. In connected mode, upon outdated ephemeris and common Timing Advance, the UE shall acquire the broadcasted parameters. Upon failed GNSS measurement and upon outdated GNSS position the UE shall move to idle mode. Upon completing the GNSS acquisition, the UE shall trigger remaining validity duration reporting.

NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement and resumed when the GNSS measurement is finished.

The UEs may be configured to report Timing Advance at initial access or in connected mode. In connected mode, event-triggered reporting of the Timing Advance is supported.



Figure 23.21.2.2-1: Illustration of Uplink/Downlink Radio Frame Timing at the UE

While the pre-compensation of the instantaneous Doppler shift experienced on the service link is to be performed by the UE, the management of Doppler shift experienced over the feeder link and transponder frequency error, whether introduced in Downlink or Uplink, is left to network implementation.

### 23.21.3 Support of discontinuous coverage

As an NTN payload moves on a specified orbit, for example in case of a NGSO satellite, the NTN payload beam(s) coverage area may move and cover different portions of a geographical area due to the orbital movement of the NTN payload. As a consequence, a UE located in the concerned geographical area may experience a situation of discontinuous coverage, due to e.g. a sparse satellite constellation deployment.

To enable the UE, in RRC\_IDLE, to save power during periods of no coverage, the network provides NTN payload assistance information (e.g. ephemeris parameters, the start-time of upcoming NTN payload coverage) to enable the UE to predict when coverage will be provided by upcoming NTN payloads. Predicting out of coverage and in coverage is up to UE implementation.

### 23.21.4 Mobility Management

#### 23.21.4.1 Mobility Management in ECM-IDLE

The principles described in clause 10.1.1 apply in NTN unless specified otherwise hereafter.

The network may broadcast more than one TAC per PLMN in an NTN cell. The AS layer indicates all received TACs for the selected PLMN to the NAS layer. The network may update the UEs upon TAC removal. UEs may by UE implementation also check whether a TAC has been removed.

For quasi-Earth-fixed cells, timing information on when the cell is going to stop serving the area may be broadcast by the network. This may be used by the UE to start measurements on neighbour cells before the broadcast stop time of the serving cell, while the exact start of the measurements is up to UE implementation.

Location and time-based measurements can be used for cell reselection.

#### 23.21.4.2 Mobility Management in ECM-CONNECTED

Radio link failure and RRC connection re-establishment are supported in NTN. The principles described in clause 10.1.6 apply unless specified otherwise. The principles described in clause 10.1.2 apply to NTN unless specified otherwise.

To enable mobility in NTN, the network provides target cell NTN payload assistance information needed to access the NTN cell in the handover command.

Conditional handover is supported for BL UEs and UEs in enhanced coverage.

When operating in NTNs the following additional trigger conditions upon which UE may execute CHO to a candidate cell is supported, as defined in TS 36.331 [16]:

- The RRM measurement-based event A4;

- A time-based trigger condition;

- A location-based trigger condition.

It is up to UE implementation how the UE evaluates the time-based or location-based trigger condition together with the RRM measurement-based event.

#### 23.21.4.X Measurements

The principles described in clause 10.1.3.0 apply in NTN unless specified otherwise.

To enable measurements, the network may provide neighbouring cell assistance information via system information.

The following can optionally be used for measurements on neighbour cells in RRC\_IDLE as specified in TS 36.331 [16]:

- The timing and location information associated to the serving cell is provided in SIB3 and SIB31;

- Timing information when the neighbour cell starts serving the current geographical area;

- Location information refering to the reference location of the serving cell and a distance threshold to the reference location.

The following measurement triggers can optionally be used in RRC\_CONNECTED to reduce the time taken for RRC reestablishment or handover as specified in TS 36.331 [16]:

- A time-based trigger condition;

- A location-based trigger condition.

### 23.21.5 Switchover

#### 23.21.5.1 Definitions

A feeder link switchover is the procedure where the feeder link is changed from a source NTN Gateway to a target NTN Gateway for a specific NTN payload. The feeder link switchover is a Transport Network Layer procedure.

Both hard and soft feeder link switchover are applicable to NTN.

#### 23.21.5.2 Assumptions

A feeder link switchover may result in transferring the established connection for the affected UEs between two eNBs.

For soft feeder link switchover, an NTN payload is able to connect to more than one NTN Gateway during a given period i.e. a temporary overlap can be ensured during the transition between the feeder links.

For hard feeder link switchover, an NTN payload only connects to one NTN Gateway at any given time i.e. a radio link interruption may occur during the transition between the feeder links.

