**3GPP TSG-RAN WG2 Meeting #127 *R2-240xxxx***

**Maastricht, Netherlands, 19th – 23rd August 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.300** | **CR** | **DRAFT** | **rev** | **-1** | **Current version:** | **18.2.0** |  |
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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:*** | Stage 2 Running CR for LTE to NR NTN idle mode mobility | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** | RAN2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_TN\_NR\_NTN\_mob-Core | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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 can be 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of a Stage 2 description for LTE TN to NR NTN mobility | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introducing Stage 2 description for:   * New definition for NR NTN * Clarifying SIB33 used for inter-RAT NTN payload info * Describing support for cell reselection and E-UTRAN broadcasting NR NTN payload info | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | LTE to NR NTN idle mode mobility not adequatedly described in Stage 2. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 7.4, 10.2.7 (New) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS/TR 36.331 CR X  TS/TR 36.306 CR X | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | 1st version for RAN2#127 in R2-2407259 | | | | | | | | |

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# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

**A2X communication:** A communication to support A2X services leveraging PC5 reference points. A2X services are realized by various types of A2X applications, e.g. BRID or DAA.

**Access Control:** the process that checks whether a UE is allowed to access and to be granted services in a closed cell.

**Aerial UE communication**: functionality enabling Aerial UE function as defined in 23.17.

**Anchor carrier**: in NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Carrier frequency**: center frequency of the cell.

**Cell:** combination of downlink and optionally uplink resources. The linking between the carrier frequency of the downlink resources and the carrier frequency of the uplink resources is indicated in the system information transmitted on the downlink resources.

**Cell Group**: in dual connectivity, a group of serving cells associated with either the MeNB or the SeNB.

**CHO candidate cell: a** candidate cell for CHO, for which UE has been configured with a CHO configuration.

**Conditional Handover (CHO): a** handover procedure that is executed only when execution condition(s) are met.

**Control plane CIoT 5GS Optimisation**: Enables support of efficient transport of user data (IP, Ethernet and Unstructured) or SMS messages over control plane via the AMF without triggering user-plane resource establishment, as defined in TS 24.501 [91]. In the context of this specification, a NB-IoT UE that only supports Control plane CIoT 5GS Optimisation is a UE that does not support User plane CIoT 5GS Optimisation and NG-U data transfer but may support other CIoT 5GS Optimisations.

**Control plane CIoT EPS optimisation**: Enables support of efficient transport of user data (IP, non-IP or SMS) over control plane via the MME without triggering data radio bearer establishment, as defined in TS 24.301 [20]. In the context of this specification, a NB-IoT UE that only supports Control plane CIoT EPS optimisation is a UE that does not support User plane CIoT EPS optimisation and S1-U data transfer but may support other CIoT EPS optimisations.

**CSG Cell:** a cell broadcasting a CSG indicator set to true and a specific CSG identity.

**CSG ID Validation:** the process that checks whether the CSG ID received via handover messages is the same as the one broadcast by the target E-UTRAN.

**CSG member cell:** a cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN and for which the Permitted CSG list of the UE includes an entry comprising cell's CSG ID and the respective PLMN identity.

**DAPS Handover:** a handover procedure that maintains the source eNB connection after reception of RRC message for handover and until releasing the source cell after successful random access to the target eNB.

**DCN-ID:** DCN identity identifies a specific dedicated core network (DCN).

**Dual Connectivity**: mode of operation of a UE in RRC\_CONNECTED, configured with a Master Cell Group and a Secondary Cell Group.

**Early Data Forwarding**: data forwarding that is initiated before the UE executes the handover.

**en-gNB**: as defined in TS 37.340 [76].

**Ephemeris:** a set of parameters that describe the movement of an NTN node over time.

**E-RAB:** an E-RAB uniquely identifies the concatenation of an S1 Bearer and the corresponding Data Radio Bearer. When an E-RAB exists, there is a one-to-one mapping between this E-RAB and an EPS bearer of the Non Access Stratum as defined in [17].

**Feeder link:** wireless link between the NTN Gateway and the NTN payload.

**Frequency layer**: set of cells with the same carrier frequency.

**FeMBMS:** further enhanced multimedia broadcast multicast service.

**FeMBMS/Unicast-mixed cell**: cell supporting MBMS transmission and unicast transmission as SCell.

**Geosynchronous Orbit:** Earth-centred orbit at approximately 35,786 kilometres in altitude above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e in the Earth's equator plane.

