**3GPP TSG-RAN WG2 Meeting #115 R2-210xxxx**

**Electronic Meeting, August 09 – August 27, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.304** | **CR** |  | **rev** | **0** | **Current version:** | **16.5.0** |  |
|  |
| *For* [***HELP***](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:***  | 38.304 running CR for NR MBS |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_MBS-Core |  | ***Date:*** | 2021-09-09 |
|  |  |  |  |  |
| ***Category:*** | ***B*** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Introduction of MBS support in NR. |
|  |  |
| ***Summary of change:*** | Introduction of MBS support in NR. |
|  |  |
| ***Consequences if not approved:*** | NR MBS is not supported in NR. This version captures the following agreements from RAN2#115-e,* The UE is allowed to prioritize the MBS frequency of interest when the cell of the MBS frequency provides MBS SIB carrying the MCCH configuration, as LTE SC-PTM.
* The UE is allowed to prioritize the MBS frequency of interest when the UE is only capable of receiving the MBS service by camping on the MBS frequency, as LTE SC-PTM.
* The UE may consider cell reselection candidate frequencies at which it cannot receive the MBS service to be of the lowest priority during the MBS session, as LTE SC-PTM.
* Working assumption: The mapping between frequency and MBS service ID (e.g. SAI) is provided in the upper layer signalling (e.g. USD), as LTE SC-PTM. (The detailed information included in the upper layer (e.g. USD) is up to the decision of other WGs)
* The mapping between frequency and MBS service ID (e.g. SAI) is provided in SIB, as LTE SC-PTM. The detailed mapping is pending for the feedbacks of other WGs.
* The mapping between frequency and MBS service ID (e.g. SAI) is allowed to be sent in cells not broadcasting MBS service, as LTE SC-PTM.
* The mapping between frequency and MBS service ID (e.g. SAI) is provided in a new SIB different from the MBS SIB providing the MCCH configuration, as LTE SC-PTM.
* An ID (e.g. SAI) of MBS services is provided in SIB and USD, as LTE SC-PTM. The details of the ID is pending for the feedbacks of other WGs.
* The extra offset to cell (which provides the MBS service) for the cell ranking criterion is not supported in Rel-17.
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*First Modified Subclause*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.300: "NR Overall Description; Stage 2".

[3] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) - Protocol Specification".

[4] 3GPP TS 38.213: "NR; Physical layer procedures for control ".

[5] Void

[6] 3GPP TS 36.331: "E-UTRA; Radio Resource Control (RRC) - Protocol Specification".

[7] 3GPP TS 36.304: "E-UTRA; User Equipment (UE) procedures in RRC\_IDLE state ".

[8] 3GPP TS 38.133: "NR; Requirements for Support of Radio Resource Management".

[9] 3GPP TS 23.122: "NAS functions related to Mobile Station (MS) in RRC\_IDLE state".

[10] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[11] 3GPP TS 38.215: "NR; Physical layer measurements".

[12] 3GPP TS 22.261: "Service requirements for the 5G system".

[13] 3GPP TS 24.890: "5G System – Phase 1; CT WG1 Aspects".

[14] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[15] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[16] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[17] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[18] 3GPP TS 22.011: "Service accessibility".

[xx] 3GPP TS 38.321: "NR; Medium Access Control (MAC); Protocol specification".[yy] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[zz] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services; Stage 2"

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**Acceptable Cell:** A cell that satisfies certain conditions as specified in 4.5.

**Allowed CAG list:** A per-PLMN list of CAG Identifiers the UE is allowed to access (see TS 23.501 [10])**.**

**Available PLMN(s):** One or more PLMN(s) for which the UE has found at least one cell and read its PLMN identity(ies).

**Available SNPN(s):** One or more SNPN(s) for which the UE has found at least one cell and read its SNPN identity(ies).

**Barred Cell**: A cell a UE is not allowed to camp on.

**CAG cell**: A cell broadcasting at least one Closed Access Group Identifier.

**Camped on a cell:** UE has completed the cell selection/reselection process and has chosen a cell. The UE monitors system information and (in most cases) paging information.

**Camped on any cell**: UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell irrespective of PLMN identity.

**Closed Access Group Identifier**: Identifier of a CAG within a PLMN.

**Commercial Mobile Alert System:** Public Warning System that delivers *Warning Notifications* provided by *Warning Notification Providers* to CMAS capable UEs.

**eCall Only Mode:** A UE configuration option that allows the UE to register at 5GC and register in IMS to perform only eCall Over IMS, and a non-emergencyIMS call for test and/or terminal reconfiguration services.

**EHPLMN:** Any of the PLMN entries contained in the Equivalent HPLMN list TS 23.122 [9].

**Equivalent PLMN list:** List of PLMNs considered as equivalent by the UE for cell selection, cell reselection, and handover according to the information provided by the NAS.