#### 23.21.5.3 Procedures

The NTN control function determines the point in time when the feeder link switchover between two eNBs is performed. For BL UEs and UEs in enhanced coverage, the transfer of the affected UEs' context between the two eNBs at feeder link switchover is performed by means of either S1 based or X2 based handover, and it depends on the eNBs' implementation and configuration information provided to the eNBs by the NTN Control function.

### 23.21.6 Signalling

The Cell Identity, as defined in TS 36.413 [25] and TS 36.423 [42], corresponds to a Mapped Cell ID, irrespective of the orbit of the NTN payload or the types of service links supported in the following cases:

- The Cell Identity indicated by the eNB to the Core Network as part of the User Location Information, or as E-UTRAN CGI in the related S1AP messages;

- The Cell Identity used for Paging Optimization in S1 interface;

- The Cell Identity used for PWS.

For a BL UE or a UE in enhanced coverage, the Cell Identity included within the target identification of the handover messages allows identifying the correct target cell.

The mapping between Mapped Cell ID(s) and geographical area(s) is configured in the RAN and Core Network.

NOTE 1: A specific geographical location may be mapped to multiple Mapped Cell ID(s), and such Mapped Cell IDs may be configured to indicate different geographical areas (e.g. overlapping and/or with different dimensions).

The eNB is responsible for constructing the Mapped Cell ID based on the UE location information received from the UE, if available. The mapping may be pre-configured (e.g., depending on operator's policy) or up to implementation.

NOTE 2: As described in TS 23.401 [17], the User Location Information may enable the MME to determine whether the UE is allowed to operate at its present location. Special Mapped Cell IDs or TACs may be used to indicate areas outside the serving PLMN's country.

The eNB reports the broadcasted TAC(s) of the selected PLMN to the MME. In case the eNB knows the UE's location information, the eNB may determine the TAI the UE is currently located in and provide that TAI to the MME.

### 23.21.7 MME(Re-)Selection by eNB

The eNB implements the NAS Node Selection Function specified in TS 36.410 [95].

For a RRC\_CONNECTED UE, the eNB ensures that the BL UE or the UE in enhanced coverage connects to an MME that serves the country in which the UE is located. If the eNB detects that a BL UE or a UE in enhanced coverage is in a different country to that served by the serving MME, it should perform an S1 handover to change to an appropriate MME or initiate anUE Context Release Request procedure towards the serving MME (in which case the MME may decide to detach the UE).

For an RRC\_CONNECTED NB-IoT UE, the eNB ensures that the NB-IoT UE connects to an MME that serves the country in which the UE is located. If the eNB detects that the UE is in a different country to that served by the serving MME, it should initiate a UE Context Release Request procedure towards the serving MME (in which case the MME may decide to detach the UE).

### 23.21.8 O&M Requirements

The NTN related parameters shall be provided by O&M to the eNB providing non-terrestrial access, as specified in TS 38.300 [79].

### 23.21.9 Coarse UE location reporting

Upon network request, after AS security is established in connected mode, BL UEs and UEs in enhanced coverage can report its coarse UE location information (most significant bits of the GNSS coordinates, ensuring an accuracy in the order of 2km) to the eNB if available.

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Annex P (informative):
Example implementation of Non-Terrestrial Networks

The following figure illustrates an example implementation of a Non-Terrestrial Network for transparent NTN payload:



Figure P-1: NTN based E-UTRAN

The eNB depicted in Figure P-1 may be subdivided into non-NTN infrastructure eNB functions and the NTN Service Link provisioning System. The NTN infrastructure may be thought of being subdivided into the NTN Service Link provisioning System and the NTN Control function. The NTN Service Link provisioning System may consist of one or more NTN payloads and NTN Gateways.

The NTN payload is embarked on a spaceborne (or airborne) vehicle, providing a structure, power, commanding, telemetry, attitude control for the satellite (resp. high altitude platform station) and possibly an appropriate thermal environment and radiation shielding.

The NTN Service Link provisioning System maps the Uu radio protocol over radio resources of the NTN infrastructure (e.g. beams, channels, Tx power).

The NTN control function controls the spaceborne vehicles as well as the radio resources of the NTN infrastructure (NTN payload(s) & NTN Gateway(s)). It provides control data, e.g. Ephemeris, to the non-NTN infrastructure eNB functions of the eNB.

Provision of NTN control data to the eNB is out of 3GPP scope.

NOTE: The transport of Uu protocol between the NTN Service Link provisioning system and the non-NTN infrastructure eNB functions is out of 3GPP scope.