**Handover**: procedure that changes the serving cell of a UE in RRC\_CONNECTED.

**Hybrid cell**: a cell broadcasting a CSG indicator set to false and a specific CSG identity. This cell is accessible as a CSG cell by UEs which are members of the CSG and as a normal cell by all other UEs.

**Late Data Forwarding**: data forwarding that is initiated after the source eNB knows that the UE has successfully accessed a target eNB.

**Local Home Network**: as defined in TS 23.401 [17].

**LTE bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in the eNB only to use eNB radio resources only.

**LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN to use both eNB and WLAN resources.

**LWAAP PDU**: in LTE-WLAN Aggregation, a PDU with DRB ID generated by LWAAP entity for transmission over WLAN.

**Make-Before-Break HO/SeNB change**: maintaining source eNB/SeNB connection after reception of RRC message for handover or change of SeNB before the initial uplink transmission to the target eNB during handover or change of SeNB.

**Mapped Cell ID**: in NTN, it corresponds to a fixed geographical area.

**Master Cell Group**: in dual connectivity, a group of serving cells associated with the MeNB, comprising of the PCell and optionally one or more SCells.

**Master eNB**: in dual connectivity, the eNB which terminates at least S1-MME.

**MBMS-dedicated cell**: cell dedicated to MBMS transmission.

**MBMS/Unicast-mixed cell**: cell supporting both unicast and MBMS transmissions.

**MCG bearer**: in dual connectivity, a bearer whose radio protocols are only located in the MeNB to use MeNB resources only.

**Membership Verification:** the process that checks whether a UE is a member or non-member of a hybrid cell.

**Multi-Connectivity**: Mode of operation whereby a multiple Rx/Tx UE in the connected mode is configured to utilise radio resources amongst E-UTRA and/or NR provided by multiple distinct schedulers connected via non-ideal backhaul.

**NB-IoT:** NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

**NB-IoT UE**: a UE that uses NB-IoT.

**ng-eNB:** node providing E-UTRA user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**Non-anchor carrier**: in NB-IoT, a carrier where the UE does not assume that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Non-geosynchronous orbit**: Earth-centred orbit with an orbital period that does not match Earth's rotation on its axis. This includes Low Earth Orbit (LEO) and Medium Earth Orbit (MEO).

**Non-terrestrial networks:** an E-UTRAN consisting of eNBs, which provide non-terrestrial LTE access to UEs by means of an NTN payload embarked on a space-borne NTN vehicle and an NTN Gateway.

**NR:** NR radio access

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [93], between two or more nearby UEs, using NR technology but not traversing any network node.

**NTN Gateway:** an earth station located at the surface of the earth, providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a TNL node.

**NR NTN:** an NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne and space-borne NTN vehicle and an NTN Gateway.

**NTN payload:** a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service link and the feeder link. In the current version of this specification, the NTN payload is a TNL node.

**PLMN ID Check:** the process that checks whether a PLMN ID is the RPLMN identity or an EPLMN identity of the UE.

**Power saving mode**: mode configured and controlled by NAS that allows the UE to reduce its power consumption, as defined in TS 24.301 [20], TS 23.401 [17], TS 23.682 [57].

**Primary PUCCH group:** a group of serving cells including PCell whose PUCCH signalling is associated with the PUCCH on PCell.

**Primary Timing Advance Group**: Timing Advance Group containing the PCell. In this specification, Primary Timing Advance Group refers also to Timing Advance Group containing the PSCell unless explicitly stated otherwise.

**ProSe-enabled Public Safety UE:** a UE that the HPLMN has configured to be authorized for Public Safety use, and which is ProSe-enabled and supports ProSe procedures and capabilities specific to Public Safety. The UE may, but need not, have a USIM with one of the special access classes {12, 13, 14}.

**ProSe Per-Packet Priority:** a scalar value associated with a protocol data unit that defines the priority handling to be applied for transmission of that protocol data unit.

**ProSe UE-to-Network Relay:** a UE that provides functionality to support connectivity to the network for Remote UE(s).

**ProSe UE-to-Network Relay Selection:** Process of identifying a potential ProSe UE-to Network Relay, which can be used for connectivity services (e.g. to communicate with a PDN).