**Home PLMN:** A PLMN where the Mobile Country Code (MCC) and Mobile Network Code (MNC) of the PLMN identity are the same as the MCC and MNC of the IMSI.

**Network Identifier**: Identifier of an SNPN in combination with a PLMN ID (TS 23.501 [10]).

**Non-Public Network:** A network deployed for non-public use, as defined in TS 22.261 [12].

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [16], between two or more nearby UEs, using NR technology but not traversing any network node.

**Process:** A local action in the UE invoked by an RRC procedure or an RRC\_IDLE or RRC\_INACTIVE state procedure.

**Radio Access Technology:** Type of technology used for radio access, for instance NR or E-UTRA.

**Registration Area**: (NAS) registration area is an area in which the UE may roam without a need to perform location registration, which is a NAS procedure.

**Registered PLMN:** This is the PLMN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

**Registered SNPN**: This is the SNPN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

**Reserved Cell**: A cell on which camping is not allowed, except for particular UEs, if so indicated in the system information.

**Selected PLMN:** This is the PLMN that has been selected by the NAS, either manually or automatically.

**Selected SNPN**: This is the SNPN that has been selected by the NAS, either manually or automatically.

**Serving cell:** The cell on which the UE is camped.

**Sidelink:** UE to UE interface for V2X sidelink communication defined in TS 23.287[16].

**SNPN Access Mode:** Mode of operation wherein UE only selects SNPNs (as defined in TS 23.501 [10]).

**SNPN identity**: An identifier of an SNPN comprising of a PLMN ID and an NID combination.

**Strongest cell:** The cell on a particular frequency that is considered strongest according to the layer 1 cell search procedure (TS 38.213 [4], TS 38.215 [11]).

**Suitable Cell:** This is a cell on which a UE may camp. For NR cell, the criteria are defined in clause 4.5, for E-UTRA cell in TS 36.304 [7].

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [17], between nearby UEs, using E-UTRA technology but not traversing any network node.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AS Access Stratum

CAG Closed Access Group

CAG-ID Closed Access Group Identifier

CMAS Commercial Mobile Alert System

CN Core Network

DCI Downlink Control Information

ETWS Earthquake and Tsunami Warning System

E-UTRA Evolved UMTS Terrestrial Radio Access

E-UTRAN Evolved UMTS Terrestrial Radio Access Network

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

IMSI International Mobile Subscriber Identity

MBS Multicast/ Broadcast Services

MCC Mobile Country Code

MCCH MBS Control Channel

MICO Mobile Initiated Connection Only

MRB MBS Radio Bearer

MTCH MBS Traffic Channel

NAS Non-Access Stratum

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

PLMN Public Land Mobile Network

RAT Radio Access Technology

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RRC Radio Resource Control

SNPN Stand-alone Non-Public Network

UAC Unified Access Control

UE User Equipment

UMTS Universal Mobile Telecommunications System

V2X Vehicle to Everything

*Next Modificatcion*

# 4 General description of RRC\_IDLE state and RRC\_INACTIVE state

## 4.1 Overview

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection (for UE not operating in SNPN access mode) or SNPN selection (for UE operating in SNPN access mode);

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, SNPN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN or SNPN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) or a SNPN is selected by NAS. For the selected PLMN/SNPN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN or selected SNPN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN/SNPN then becomes the registered PLMN/SNPN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

For UE not operating in SNPN access mode, search of available CAGs may be triggered by NAS to support manual CAG selection. The AS shall report available CAG-ID(s) together with their HRNN (if broadcast) and PLMN(s) to the NAS.

If the UE loses coverage of the registered PLMN/SNPN, either a new PLMN/SNPN is selected automatically (automatic mode), or an indication of available PLMNs/SNPNs is given to the user so that a manual selection can be performed (manual mode). As part of manual SNPN selection, the AS shall report available SNPN identifiers together with their HRNN (if broadcast) to the NAS.

Registration is not performed by UEs only capable of services that need no registration.

The UE may perform NR sidelink communication and/or V2X sidelink communication while in-coverage or out-of-coverage for sidelink, as specified in clause 8.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state isas follows:

a) It enables the UE to receive system information from the PLMN or the SNPN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

e) It enables the UE to receive MBS broadcast services.Editor’s note: To align with other RAN2 spec, the term “MBS broadcast services” may be changed later if needed.*Next Modificatcion*

### 5.2.4 Cell Reselection evaluation process

#### 5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

If the MBS capable UE is receiving or interested to receive an MBS session(s) with delivery mdoe 2 and can only receive this MBS broadcast service(s) by camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBS broadcast session [2] as long as the two following conditions are fulfilled:

Editor’s note: FFS whether there is a seperate capability for MBS Broadcast and MBS Multicast or a single MBS capability.