At least the following NTN related parameters are expected to be provided by O&M to the eNB for its operation.

a) Earth fixed beams: for each beam provided by a given NTN-payload:

- The Cell identifier (S1 and Uu) mapped to the beam;

- The Cell's reference location (e.g. cell's center and range).

b) Quasi Earth fixed beams: for each beam provided by a given NTN-payload:

- The Cell identifier (S1 and Uu) and time window mapped to a beam;

- The Cell's/beam's reference location (e.g. cell's center and range);

- The time window of the successive switchovers (feeder link, service link);

- The identifier and time window of all serving NTN payloads and NTN-Gateways.

c) Earth moving beams: for each beam provided by a given NTN-payload:

- The Uu Cell identifier mapped to a beam and mapping information to fixed geographical areas reported on NG, including information about the beams direction and motion of the beam's foot print on Earth;

- Its elevation with regard to NTN-payload;

- Schedule of successive serving NTN-Gateways/eNBs;

- Schedule of successive switchovers (feeder link, service link).

|  |
| --- |
| END OF CHANGE |

# Appendix Agreements (this section to be removed)

## RAN2#119

Agreements:

1. Disabling DL HARQ feedback is supported for NB-IoT and eMTC NTN. FFS on UE capability
2. For UL HARQ operation, introduce two HARQ modes, i.e., HARQ mode A and HARQ mode B in IoT NTN (both NB-IoT and eMTC NTN), similarly to NR NTN
3. From RAN2 perspective, at least for eMTC, enabling/disabling HARQ feedback can be configured per DL HARQ process at least via UE specific RRC signalling. FFS for NB-IoT (and especially for CP solution for NB-IOT).

Agreements:

1. IoT NTN can use the mechanism for neighbour cell measurements in connected mode (specified in Rel-17 for NB-IoT). FFS if any enhancements are needed (e.g. triggers) for both NB-IoT and eMTC.
2. RAN2 to continue working on a new time-based trigger for triggering intra and inter frequency measurements in connected mode, e.g. the serving cell is going to stop covering the current area, for both earth-moving and earth-fixed cell (FFS on distance-based trigger)
3. CHO enhancements for eMTC NTN (i.e. time/timer based solution) are introduced based on the R17 NR NTN solution. FFS on location-based solution
4. Measurement results reporting is not supported in Rel-18 NB-IoT NTN.

## RAN2#119bis

Agreements:

1. For NB-IoT, enabling/disabling HARQ feedback can be configured per DL HARQ process at least via UE specific RRC signaling (e.g. RRCConnectionSetup). This does not preclude other options (e.g. DCI-based). We can also revert this decision if requested by RAN1.
2. Disabling HARQ feedback is supported for NB-IoT with single HARQ process, and it is up to eNB implementation whether to disable the HARQ feedback

Working Assumption:

1. Blind retransmission can be used in IoT NTN when HARQ feedback is disabled and when HARQ mode B is used (RAN2 assumes there is no spec change for this)

Agreements:

1. HARQ mode A/B for uplink transmission may be configured per UL HARQ process at least via UE specific RRC signalling for eMTC and NB-IOT NTN. We can also revert this decision if requested by RAN1

Agreements:

1. RAN2 agree to take R17 NR NTN DRX solution as baseline for IoT NTN, e.g. for HARQ process with DL HARQ feedback disabled, the UE will not start the corresponding DL HARQ RTT timer.
2. For NB-IoT NTN with single HARQ process when the HARQ feedback is disabled, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PDSCH reception (can still check whether the alternative to set the HARQ RTT timer to 0 also works)
3. RAN2 agree to take R17 NR NTN DRX solution as baseline for IoT NTN, e.g. for HARQ process in HARQ mode B, the UE will not start the corresponding UL HARQ RTT timer.
4. For NB-IoT NTN with single HARQ process in HARQ mode B, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PUSCH transmission (can still check whether other alternatives also work)
5. The solutions of LCP restriction on allowed HARQ mode in NR NTN can be reused for eMTC NTN.