**ProSe UE-to-Network Relay Reselection:** process of changing previously selected ProSe UE-to-Network Relay and identifying potential a new ProSe UE-to-Network Relay, which can be be used for connectivity services (e.g. to communicate with PDN).

**Public Safety ProSe Carrier:** carrier frequency for public safety sidelink communication and public safety sidelink discovery.

**PUCCH group:** either primary PUCCH group or a secondary PUCCH group.

**PUCCH SCell:** a Secondary Cell configured with PUCCH.

**RACH-less HO/SeNB change**: skipping random access procedure during handover or change of SeNB.

**Receive Only Mode:** See TS 23.246 [48].

**Remote UE:** a ProSe-enabled Public Safety UE, that communicates with a PDN via a ProSe UE-to-Network Relay.

**Satellite:** a space-borne vehicle orbiting the Earth that carries the NTN payload.

**SCG bearer**: in dual connectivity, a bearer whose radio protocols are only located in the SeNB to use SeNB resources.

**Secondary Cell Group**: in dual connectivity, a group of serving cells associated with the SeNB, comprising of PSCell and optionally one or more SCells.

**Secondary eNB**: in dual connectivity, the eNB that is providing additional radio resources for the UE but is not the Master eNB.

**Secondary PUCCH group:** a group of SCells whose PUCCH signalling is associated with the PUCCH on the PUCCH SCell.

**Secondary Timing Advance Group**: Timing Advance Group containing neither the PCell nor PSCell.

**Service link:** wireless link between the NTN payload and the UE.

**Short Processing Time**: For 1 ms TTI length, the operation with short processing time in UL data transmission and DL data reception.

**Short TTI:** TTI length based on a slot or a subslot.

**Sidelink**: UE to UE interface for sidelink communication, V2X sidelink communication and sidelink discovery. The Sidelink corresponds to the PC5 interface as defined in TS 23.303 [62].

**Sidelink Control period**: period over which resources are allocated in a cell for sidelink control information and sidelink data transmissions. The Sidelink Control period corresponds to the PSCCH period as defined in TS 36.213 [6].

**Sidelink communication**: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [62], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. In this version, the terminology "sidelink communication" without "V2X" prefix only concerns PS unless specifically stated otherwise.

**Sidelink discovery**: AS functionality enabling ProSe Direct Discovery as defined in TS 23.303 [62], using E-UTRA technology but not traversing any network node.

**Split bearer**: in dual connectivity, a bearer whose radio protocols are located in both the MeNB and the SeNB to use both MeNB and SeNB resources.

**Split LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN to use both eNB and WLAN radio resources.

**Switched LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN but uses WLAN radio resources only.

**Timing Advance Group**: a group of serving cells that is configured by RRC and that, for the cells with an UL configured, use the same timing reference cell and the same Timing Advance value.

**User plane CIoT 5GS Optimisation**: Enables support for change from 5GMM-IDLE mode to 5GMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.501 [91].

**User plane CIoT EPS optimisation**: Enables support for change from EMM-IDLE mode to EMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.301 [20].

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [72], between nearby UEs, using E-UTRA technology but not traversing any network node.

**WLAN Termination**: the logical node that terminates the Xw interface on the WLAN side.

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# 7 RRC

## 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;

- *SystemInformationBlockType33* contains assistance information for neighbouring NTN and NR NTN cells.

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;

- *SystemInformationBlockType33-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.

# 10 Mobility

## 10.2 Inter RAT

### 10.2.0 General

Service-based redirection between GERAN / UTRAN and E-UTRAN is supported in both directions. This should not require inter-RAT reporting in RRC CONNECTION REQUEST.

### 10.2.1 Cell reselection

A UE in RRC\_IDLE performs cell reselection. The principles of this procedure are as follows:

- The UE makes **measurements** of attributes of the serving and neighbour cells to enable the reselection process:

- For a UE to search and measure neighbouring GERAN cells, the ARFCNs of the BCCH carriers need to be indicated in the serving cell system information (i.e., an NCL). The NCL does not contain BSICs or cell specific offsets and Qrxlevmin is given per frequency band.

- For a UE to search and measure neighbouring UTRAN cells, the serving cell can indicate an NCL containing a list of carrier frequencies and scrambling codes.