Editor’s note:FFS if there is a need to prioritize a frequency with multicast support for idle/inactive UEs that monitor multicast activation notification.

1) The reselection candidate cell is broadcasting SIBx;

Editor’s note: SIBx is the MBS SIB carrying the MCCH configuration. The name of SIBx will be updated according to [3] later.

Editor’s note: FFS whether UE needs to read the SIBx of the candidate cell before cell reselection. As an alternative, UE may determine whether the reselection candidate cell is broadcasting SIBx based on whether the scheduling info of SIBx is present in SIB1 of the reselection candidate cell or not.

Editor’s note: FFS whether UE should stop to prioritize the frequency if SIBx is not scheduled on the serving cell(i.e. reselected cell) anymore.

2) Either

- One or more IDs (e.g. SAI) of that frequency are indicated in SIBy of the serving cell and the same ID(s) is/are also indicated for this MBS broadcast service in MBS User Service Description (USD), or

Editor’s note: FFS whether frequency in USD should also be check when One or more IDs (e.g. SAI) of that frequency are indicated in SIBy of the serving cell.

- SIBy is not broadcast in the serving cell and that frequency is included in the USD of this service.

Editor’s note: SIBy is the SIB providing the mapping between frequency and MBS service ID (e.g. SAI). The name of SIBy will be updated according to [3] later.

 Editor’s note: The details of the ID (e.g. SAI) of MBS services in SIB and USD is pending for the feedbacks of other WGs,the description above may be updated if necessary based on feedback from other WGs.

Editor’s note: The term “USD” may be updated if needed based on SA4 conclusion.

If the MBS capable UE is receiving or interested to receive an MBSsession(s) with delivery mode 2, the UE may consider cell reselection candidate frequencies at which it can not receive the MBS broadcast service to be of the lowest priority during the MBS broadcast session [2], as long as the condition 1) above is fulfilled for the cell on the MBS frequency which the UE monitors and as long as the condition 2) above is fulfilled for the serving cell.In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- the UE receives an *RRCRelease* message with the field *cellReselectionPriorities* absent; or

- a PLMN selection or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any black listed cells as candidate for cell reselection.

The UE shall consider only the white listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

*Next Modificatcion*

# 6 Reception of broadcast information

## 6.1 Reception of system information

The NAS is informed if the cell selection and reselection results in changes in the received NAS system information.

The UE shall monitor the Paging Occasions (POs) as described in clause 7.1 to receive System Information change notifications in RRC\_IDLE and RRC\_INACTIVE. The changes in the system information are notified by the network using a Short Message as specified in TS 38.331 [3]. When the Short Message notifies system information changes, then the UE shall acquire or re-acquire the concerned system information as specified in TS 38.331 [3].

## 6.2 MCCH reception

A UE receiving or interested to receive MBS session(s) with delivery mode 2 shall apply the MCCH information acquisition procedure as specified in [3] to receive the MCCH information upon entering a new cell and upon receiving a notification that the MCCH information has changed. A UE interested to receive MBS services identifies if a service that it is interested to receive is started or ongoing by receiving the MCCH information, and then receives the interest MBS session according to the MBS service reception procedure for delivery mode 2 in [3].

UEs joining a multicast session in RRC IDLE/INACTIVE state shall apply the paging message reception procedure as specified in [3] to receive the group activation notification for the multicast session.

~~Editor’s note: FFS whether to support reception of MBS Multicast services in RRC\_INACTIVE state.~~

*End of Modificatcion*

*Next Modificatcion*

# 7 Paging

## 7.1 Discontinuous Reception for paging

The UE may use Discontinuous Reception (DRX) in RRC\_IDLE and RRC\_INACTIVE state in order to reduce power consumption. The UE monitors one paging occasion (PO) per DRX cycle. A PO is a set of PDCCH monitoring occasions and can consist of multiple time slots (e.g. subframe or OFDM symbol) where paging DCI can be sent (TS 38.213 [4]). One Paging Frame (PF) is one Radio Frame and may contain one or multiple PO(s) or starting point of a PO.

……….

5G-S-TMSI is a 48 bit long bit string as defined in TS 23.501 [10]. 5G-S-TMSI shall in the formulae above be interpreted as a binary number where the left most bit represents the most significant bit.

For the non-MBS supporting gNB, the multicast session activation/re-activation notification is sent to the related RRC\_IDLE/RRC\_CONNECTED UE joining the multicast session using the UE’s 5G-S-TMGI in the PO calculated with UE-ID.

## 7.2 Reception of group activation notification for multicast session

For the MBS supporting gNB, the multicast session activation/re-activation notification is sent to the related RRC\_IDLE/RRC\_CONNECTED UE joining the multicast session using the MBS session ID in the extended paging message on PCCH using P-RNTI in the PO calculated with UE-ID.