Agreements:

1. For eMTC over NTN, for both earth-moving and earth-fixed cell scenarios, we introduce location based CHO triggering events

## RAN2#120

Agreements:

1. For NB-IoT NTN with single HARQ process when the HARQ feedback is disabled, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PDSCH reception plus 12 subframes.
2. RAN2 understands that something needs to be added to consider the processing time also for inactivity timer of HARQ mode B. Continue the discussion on the details in the next meeting

Agreements:

1. For eMTC, 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).

 4) If UL HARQ mode is not configured, LCH mapping rules are not supported (legacy behaviour)

2. For eMTC, introduce allowedHARQ-mode for each logical channel, e.g. included in LogicalChannelConfig IE.

Agreements:

1. An optional UE capability is introduced to indicate whether the UE supports disabling HARQ feedback for downlink transmission.
2. An optional UE capability is introduced to indicate whether the UE supports HARQ Mode B and, for eMTC, the corresponding LCP restrictions for uplink transmission

Agreements:

1. For NB-IoT we support a trigger for neighbour cell measurements based on T-service (in the quasi-Earth fixed case) (this does not preclude anything for eMTC discussion)

Agreements:

1. At least for NB-IoT NTN, for quasi-earth fixed cells, UE shall start intra/inter frequency measurement in connected mode before the t-Service if present. The exact time to start measurements in connected mode before t-Service can be left to UE implementation” (can revisit if we agree other proposal based on neighbour cell coverage)
2. RAN2 will not specify the condition of stopping UE measurement before t-Service
3. For earth-moving cell, the UE derives when loss of coverage of current cell happens (how to derive this information is FFS)
4. For earth-moving cell, UE shall start intra/inter frequency measurements in RRC connected mode before losing coverage. The exact time to start measurements can be left to UE implementation

Agreements:

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.: UE is allowed to perform HO only during T1 to T2.
2. For eMTC NTN, introduce a location-based conditional reconfiguration trigger based on condEventD1 in NR, where the event will be satisfied if the distance between the UE and a first reference location (e.g. within the serving cell) is above a threshold, and the distance between the UE and a second reference location (e.g. within a neighbour cell) is below a threshold. (similar to condEventD1 in NR)
3. For eMTC NTN, introduce event A4 based conditional trigger (similar to condEventA4 in NR).
4. FFS whether time and location-based trigger conditions may be configured independently (i.e., without a jointly configured event A4 measurement condition) for eMTC NTN.

## RAN2#121

Agreements:

1. For UE to report GNSS position fix time duration for measurement during the initial access, at least the following Msg5 message can be used:

 RRCConnectionSetupComplete, RRCConnectionSetupComplete-NB,

 RRCConnectionResumeComplete, RRCConnectionResumeComplete-NB,

 FFS for RRCreestablishmentComplete and RRCConnectionReconfigurationComplete.

 FS for Msg3

1. FFS whether the UE can stay in RRC\_CONNECTED state when current GNSS position becoming out-of-date if the UE has initiated a new measurement
2. The value range {10s, 20s, 30s, 40s, 50s, 60s, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min, 60 min, 90 min, 120 min, infinity} introduced in R17 is reused for connected UE GNSS validation duration report, unless modified by RAN1.
3. UE reports GNSS validity duration after GNSS measurement. FFS whether the UE reports every time or only if the validity duration changes. FFS if the duration is the remaining validity duration or the whole duration

Agreements:

1. Location-based connected mode measurement initiation is supported in quasi-Earth-fixed cell (UE is not required to update the GNSS location for this). A serving cell reference location and a distance threshold/radius for detecting when to trigger connected mode measurements will be broadcast for quasi-Earth-fixed cell. FFS on whether the R17 IEs are reused or not. FFS if the same mechanism can also be used in idle (like in NR-NTN)
2. Location-based connected mode measurement initiation is supported in earth-moving cell (UE is not required to update the GNSS location for this). A serving cell reference location and a distance threshold/radius for detecting when to trigger connected mode measurements will be broadcast for earth-moving cell. FFS on whether the R17 IEs are reused or not. FFS on whether additional information needs to be broadcast to inform the UE how the reference location moves over time or if this can be derived from other information (e.g. Epoch time and ephemeris). FFS if the same mechanism can also be used in idle (like in NR-NTN)

Agreements:

1. We don’t introduce any new low mobility criterion for enhanced mobility in Rel-18

Agreements:

1. RAN2 can continue to check whether dedicated RRC signalling can be used for providing satellite information corresponding to discontinuous coverage.