- For a UE to search and measure neighbouring NR cells, the serving cell can indicate the measured RS types and parameters for cell quality derivation.

- Measurements may be omitted if the serving cell attribute fulfils particular search or measurement criteria.

- **Cell reselection** identifies the cell that the UE should camp on. It is based on cell reselection criteria which involves measurements of the serving and neighbour cells:

- Inter-RAT reselection is based on absolute priorities where UE tries to camp on highest priority RAT available. Absolute priorities for inter-RAT reselection are provided only by the RPLMN and valid only within the RPLMN; priorities are given by the system information and valid for all UEs in a cell, specific priorities per UE can be signalled in the RRC Connection Release message. A validity time can be associated with UE specific priorities.

- It should be possible to prevent the UE from reselecting to specific detected neighbouring cells;

- The UE is allowed to "leave" the source E-UTRAN cell to read the target GERAN cell broadcast, in order to determine its "suitability", prior to completing the cell reselection;

- Cell reselection can be speed dependent (speed detection based on UTRAN solution);

Cell access restrictions apply as for UTRAN, which consist of access class (AC) barring and cell reservation (e.g. for cells "reserved for operator use") applicable for mobiles in RRC\_IDLE mode.

When performing cell reselection while the UE is camped on another RAT, the principles of this procedure are as follows:

- The UE measures attributes of the E-UTRA neighbouring cells:

- Only the carrier frequencies need to be indicated to enable the UE to search and measure E-UTRA neighbouring cells;

- Cell reselection identifies the cell that the UE should camp on. It is based on cell reselection criteria which involves measurements of the serving and neighbour cells:

- For E-UTRA neighbouring cells, there is no need to indicate cell-specific cell reselection parameters i.e. these parameters are common to all neighbouring cells on an E-UTRA frequency;

- Cell reselection parameters are applicable to all UEs in a cell, but it is possible to configure specific reselection parameters per UE group or per UE.

- It should be possible to prevent the UE from reselecting to specific detected neighbouring cells.

### 10.2.2 Handover

Inter RAT HO is designed so that changes to GERAN, UTRAN and NR are minimised. This can be done by following the principles specified for GERAN to/from UTRAN intersystem HO. In particular the following principles are applied to E-UTRAN Inter RAT HO design:

1. Inter RAT HO is network controlled through source access system. The source access system decides about starting the preparation and provides the necessary information to the target system in the format required by the target system. That is, the source system adapts to the target system. The actual handover execution is decided in the source system.

2. Inter RAT HO is backwards handover, i.e. radio resources are prepared in the target 3GPP access system before the UE is commanded by the source 3GPP access system to change to the target 3GPP access system.

3. To enable backwards handover, and while RAN level interfaces are not available, a control interface exists in CN level. In Inter RAT HO involving E-UTRAN access, this interface is between:

- 2G/3G SGSN and corresponding MME/Serving Gateway;

- AMF/UPF and corresponding MME/Serving Gateway.

4. The target access system will be responsible for giving exact guidance for the UE on how to make the radio access there (this includes radio resource configuration, target cell system information etc.). This information is given during the handover preparation and should be transported completely transparently through the source access system to the UE.

5. Mechanisms for avoiding or mitigating the loss of user data (i.e. forwarding) can be used until the 3GPP Anchor determines that it can send DL U-plane data directly to the target system.

6. The handover procedure should not require any UE to CN signalling in order for data to start to flow in the target system. This requires that the security context, UE capability context and QoS context is transferred (or translated) within the network between source and target system.

7. Similar handover procedure should apply for handovers of both real time and non-real time services.

8. Similar handover procedure should apply for Inter RAT Handover, intra-LTE Handover with EPC node change, and intra-E-UTRA inter-system Handover.

9. Network controlled mobility is supported even if no prior UE measurements have been performed on the target cell and/or frequency i.e. "blind HO" is supported.

10. Inter-RAT HO from E-UTRA with EN-DC configuration to GERAN/UTRAN/NR is supported.

11. Inter-RAT HO from GERAN/UTRAN to E-UTRA with EN-DC configuration is not supported.

12. Inter-RAT HO from NR standalone to E-UTRA with EN-DC configuration is supported.

NOTE: It is up to the E-UTRA network, if possible, to avoid handover attempts of an (e)RedCap UE to a target NR cell not supporting (e)RedCap (see TS 38.300 [79]).