# Annex - collection of RAN2 agreements on NR MBS WI

RAN2#111-E agreements

* Focus initially on NR SA, TBD to what extent other scenarios NR DC, NE DC can be supported.
* Confirm Will support PTM transmission in a cell.
* Confirm that We will, for multicast services introduce support for PTP and PTM transmission of shared traffic delivered by 5GC, at least for connected mode (this is not intended to exclude other cases)
* For a UE, gNB dynamically decides whether to deliver multicast data by PTM or PTP (Shared delivery)
* FFS which layer(s) handles reliability (in general), in order delivery / duplicate handling, and it is FFS how it works at PTM PTP switch.
* Focus on MBS-MBS scenario initially (i.e. shared delivery), including both PTM and PTP (if applicable). Other scenarios later, TBD.
* Requirements for lossless mobility are TBD. Assume for now that R2 will anyway discuss service continuity functionality for low or no data loss.
* R2 assumes that for Rel-17 NR multicast Mobility in Connected mode, handover (including variants) is the baseline, TBD exactly which variants.
* R2 expect that there may be HARQ with feedback (for PTM) and this is specified by R1.

RAN2#112-e agreements

***Broadcast and multicast sessions support, RRC states and other aspects related to SA2 LS***

* For Rel-17, R2 specifies two *modes*:

 **1: One *delivery mode* for high QoS (reliability, latency) requirement, to be available in CONNECTED (possibly the UE can switch to other states when there is no data reception TBD)**

 **2: One *delivery mode* for “low” QoS requirement, where the UE can also receive data in INACTIVE/IDLE (details TBD).**

 **R2 assumes (for R17) that delivery mode 1 is used only for multicast sessions.**

 **R2 assumes that delivery mode 2 is used for broadcast sessions.**

 **The applicability of delivery mode 2 to multicast sessions is FFS.**

* No data: When there is no data ongoing for the multicast session, the UE can stay in RRC\_CONNECTED. Other cases FFS
* It is up to SA2 to decide whether the multicast session activation/deactivation mechanism is supported or not, and RAN2 will discuss if there is any RAN2 impacts based on SA2 inputs.
* It is up to SA2 to decide on the support of local MBS service, and RAN2 will discuss the RAN2 impacts based on SA2 inputs.
* In general, Information of MBS services/groups subscribed by the UE (e.g. TMGI) and QOS requirements of a MBS service should be provided to RAN. Detail information e.g. for PTM PTP switch if any is FFS.

***Layer 2 architecture***

* The function of mapping from QoS flows to MBS RBs in SDAP is needed for NR MBS. TBD whether any SDAP header is needed.
* (Working assumption) no SDAP functions other than “mapping from QoS flows to radio bearers” and “transfer of user plane data” are supported for MBS. FFS whether to support QoS flows to radio bearers remapping.
* In general: RAN2 wait for SA3’s progress for discussing security issues. TBD whether we need to send LS to SA3.
* RoHC (at least U-mode) can be configured for NR MBS bearers. This is applicable for Mcast, assume this is applicable also to broadcast.
* RoHC is located at PDCP.
* The reordering and in-order delivery function in PDCP is supported for NR MBS.
* The following PDCP functions are also supported for NR MBS: transfer of data; maintenance of PDCP SNs; duplicate discarding. Other PDCP functions are FFS.
* RLC AM is supported for PTP transmission of NR MBS.
* RLC UM is supported for PTP transmission of NR MBS.
* RLC UM is supported for PTM transmission of NR MBS.
* RLC TM is not supported for PTP transmission of NR MBS.
* RLC TM is not supported for PTM transmission of NR MBS.
* FFS for PTM if multiplexing/de-multiplexing of different logical channels are to be supported in MAC for NR MBS.
* Working assumption: RLC-AM for PTM is not supported (can be revisited but it means that proponents of RLC-AM for PTM need to demonstrate the need, to change this).

***Service continuity***

* R2 aim to support lossless handover for MBS-MBS mobility for service that requires this (TBD which detailed scenario but at least PTP-PTP)
* In order to support the lossless handover for 5G MBS services, at least DL PDCP SN synchronization and continuity between the source cell and the target cell should be guaranteed by the network side to realize. The design of specific approach to realize this can be involved with WG RAN3.
* From network side, the source gNB may forward the data to the target gNB and the target gNB will deliver the forwarding data. Meanwhile, the SN STATUS TRANSFER should be extended to cover the PDCP SN for MBS data; Then (TBD after or in parallel) the UE receives the MBS in the target cell by the target cell according to target configuration.
* From UE side, PDCP status report may be supported as well.

***Idle/Inactive support***

* UE receives the MBS configuration (for broadcast/delivery mode 2) by BCCH and/or MCCH (TBD), and this can be received in Idle / Inactive mode. Connected mode FFS (dep on UE cap and where service is provided etc). A notification mechanism is used to announce the change of MBS Control information.