2. RAN2 will support enhancements in paging and eDRX, in alignment with the work in SA2 and CT1. FFS on the details

3. RAN2 may consider enhancements for connected UE upon detecting discontinuous coverage (e.g., suspend RLM, RLF detection, and RRC re-establishment process)

4. Companies supporting the store and forward approach can bring a proposal to the plenary for TEI18 or for updating the WID

## RAN2#121bis

#### 7.6.2.1 HARQ enhancements

Agreements:

1. RAN2#121’s agreement is revised to “For NB-IoT NTN with single HARQ process when the HARQ feedback is disabled, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PDSCH reception plus 12 subframes plus deltaPDCCH” (Can further check in the NB-IoT session if anything needs to be done for legacy NB-IoT as well, as some timers don’t take deltaPDCCH into account)
2. Wait for RAN1’s decision on the RRC signalling of enabling DCI-based solution to indicate HARQ feedback enabled/disabled, and the signalling granularity, e.g. per UE or per HARQ process
3. On DCI indication overriding RRC configuration for the HARQ feedback enabled/disabled, wait for RAN1’s progress on DCI-based solution before discussing related DRX impact in RAN2.
4. On DL multiple TB scheduling, wait for RAN1’s progress before discussing related DRX impact in RAN2.
5. P4 in [R2-2302557](file:///C%3A/Data/3GPP/Extracts/R2-2302557.DOCX) is not agreed, i.e. no special handling for single HARQ process for eMTC.
6. For eMTC NTN, a parameter harq-FeedbackEnablingforSPSactive could be configured for a UE. If harq-FeedbackEnablingforSPSactive is configured to enable HARQ feedback, UE reports ACK/NACK for the first SPS PDSCH after activation, regardless of if HARQ feedback is enabled or disabled corresponding to the first SPS PDSCH after activation.
7. For a NB-IoT UE configured with a single HARQ process in HARQ mode B, send LS to RAN1 and ask for the “processing time for starting drx-InactivityTimer (i.e. start to monitor NPDCCH)”. (can further check the detailed wording of the question)
8. Network implementation resolves the issue of ambiguity on start of DRX inactivity timer after the PUSCH transmission by not scheduling the NPDCCH back-to-back during the ambiguity period (i.e., Koffset – UE’s TA)
9. Send LS to RAN1 to check for UL multiple TB scheduling, which UL HARQ mode combination(s) are to be supported.
10. In the LS to RAN1, we don’t include a question on whether RAN1 intends to introduce the DCI-based solution for the UL HARQ mode
11. UL transmission using SPS can be configured with HARQ mode B
12. P1 in [R2-2303713](file:///C%3A/Data/3GPP/Extracts/R2-2303713%20%28R18%20IoT-NTN%20WI%20AI%207.6.2.1%29%20-%20disabling%20HARQ%20feedback.docx) is not agreed, i.e. do not enhance the LCP restriction based on uplinkHARQ-Mode for different RLC PDU types
13. Send LS to RAN1 informing RAN2’s agreements and also including potential questions to be checked with RAN1

Agreements via email – from offline 103 – second round:

1. Add one more question in the LS to check with RAN1 which of the below understandings is correct for the RAN1 agreement.

 Understanding 1: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for the same HARQ process in a period of Y=12(ms) from the end of reception of the NPDSCH.

 Understanding 2: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for all the HARQ processes in a period of Y=12(ms) from the end of reception of the NPDSCH.

1. RAN2 further discuss whether UL transmission using PUR can be configured with HARQ mode B.

#### 7.6.2.2 GNSS operation enhancements

Agreements:

1. There is no need for UE to provide GNSS position fix time duration in Msg3.
2. RLM is suspended during the GNSS measurement gap while the UE is measuring GNSS

Agreements via email – from offline 104 – second round:

1. UE can stay in RRC\_CONNECTED state when current GNSS position becomes out-of-date if the UE enters a GNSS measurement gap. FFS whether the new GNSS measurement shall be started before, upon or after the current GNSS validity duration expiry
2. For a UEs that cannot acquire system information and GNSS position at the same time, acquisition of SIB31 may be postponed until GNSS measurement is completed if the UE cannot complete acquisition of SIB31 before the start of GNSS measurement gap

Agreements online:

1. For the NB-IoT CP solution, UE will report the GNSS validity duration by using a MAC CE
2. RAN2 can discuss UE autonomously reacquire GNSS during inactive state of C-DRX based on RAN1’s input in the next RAN2 meeting

Working Assumption:

1. GNSS validity duration UE reported after GNSS measurement is the remaining validity duration

#### 7.6.3.1 Enhancements for neighbour cell measurements

Agreements:

1. New SIBxx is introduced to broadcast the neighbor cell/satellite information.

Agreements via email – from offline 114:

1. Common TA parameters are broadcast as assistance information for neighbor cell measurements.
2. Kmac is broadcast as neighbor cell assistance information.
3. For moving cell, the UE can derive the trajectory of serving cell with rough accuracy based on serving satellite ephemeris and epochTime, with the assumption that the serving cell reference location broadcast by the network is the one at Epoch time (like in NR-NTN)