### 10.2.2a Inter-RAT cell change order to GERAN with NACC

For interworking towards GERAN, inter-RAT cell change order with NACC is supported even if no prior UE measurements have been performed on the system i.e. "blind NACC" is supported.

### 10.2.2b Inter-RAT handovers from E-UTRAN

#### 10.2.2b.1 Data forwarding

##### 10.2.2b.1.1 For RLC-AM bearers

Upon handover, the eNB may forward all downlink PDCP SDUs that have not been acknowledged by the UE, or all downlink PDCP SDUs that have not been transmitted to the UE, to the target node. In addition, the eNB may forward fresh data arriving over S1 to the target node.

NOTE: Any assigned PDCP SNs are not forwarded because of PDCP reset.

NOTE: Target node does not have to wait for the completion of forwarding from the eNB before it begins transmitting packets to the UE.

The eNB discards any remaining downlink RLC PDUs.

Upon handover, all successfully received PDCP SDUs are delivered to the upper layers in the UE.

NOTE: eNB does not need to abort ongoing RLC transmissions with the UE as it starts data forwarding to the target node.

Upon handover, the eNB may forward uplink PDCP SDUs successfully received to the Serving Gateway and shall discard any remaining uplink RLC PDUs.

Correspondingly, the eNB does not forward the downlink and uplink RLC context.

For the uplink, the UE transmits over the target RAT from the first PDCP SDU for which transmission has not been attempted in the source cell.

In-sequence delivery of upper layer PDUs during handover is not guaranteed.

##### 10.2.2b.1.2 For RLC-UM bearers

Upon handover, the eNB does not forward to the target node downlink PDCP SDUs for which transmission had been completed in the source cell. PDCP SDUs that have not been transmitted may be forwarded. In addition, the eNB may forward fresh data arriving over S1 to the target node. The eNB discards any remaining downlink RLC PDUs.

Upon handover, all successfully received PDCP SDUs are delivered to the upper layers in the UE.

Upon handover, the eNB may forward all uplink PDCP SDUs successfully received to the Serving Gateway and discards any remaining uplink RLC PDUs.

For the uplink, the UE transmits over the target RAT from the first PDCP SDU for which transmission has not been attempted in the source cell.

Correspondingly, the eNB does not forward the downlink and uplink RLC context.

### 10.2.2c Intra-EUTRA inter-system Handover

For intra-EUTRA handover, the source node decides whether to trigger inter-system HO (with CN type change) or intra-system HO (without CN type change). The UE gets the knowledge of the target CN type from handover command during handover procedure.

### 10.2.3 Measurements

#### 10.2.3.1 Inter-RAT handovers from E-UTRAN

Measurements to be performed by a UE for inter-RAT mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC\_CONNECTED state, a UE shall follow the measurement parameters specified by RRC directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT\_CONTROL).

UE performs inter-RAT neighbour cell measurements during DL/UL idle periods that are provided by the network through suitable DRX/DTX period or packet scheduling if necessary.

#### 10.2.3.2 Inter-RAT handovers to E-UTRAN

From UTRAN, UE performs E-UTRAN measurements by using idle periods created by compressed mode (CELL\_DCH) or DRX (other states) or measurement occasions (CELL\_FACH).

From GERAN, E-UTRAN measurements are performed in the same way as WCDMA measurements for handover to UTRAN: E-UTRAN measurements are performed in GSM idle frames in a time multiplexed manner.

For NR, UE performs E-UTRAN measurements according to the measurement configuration decided by gNB.

#### 10.2.3.3 Inter-RAT cell reselection from E-UTRAN

In RRC\_IDLE state, a UE shall follow the measurement parameters specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control is possible through the provision of UE specific priorities (see clause 10.2.4).

#### 10.2.3.4 Limiting measurement load at UE

Introduction of E-UTRA implies co-existence of various UE capabilities. Each UE may support different combinations of RATs, e.g., E-UTRA, UTRA, GSM, and non-3GPP RATs, and different combinations of frequency bands, e.g., 800 MHz, 1.7 GHz, 2 GHZ, etc. Despite such heterogeneous environment, the measurement load at UE should be minimised. To limit the measurement load and the associated control load:

- E-UTRAN can configure the RATs to be measured by UE;

- The number of measurement criteria (event and periodic reporting criteria) should be limited (as in TS 25.133 [7] clause 8.3.2);

- E-UTRAN should be aware of the UE capabilities for efficient measurement control, to prevent unnecessary waking up of the measurement entity;

- Blind HO (i.e., HO without measurement reports from UE) is possible.