RAN2#113-e agreements

***Reply LS on 5MBS progress and issues to address***

* [037] RAN2 assumes that MBS session join/leave indications are sent using NAS signalling regardless of the RRC state the UE is in. 5GC should inform RAN about the UE leaving the MBS session.
* [037] If the UE which joined the multicast session is in RR CONNECTED state when the session is started, the gNB sends RRC Reconfiguration message with relevant MBS configuration to the UE and there is no need for separate session start notification for this UE. FFS for session activation.
* [037] RAN2 assumes that from RAN2 perspective, mobility from the source gNB supporting MBS to target gNB not supporting MBS can be achieved by switching the traffic from delivery via MRB to delivery via DRB either before or during the handover. Whether and how this can be done without data losses has to be further investigated and requires progress and input from other WGs, i.e. RAN3 and SA2.
* [037] RAN2 will not provide further reply to SA2 on assistance information from CN to RAN on PTP/PTM delivery method decision and switching.
* [037] RAN2 will reply that it will wait for SA3 to finalize their study on security for MBS before discussing security aspects in RAN2.
* [037] Request a clarification from SA2 on whether and what the difference is between session start and session activation and between the session stop and session deactivation.
* [037] RAN2 will not address the note on 5GC Shared MBS delivery in the reply LS to SA2.
* [037] Reply to SA2/SA4 that:

SYNC protocol is not supported in the specifications in Rel-17

RAN2 has agreed that ROHC is to be located in RAN

***Reliability and UP architecture***

* Confirm P1 P2 P3 (assume that MRB may include both PTP and PTM)
* For the case that both PTM and PTP are RLC-UM, configuration with No L2 ARQ and with PDCP anchored PTM – PTP switching shall be supported (e.g. for services that would typically be configured with RLC UM for unicast).

***Idle and Inactive mode Ues***

* Both idle/inactive UEs and connected mode UEs can receive MBS services transmitted by NR MBS delivery mode 2 (Broadcast service as already agreed, TBD other). The ability for connected mode UEs to receive this may depend on the network provisioning of the service (e.g. which freq), UE connected mode configuration and UE capabilities.
* The two-step based approach (i.e. BCCH and MCCH) as adopted by LTE SC-PTM is reused for the transmission of PTM configuration for NR MBS delivery mode 2.
* Assume it is possible to reuse LTE SC-PTM mechanism for the CONNECTED UEs to receive the PTM configuration for NR MBS delivery mode 2, i.e. broadcast based manner.
* Assume that MCCH change notification mechanism is used to notify the changes of MCCH configuration due to session start for delivery mode 2 of NR MBS (other cases FFS, if any).
* Assume that MBS Interest Indication is supported for UEs in connected mode for Broadcast service (assume that as usual there is no mandatory network requirement, network action is up to network).
* MBS Interest Indication is NOT supported for UEs in idle/inactive mode for NR MBS delivery mode 2.
* Assume that some information for purpose of service continuity can be provided for NR MBS delivery mode 2. (FFS what - need to be revisited, e.g. based on progress in other groups, e.g. USD, SAI/TMGI etc)
* FFS whether support UE awareness of MBS services on frequency basis for service continuity for NR MBS delivery mode 2 (i.e. Reuse LTE SC-PTM mechanism).
* FFS Support frequency prioritization during cell reselection for service continuity for NR MBS delivery mode 2 (i.e. Reuse LTE SC-PTM mechanism).
* P2: Whether UEs that receive Multicast can be released to RRC Inactive / Idle and continue receiving Multicast is Postponed. Should limit to RRC inactive in future discussions

RAN2#113bis-e agreements

***Session activation***

* There is Support to have group notification for multicast for MBS supporting nodes (e.g. paging)
* Support group notification for multicast for MBS supporting nodes
* For delivery mode 1 UE is not expected to monitor Group notification channel in RRC\_CONNECTED
* It is FFS whether RAN2 needs to handle PRACH capacity issues due to group notifications
* Use same group notification identity for both RRC\_IDLE and RRC\_INACTIVE states

**For the reply LS**

* For non-supporting nodes, using MBS session ID will not work as it would impact non-MBS nodes. Unicast paging would work.
* For supporting nodes, using MBS session ID is feasible.

***Connected mode UEs***

***Reliability***

* For a given UE, if the MRB’s QoS requirements are not met via PTM, switching to PTP with RLC-AM shall be supported.