Agreements online:

1. Introduce satellite ID for the satellite in a list in new SIB-xx. FFS on the details of the new IE
2. For eMTC NTN, for fixed cell, location-based measurement initiation can also be used in RRC\_IDLE for cell re-selection purposes (like in NR-NTN)
3. For eMTC NTN, for moving cell, location-based measurement initiation can also be used in RRC\_IDLE for cell re-selection purposes (like in NR-NTN). FFS whether to consider solution that does not require UE to update the GNSS for this same as in connected mode
4. SIB3 is extended to include the reference location and distanceThresh

### 7.6.4 Enhancements to discontinuous coverage

Agreements via email – from offline 115:

1. RAN2 will not introduce any enhancement to allow a UE in RRC Connected to stay in RRC\_CONNECTED during/after a coverage gap (e.g. suspend RLM/RLF, activation time in RRC Reconfiguration, CHO enhancement)

Agreements online:

1. RAN2 to introduce enhancement to RRC Release using one of the following options (FFS which one):

 - Explicit RRC Release using a new RRC Release cause

 - UE Autonomous release (e.g. timer based or upon detection of coverage gap)

## RAN2#122

Agreements:

1. Confirm the working assumption that GNSS validity duration UE reports is the remaining validity duration.
2. The UE triggers GNSS measurement reporting every time upon completing the GNSS fix operation.
3. When network triggers GNSS measurement initiation is up to network implementation.
4. Add a note to state some AS operations are suspended when UE is performing GNSS measurement during GNSS measurement gap.
5. GNSS fix time duration should be reported in 1) and 2):

 1) RRCConnectionReestablishmentComplete and RRCConnectionReestablishmentComplete-NB

 2) RRCConnectionReconfigurationComplete for HO case

 (FFS whether there are some scenarios where this is not needed or whether there has to be some explicit NW indication to do so)

Working Assumptions:

1. An UL MAC CE for GNSS validity duration reporting is used for NB-IoT user plane solution and eMTC UE as well, in addition to previously agreed NB-IoT control plane solution

2. A new DL MAC CE is introduced to trigger connected UE to perform GNSS measurement.

Agreements:

1. Extend the neighbour cell information in existing SIBs (not SIB31) to include satellite ID
2. The system Information modification procedure is not triggered for an update of new SIB on neighbor-cell assistance information.
3. For NB-IoT, SIBxx is not an essential SIB. UE does not need to consider the cell barred if it is unable to acquire the SIB when scheduled. FFS for eMTC
4. In RRC IDLE, how to (re-)acquire neighbour cell assistance information is up to UE’s implementation.
5. The satellite ID in the new SIB is an integer of X bits wherein X depends on the maximum number of satellites to be considered for mobility.
6. The satellite ID is defined as Radio resource control information element to be used in other configurations.
7. If a parameter in the common TA parameters is absent, then the value of the parameter is assumed zero.
8. If Kmac is absent, then the value of Kmac for the neighbor satellite in the list is assumed zero. FFS on further optimization on signaling, e.g., signalling explicit value 0 of Kmac.

Agreements:

1. Reference location and distanceThresh in SIB31. A change of reference location does not trigger SI modification. A UE does not need to get a new reference location as long as ephemeris and Epoch time are valid (in Connected mode the UE relies on T317)

Agreements:

1. For earth-fixed cells, introduce t-ServiceStart for neighbor cells. If UE is aware of the t-ServiceStart of the neighbour cell then may be used (up to UE implementation) to determine when to start measurements of that neighbor cell
2. If the serving cell t-service expires, stop T310 (if running) and start T311 (i.e. perform cell search and re-establishment without attempting to recover on the current cell for the duration of T310). FFS on discontinuous coverage
3. The distance between the UE and a second reference location (e.g. within a neighbour cell) is not taken into account.
4. R18 location and time based trigger for measurements (for connected mode and for idle) apply to both NB-IoT and eMTC.