#### 10.2.3.5 Inter-RAT measurements in RRC\_IDLE or RRC\_INACTIVE

Network may request UE to measure NR carriers in RRC\_IDLE or RRC\_INACTIVE via system information or via dedicated measurement configuration in RRC Connection Release. The UE performs the requested measurements and provides indication of the availability of measurement report to the eNB during RRC Connection Setup or Resume procedure. The network may request UE to report those measurements after security activation. The request for the measurements can be sent by the network immediately after transmitting the Security Mode Command (i.e. before the reception of the Security Mode Complete from the UE). Alternatively, during connection resume from suspended RRC connection or from RRC\_INACTIVE, the eNB can request the UE to provide the idle/inactive measurement results in the *RRCConnectionResume* message and then the UE can include the available measurement results in the *RRCConnectionResumeComplete* message.

### 10.2.4 Network Aspects

Inter-frequency/inter-RAT UE based mobility relies on a "priority based scheme", where the network configures a list of RATs/frequencies to be taken as basis for UE's inter-frequency/inter-RAT cell reselection decisions in priority order. E-UTRAN cells can enable inter-frequency/inter-RAT cell reselection by broadcasting a common priority valid for all UEs in a given cell in addition to other inter-frequency/inter-RAT information.

NOTE: The same principles apply in UTRAN.

These common priorities can be overwritten by E-UTRAN through dedicated signalling to individual UEs at RRC\_CONNECTED to RRC\_IDLE transition.

NOTE: In order to have consistent inter-RAT operation, the same principles apply to inter-RAT reselection to E-UTRAN. For UTRAN this includes also the transitions within RRC\_CONNECTED state from CELL\_DCH to CELL\_PCH and URA\_PCH.

Setting dedicated priorities by E-UTRAN can be based on subscription related information provided by the MME.

Based on operator policy the eNBs may be configured to always integrity protect the redirection to GERAN as described in TS 33.401 [22].

### 10.2.5 CS fallback

CS fallback can be performed via different options. The following table summarize the various CS fallback options per RAT, necessary UE capabilities and FGI index which should be set to '1'. The meaning of FGI index is specified in TS 36.331 [16], Annex B.

Table 10.2.5-1: CS fallback options

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Target RAT | Solutions | Release | UE Capability | FGI Index |
| CS fallback to UMTS | RRC Connection Release with Redirection without Sys Info | Rel-8 | (NOTE 1)  Mandatory for UEs supporting CS fallback to UMTS |  |
| RRC Connection Release with Redirection with Sys Info | Rel-9 | (NOTE 1)  e-RedirectionUTRA |  |
| PS handover with DRB(s) | Rel-8 | (NOTE 1)  Mandatory for UEs supporting CS fallback to UMTS | FGI8, FGI22 |
| CS fallback to GSM | RRC Connection Release with Redirection without Sys Info | Rel-8 | (NOTE 2)  Mandatory for UEs supporting CS fallback to GSM |  |
| RRC Connection Release with Redirection with Sys Info | Rel-9 | (NOTE 2)  Mandatory for UEs supporting CS fallback to GSM |  |
| Cell change order without NACC | Rel-8 | (NOTE 2)  Mandatory for UEs supporting CS fallback to GSM | FGI10 |
| Cell change order with NACC | Rel-8 | (NOTE 2)  Mandatory for UEs supporting CS fallback to GSM | FGI10 |
| PS handover | Rel-8 | (NOTE 2)  interRAT-PS-HO-ToGERAN |  |
| NOTE 1: All CS fallback to UMTS capable UE shall indicate that it supports UTRA FDD or TDD and supported band list in the UE capability.  NOTE 2: All CS fallback to GSM capable UE shall indicate that it supports GERAN and supported band list in the UE capability.  NOTE 3: The measurement may be performed before any of the above CS fallback solution is triggered to select the target cell or frequency layer more accurately based on eNB decision. eNB may trigger any of above CS fallback solutions blindly. | | | | |

### 10.2.6 Idle mode Inter-RAT Cell Selection to/from NB-IoT

NB-IoT may provide assistance information for inter-RAT cell selection to E-UTRAN/GERAN and E-UTRAN may provide assistance information for inter-RAT cell selection to NB-IoT. A UE may use the assistance information provided by the network for cell selection to/from NB-IoT.