***Dynamic PTM PTP switch and service continuity***

Chair: NOTE that the below agreements are only based on architecture decisions so far. The reliability discussion not concluded yet i.e. other cases than RLC UM + RLC UM. PTM PTP switch for such other cases is FFS

* Dynamic PTM/PTP switch is supported for a split MRB bearer (type) with a common (single) PDCP entity.
* As a baseline, no new UE based signalling is introduced to support gNB switch decision (e.g. PDCP SR for high reliability is still TBD)
* Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, the usage of the PTP leg cannot be deactivated (i.e. the UE needs to always monitor C-RNTI) after the necessary split-MRB configuration.
* Assuming a split-MRB (as agreed during the online session) configured with a PTM leg and PTP leg, it is FFS whether the usage of the PTM leg of the split-MRB may be subject to activation or deactivation and the details of such.

***Support of Multicast in Idle Inactive***

* Chair: RAN2 will prioritize Active Multicast support in RRC Connected mode in Rel-17. If time permits Multicast support for RRC Inactive can be considered later (once connected mode Multicast solution, and Broadcast solution has become more mature).

***Idle and Inactive mode Ues***

* The MCCH transmission window is defined by MCCH repetition period, MCCH window duration and radio frame/slot offset.
* New RNTI is defined for scheduling MCCH.
* The concept of MCCH transmission window, similar to the one used for LTE SC-PTM, is used for NR MCCH scheduling. The exact parameters to define the window are FFS (discussed in the following proposals).
* Common search space is needed for MCCH scheduling. RAN2 should request RAN1 to discuss the details of CSS for MCCH.
* R2 assumes PDCCH occasions for MCCH search space are associated with SSBs in a pre-defined manner so that the UE can receive MCCH scheduling on PDCCH occasions according to its detected SSB.
* R2 assumes, In case searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the mapping between PDCCH occasions and SSBs is the same as for SIB1.
* R2 assumes that If common search space other than searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the PDCCH monitoring occasions for MCCH message which are not overlapping with UL symbols are sequentially numbered from one in the MCCH transmission window and mapped to SSBs using the similar rule as defined for OSI in TS 38.331.
* Request RAN1 to discuss the details of the configuration of the bandwidth for MCCH reception.
* The modification period is defined for NR MCCH and NR MCCH contents are only allowed to be modified at each modification period boundary.
* The updated MCCH message should be sent in the same MCCH modification period where the change notification is sent.
* UE in RRC IDLE/INACTIVE should be able to monitor/read both MCCH channel and SI/Paging without BWP switch. It is up to RAN1 to decide how this is ensured.
* It is up to RAN1 to to decide about the RNTI and DCI format used for MCCH change notifications.
* FFS whether to support multiple MCCH, e.g. to support different service types.
* RAN2 will discuss and down-select from the following two options for the UE to get aware of session stop/modification:

Reading MCCH once per each MCCH modification period when receiving an ongoing broadcast session

DCI used for MCCH notification indicates the change of an ongoing broadcast session

RAN2#114-e agreements

***Stage-2 and Multicast activation***

* Use PCCH for Multicast activation notification (also for MBS supporting nodes).
* Confirm that we convey the MBS session ID in the notification.
* Use of paging in all (legacy) PO with PRNTI is the baseline assumption (can still discuss other variants)

***Reliability***

* RLC-AM is not supported for PTM (for MBS R17 WI).

***Group scheduling and others***

* One-to-one mapping between G-RNTI and MBS session is supported in NR MBS. Other mappings FFS
* One-to-one mapping between G-CS-RNTI and MBS session is supported in NR MBS. Other mappings FFS.
* A UE can support multiple G-RNTIs/G-CS-RNTIs, It is FFS whether this depends on UE capability. Inform RAN1 of this agreement.
* Multiple MBS QoS flows corresponding to the same MBS session can be mapped to one or more than one MBS radio bearers.
* MCCH is mapped to the DL-SCH for NR MBS delivery mode 2.
* MTCH is specified for PTM transmission of NR MBS.
* MTCH is mapped to the DL-SCH.
* DTCH is reused for PTP transmission of NR MBS.
* FFS if there is a need to have specific LCID spaces for the used channels.
* Multiplexing/de-multiplexing of different logical channels associated with the same G-RNTI is supported for NR MBS.
* FFS if Multiplexing/de-multiplexing of different logical channels associated with the same G-CS-RNTI is supported for NR MBS.
* Multiplexing/de-multiplexing of different logical channels associated with the C-RNTI is supported for NR MBS.
* For NR MBS delivery mode 2, LTE SC-PTM DRX scheme is used as baseline.
* FFS whether For PTM transmission of NR MBS, DRX scheme is independent of DRX for unicast transmission, e.g. supported on a per G-RNTI basis
* FFS whether For PTP transmission, DRX operation for unicast transmission is reused.