## RAN2#123

Agreements:

1. For eMTC NTN, it can be left to eNB’s implementation to configure either HARQ mode A or HARQ mode B for all HARQ process (or no HARQ mode) if mpdcch-UL-HARQ-ACK-FeedbackConfig is configured.
2. For NB-IoT NTN and eMTC NTN for CE Mode B, to configure/indicate enabling/disabling of HARQ feedback for downlink transmission:

 • Introduce an RRC bitmap with a value per HARQ process to indicate the HARQ feedback enabling/disabling for each HARQ process. (Similar to NR)

 • Introduce a single flag in RRC signaling to indicate whether DCI-based solution is enabled or not

1. HARQ feedback shall always be sent for DL SPS deactivation (i.e. regardless of HARQ feedback enabled/disabled).
2. For NB-IoT, UL HARQ mode configuration is based on RRC signalling (similar like NR NTN).
3. For a NB-IoT UE configured with a single HARQ process, if the HARQ process is configured with HARQ mode B, UE (re)starts drx-InactivityTimer in the subframe containing the last repetition of the corresponding PUSCH transmission plus 1 subframe plus deltaPDCCH.
4. HARQ mode B is not applicable for UL transmission using PUR. FFS whether HARQ mode can be configured for PUR.
5. In the case mpdcch-UL-HARQ-ACK-FeedbackConfig is configured, for a HARQ process configure with HARQ mode B, the corresponding drx-ULRetransmissionTimer is not started after the last repetition of the corresponding PUSCH transmission if an UL HARQ-ACK feedback has not been received on MPDCCH until the last repetition of the corresponding PUSCH transmission
6. For eMTC, UL HARQ mode configuration is based on RRC signalling (similar like NR NTN).
7. RAN2 confirms working assumption 2 in LS R2-2307016 (R1-2306245) is feasible

Agreements:

1. An UL MAC CE for GNSS validity duration reporting is used for NB-IoT user plane solution and eMTC UE as well and A new DL MAC CE is introduced to trigger connected UE to perform GNSS measurement.
2. RAN2 will wait for more input foRAN1 for the detailed format of UL MAC CE for GNSS validity duration reporting and DL MAC CE for GNSS measurement wait for more input from RAN1.
3. T318 is restarted after GNSS position fix
4. Capture the following NOTE in Stage 2 (can further fix the wording):

 NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement during GNSS measurement gap.

 FFS whether we need to state something about AS resumption

1. UE assumes the GNSS location is valid upon successful GNSS measurement
2. Network enables the reporting of GNSS position fix duration, in SIB2 and in dedicated signalling for the HO case
3. UE autonomously trigger GNSS measurement can be configured via RRC dedicated signalling
4. UE can autonomously start GNSS measurement during the inactive state of C-DRX.
5. The exact time of starting GNSS measurement during the inactive state of C-DRX can be left for UE implementation.

Agreements:

1. The priority of GNSS validity duration MAC CE is higher than BSR. The exact priority can be further checked during MAC running CR review.
2. RRC layer needs to send indication to trigger MAC to report the remaining GNSS measurement validity duration.
3. RRC layer sends such indication to MAC layer upon RRC layer receives indication that GNSS becomes valid.
4. MAC layer should guarantee the reported remaining GNSS measurement validity duration is the latest value.
5. If UE failed to autonomously re-acquire the GNSS position fix and the GNSS position is still valid during the inactive state of C-DRX, UE does not move to RRC\_IDLE. There is no specification impact. FFS if we still allow the UE not to move to Idle in case GNSS position is outdated
6. If there is neither network aperiodically trigger nor network configuration of UE autonomously GNSS measurement, UE moves to RRC\_IDLE after GNSS becomes invalid. It’s FFS how to decide GNSS valid or invalid considering duration X and Y.

Agreements:

1. For eMTC, the new SIB (SIBxx) is not an essential SIB. UE does not need to consider the cell barred if it is unable to acquire the SIB when scheduled.
2. RAN2 will not consider to include cell stop time of neighbor cell in the new SIB (SIBxx) in this release.
3. for NB-IoT NTN, location-based measurement initiation can also be optionally used in RRC\_IDLE for cell re-selection purposes (like in NR-NTN), with the assumption that it is up to the UE to update GNSS location.
4. validity duration is optional, and if this field is absent, the UE uses validity duration from the serving cell
5. For re-acquisition of SIBXX the UE may rely on T317/T318 in connected mode
6. For CHO in NTN (both NR NTN and eMTC NTN, time and location-based trigger conditions may be configured independently (i.e., without a jointly configured measurement condition). We add a description/note saying in which scenarios this is reasonable, e.g. at least hard-switch case where gap is assumed to be zero/negligible

Agreements:

1. RAN2 understands that UE may directly go to RRC\_IDLE after RLF is triggered, if there is not enough time for the UE to finish the procedure of RRC re-establishment due to the discontinuous coverage (FFS whether this needs to be captured in the specs, e.g. a NOTE)

## RAN2#123bis

Agreements:

1. For NB-IoT UEs configured with two HARQ processes and at least one of them is configured with HARQ feedback disabled, RAN2 does not change the operation on drx-InactivityTimer for single-TB scheduling case.
2. For a HARQ process configured as HARQ feedback disabled by RRC and further reversed to HARQ feedback enabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled.
3. For multiple UL TBs scheduling, it is up to network implementation to configure multiple TBs using HARQ processes in the same or different HARQ modes. Start time for UL HARQ RTT timer for mode A will not change
4. For multiple TB scheduling with the same HARQ feedback enabled/disabled configuration (by RRC/DCI), HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy (can further check in offline 308)
5. For multiple TB scheduling with mixed HARQ feedback enabled/disabled configuration (by RRC), if HARQ-ACK bundling is configured, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy.
6. HARQ mode configuration is not applicable for PUR in IoT NTN

Agreements:

1. For NB-IoT UE configured with two HARQ processes and at least one of them is configured with HARQ mode B, RAN2 does no change to the operation on drx-InactivityTimer for single TB scheduling case.
2. For eMTC over NTN with HARQ process configured with HARQ mode B, there is no need to change drx-InactivityTimer operation.
3. For NB-IoT, for a HARQ process configured as HARQ feedback enabled by RRC and further reversed to HARQ feedback disabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled (e.g., not start the corresponding DL HARQ RTT Timer for this HARQ process, and for NB-IoT NTN with single HARQ processes, start drx-InactivityTimer in the subframe containing the last repetition of the PDSCH plus 12 subframes plus deltaPDCCH).
4. For multiple TB scheduling with the same HARQ feedback enabled configuration at least by RRC, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy.
5. In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for multiple DL TBs, UE stops drx-InactivityTimer as legacy, regardless of the enabling/disabling HARQ feedback configuration for each of the multiple scheduled TB.
6. For UL multiple TB scheduling, UE only starts the UL HARQ RTT Timer for the HARQ process(es) with HARQ mode A.
7. In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for UL multiple TBs, UE stops drx-InactivityTimer as legacy, regardless of the HARQ mode configuration for each of the multiple scheduled TB.
8. HARQ feedback enabled/disabled and HARQ mode configuration related to SPS are already perfectly captured by the NOTE in stage-2 running CR (no further spec changes are needed)

Agreements:

1. A new RRC parameter is introduced in dedicated RRC signalling to enable/disable duration X.
2. A new RRC parameter is introduced in dedicated RRC signalling to configure duration Y when timeAlignmentTimer is infinity.

Agreements:

1. GNSS Duration Report MAC CE will not trigger SR; instead CBRA will be used.
2. A reserved LCID will be used for GNSS measurement command MAC CE (in DL).
3. GNSS measurement validity duration report MAC CE priority is in-between TAR MAC CE and BSR MAC CE.
4. The following update in NOTE in Stage 2 running CR is agreed:

 NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement during GNSS measurement gap and resumed when the GNSS measurement is finished

1. The following update in NOTE in Stage 2 running CR is agreed ((FFS whether to suspend T317, T318 during measurement gap):

 NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement ~~during GNSS measurement gap~~

1. For both network-triggered and UE-autonomous Measurement Gap Length Configuration: Use MAC CE (with 1 bit indication to differentiate the two cases) (FFS if a RRC configuration is needed for NW trigger case)

Agreements:

1. Upon absence of satellite IDs for intra-frequency, the UE assumes Rel-17 behavior for intra-frequency measurements, i.e. measurement according to UE implementation.
2. Upon absence of satellite IDs for inter-frequency, the UE assumes Rel-17 behavior for inter-frequency measurements, i.e. measurement according to UE implementation.
3. RAN2 understands that if SIBxx is present, then satellite IDs in either SIB3, SIB5 or both SIB3 and SIB5 should be present (up to NW implementation, no spec impact)
4. Satellite assistance information is provided per frequency, and not associated with PCIs. The satellite IDs for intra-frequency measurements are in SIB3 as in the current running CR (no need to place them into SIB4).
5. Introduce satellite ID for serving satellite (in SIB31) as well. RAN2 does not consider implicitly reusing serving satellite assistance information.
6. t-ServiceStartNeigh is signalled per satellite
7. Separate reference locations are introduced for earth-quasi fixed cells and earth-moving cells.

Working assumption:

1. Adopt the same decision as for NR NTN to discriminate whether a frequency is for TN or NTN

Agreements:

1. Provide carrier frequency for the existing satellite list in SIB32 to facilitate cell selection and reduce service interruption after an NTN coverage gap (FFS if the information can be considered as valid after the validity of SI)