### 10.2.XX Inter-RAT Cell reselection to NR NTN

E-UTRAN supports inter-RAT cell reselection in RRC\_IDLE and RRC\_INACTIVE to NR NTN. E-UTRAN provides NR NTN payload assistance information to assist UEs in searching and measuring NR NTN cells.

*END OF CHANGE*

# Related Agreements

## RAN2#125bis

### 8.8.6 LTE to NR NTN mobility

Agreement:

1. For idle mode mobility from LTE to NR NTN, at least normal LTE UE are in scope. Can come back in the next meeting to check if also eMTC UE and NB-IoT UEs could also be considered in scope

Working Assumption:

1. We don’t introduce multiple SMTCs in LTE

## RAN2#126

### 8.8.6 LTE to NR NTN mobility

Agreements:

1. For idle mode mobility from EUTRA TN to NR NTN, NB-IoT UEs are considered not in the scope.
2. For idle mode mobility from EUTRA TN to NR NTN, we don’t consider specific optimizations for BL UEs and UEs in CE.
3. SIB24 is reused to provide the NR NTN cell reselection related information (e.g. frequency information, SMTC config, etc.), introducing a satellite ID list in per frequency. The EUTRA cell provides the satellite assistance information for NR neighbor cell per satellite, as identified by the satellite ID.

4. To support the idle mode mobility from EUTRA TN to NR NTN, the satellite assistance information for NR NTN neighbor cells is needed and should include the following parameters:

- Satellite ephemeris information

- TA common information

- k-Mac

- epoch time

- validity duration

- ntn-PolarizationDL (FFS if mandatory or optional)

5. The Ephemeris information/epoch time/k-mac/validity duration IEs defined in SIB33 specified in TS36.331 should be reused for NR satellite assistance information.

6. The signalling format for ntn-PolarizationDL and TA common related configurations within NTN-Config specified in TS38.331 should be introduced in TS36.331 for NR satellite assistance information.

7. RAN2 will decide in the next meeting which of the following options to adopt for the provision of the NR satellite assistance information (based on TPs provided by the WI RRC Rapporteur):

Option 1: Introduce a new SIB to include the NR satellite assistance information.

Option 2: Define new IE for NR satellite assistance information and define separate neighbour satellite information list to provide the NR satellite information in SIB33.

Option 3: Extend the NeighSatelliteInfo defined for IoT NTN to include the parameters needed for NR satellite, and reuse the neighSatelliteInfoList defined in SIB33 to provide either NR or IoT NTN information.

8. Introduce the clarification in the field description of measTimingConfig (configured via SIB24 in TS 36.331) that it is configured based on the assumption that the gNB-UE propagation delay equals to 0 ms, and UE can adjust the offset based on the actual propagation delay, when the corresponding frequency is associated with a satellite ID.

Working Assumption:

1. NR NTN cell reselection evaluation is based on RRM measurements as legacy; no spec impact foreseen for EUTRA TN to NR NTN cell (can come back in the next meeting to see if the WA can be confirmed)

## RAN2#127

### 8.8.6 LTE to NR NTN mobility

Agreements:

1. Define new IE for NR satellite assistance information and define separate neighbour satellite information list to provide the NR satellite information in SIB33.

2. The ntn-PolarizationalDL is optional.

3. Reuse the SatelliteId-r18 to identify either an NR satellite or an IoT NTN satellite

4. Consider a solution that avoids repeating the ephemeris for a satellite which provides both IoT NTN and NR NTN cells

5. maxSat-r17 (4) is reused for the maximum number of NR satellites.

6. RAN2 will not do further work to introduce multiple SMTCs in LTE

7. NR NTN cell reselection evaluation is based on RRM measurements as legacy; no spec impact foreseen for EUTRA TN to NR NTN cell.

8. RAN2 confirms that measurements of NR NTN cells for a UE in E-UTRAN TN RRC\_INACTIVE are supported, with the understanding that UE moves to RRC idle upon selecting the NR NTN cell

9. Introduce a new UE capability without signalling for LTE TN to NR NTN mobility.