***Idle and Inactive UEs***

* MBS specific SIB is defined to carry MCCH configuration.
* MCCH contents should include information about broadcast sessions such as G-RNTI, MBS session ID as well as scheduling information for MTCH (e.g. search space, DRX). L1 parameters that need to be included in MCCH are pending further RAN1 progress and input.
* Postpone the discussion on whether dedicated MCCH configuration is required until RAN1 makes progress on BWP/CFR for MCCH.
* Indication of an MCCH change due to modification of an ongoing session’s configuration (including session stop) is provided with an explicit notification from the network (provided that RAN1 confirms a separate bit for this purpose can be accommodated in the MCCH change notification DCI, in addition to a bit for session start notification). FFS on whether this notification can be reused for modification of other information carried by MCCH, if any.
* FFS whether the possibility of UE missing an MCCH change notification needs to be addressed or can be left to UE implementation.
* At least in case RAN1 decides to utilize RNTI other than MCCH-RNTI for MCCH change notification, MCCH change notification is sent in the first MCCH monitoring occasion of each MCCH repetition period.
* We support single MCCH (in this release)

RAN2#115-e agreements

***General***

* MRB configuration and procedures in RRC are separated from DRB configuration and procedures (as in current CR).
* MRB is defined as MBS Radio Bearer, which denotes radio bearers carrying both multicast and broadcast sessions.

***Multicast Service Continuity***

* In RRC signalling, one MRB can be configured with PTM only or PTP only or both PTM and PTP. Whether PTM, PTM+PTP or PTP-only can be changed from one to other via RRC signaling.
* In RRC signalling, Support DL only UM RLC configuiration for PTM, both DL and UL AM RLC configuiration for PTP, DL only UM RLC configuiration for PTP, FFS both DL and UL UM RLC configuiration for PTP.
* FFS whether PDCP SR can be triggered due to bearer type change in RRC signaling and FFS how to tigger PDCP SR if need.
* Will not support PTM deactivation/activation beyond RRC reconfiguration acc to first agreement above (and whatever R1 decides).
* For PTM PDCP state variables setting while configured, the SN part of COUNT values of these variables are set according to the SN of the first received packet (by the UE) and the HFN indicated by the gNB, if needed.
* Initialize the PTM RLC entity for an MRB configuration, the value of RX\_Next\_Highest and RX\_Next\_Reassembly are set according to the SN of the first received packet containing an SN.
* RLC state variables of PTP RLC reception window can be set to initial value, i.e. 0, due to MRB configuration.

***Scheduling and power saving***

* Single bearer ID is used for each Multicast RB. FFS whether DRB ID space can be shared with MRB ID.
* FFS whether to share common LCID space for Multicast PTM and Unicast DTCH. FFS How many PTM LCIDs to be reserved if separate space is used.
* Multicast PTP and Unicast DTCH/DRB share common LCID space.
* Broadcast PTM/MTCH uses reserved LCID(s), which is different than Unicast DTCH/DRB LCID space.
* Broadcast MCCH uses reserved LCID .
* Multiplexing/de-multiplexing of different logical channels associated with the same G-CS-RNTI is supported for NR MBS.
* If Data Inactivity timer is configured, data monitoring is applied both for unicast and MBS multicast (i.e. both PTM and PTP data) (but not MBS broadcast)
* For multicast PTM transmission, Multicast DRX pattern is configured on a per G-RNTI basis (i.e. independent of legacy UE-specific DRX for unicast transmission).
* Legacy UE-specific DRX pattern for unicast is reused for PTP transmission of NR MBS, which means the UE specific DRX pattern are for both unicast services and the MBS PTP bearer of UE
* Multicast long DRX support is baseline for PTM. FFS whether to support optional short DRX or not.
* The Multicast Long DRX operation has to support the following parameters which are similar to the UE-specific DRX for unicast, where the last two parameters are needed if the HARQ- feedback is enabled:

- drx-onDurationTimerPTM

- drx-InactivityTimerPTM

- drx-LongCycleStartOffsetPTM

- drx-SlotOffsetPTM

- drx-HARQ-RTT-TimerDLPTM

- drx-RetransmissionTimerDLPTM

* For NR Broadcast, the DRX pattern is configured per G-RNTI.
* For NR Broadcast, DRX configuration includes: drx-onDurationTimerPTM, drx-SlotOffsetPTM, drx-InactivityTimerPTM, drx-CycleStartOffsetPTM.

***L2 Centric Other***

* ROHC O/R-mode can be used for MRB, for cases when feedback path is available (UL RLC). R2 assumes the detailed operation is up to implementation and expect no further optimizations to be needed.
* Reflective QoS is not supported for MBS.
* No SDAP header is needed for MBS.
* Add p7 to stage-2 CR discussion

***Broadcast Service Continuity***

**For IDLE / INACTIVE:**

* The UE is allowed to prioritize the MBS frequency of interest when the cell of the MBS frequency provides MBS SIB carrying the MCCH configuration, as LTE SC-PTM.
* The UE is allowed to prioritize the MBS frequency of interest when the UE is only capable of receiving the MBS service by camping on the MBS frequency, as LTE SC-PTM.
* The UE may consider cell reselection candidate frequencies at which it cannot receive the MBS service to be of the lowest priority during the MBS session, as LTE SC-PTM. (25/25)
* Working assumption: The mapping between frequency and MBS service ID (e.g. SAI) is provided in the upper layer signalling (e.g. USD), as LTE SC-PTM. (The detailed information included in the upper layer (e.g. USD) is up to the decision of other WGs)
* Send an LS to SA2 and SA4 to check whether the mapping between frequency and MBS service ID (e.g. SAI) is provided in the upper layer signalling (e.g. USD), as LTE SC-PTM.
* The mapping between frequency and MBS service ID (e.g. SAI) is provided in SIB, as LTE SC-PTM. The detailed mapping is pending for the feedbacks of other WGs.
* The mapping between frequency and MBS service ID (e.g. SAI) is allowed to be sent in cells not broadcasting MBS service, as LTE SC-PTM.
* The mapping between frequency and MBS service ID (e.g. SAI) is provided in a new SIB different from the MBS SIB providing the MCCH configuration, as LTE SC-PTM.
* An ID (e.g. SAI) of MBS services is provided in SIB and USD, as LTE SC-PTM. The details of the ID is pending for the feedbacks of other WGs.
* Send an LS to SA2, SA4 and RAN3 to check whether an ID (e.g. SAI) of MBS services can be provided in SIB and USD, as LTE SC-PTM.
* It is FFS whether the gNB may indicate a list of neighbour cells where ongoing broadcast MBS service provided in the current cells are also provided, as LTE SC-PTM.
* The extra offset to cell (which provides the MBS service) for the cell ranking criterion is not supported in Rel-17.

CONNECTED

* The UE reports the following MBS interest information (as LTE SC-PTM):

MBS frequency list (20/24)

priority between the reception of all listed MBMS frequencies and the reception of any unicast bearer (23/24)

TMGI list (24/24)

* If MBS frequencies are allowed to be reported, the MBS frequencies reported by the UE is sorted by decreasing order of interest, as LTE SC-PTM. (25/25)
* Send an LS to SA3 to check whether the MBS interest information can be reported by the UE before security activation.
* FFS whether the MII is reported via *UEAssistanceInformation* or a new RRC message.

***Notifications***

* RAN2 waits for RAN1’s final decision on which RNTI/DCI (i.e. Alt1 and/or Alt 2 as identified by RAN1) for MCCH change notification to be adopted.
* Do not specify any mechanism to address the possibility of UE missing an MCCH change notification and it is left to UE implementation.
* Provided RAN3 confirms, paging for multicast activation notification is used in the relevant legacy POs for the UEs with deactivated multicast session(s).
* RAN2 sends an LS to RAN3 and SA2 to indicate its preference for paging for multicast activation notification to be used in the relevant legacy POs for the UEs with non activated multicast session(s). Further, RAN2 requests RAN3 for confirmation and if so, also specifying required network signalling.
* Confirm extending the unicast paging message to include a new paging record list ( *pagingGroupList)* for group activation notification of multicast sessions.
* NAS is expected to inform UE about multicast session release (e.g. to stop monitoring for multicast session activation).
* It is up to network implementation (e.g. paging repetitions) for addressing scenario of potential notification loss for UEs.
* RAN2 not to prioritize addressing of PRACH capacity issue due to group notification.
* It is FFS that short message or WUS based indication for multicast activation notification in corresponding paging message can be used.
* It is FFS to introduce MBS specific UAC.
* It is FFS on the establishment cause and resume cause for MBS.
* It is FFS if there is a need to prioritize a frequency with multicast support for idle/inactive UEs that monitor multicast activation notification.

***L3 Other***

* [049] Send and LS to SA2 to consult on whether TMGI is sufficient for MBS session identification or some additional parameter is required (such as sessionID in LTE).
* [049] There is no SDAP configuration provided to the UE for neither broadcast nor multicast.
* [049] For broadcast, it is FFS whether sn-FieldLength (for RLC) and pdcp-SN-SizeDL parameters are configurable or predefined in specifications (related UE capabilities should be considered).
* [049] For broadcast, it is FFS whether t-Reassembly (in RLC configuration) and t-Reordering (in PDCP configuration) are needed, e.g. considering whether out of sequence reception can happen as there is no HARQ feedback for broadcast.
* [049] For broadcast, it is FFS whether ROHC, when enabled by the network, has a predefined configuration or ROHC parameters are configurable by the network.
* [049] On-demand MCCH mechanism is not introduced in Rel-17.
* [049] A single MCCH channel with multiple modification/repetition periods is not supported, i.e. there is a single configuration of modification/repetition for MCCH (in Rel-17).