**3GPP TSG-RAN WG2 Meeting #116-e *R2-210xxxx***

**Electronic meeting, November 01 – 12, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **36.300** | **CR** |  | **rev** | **-** | **Current version:** | **16.6.0** |  |
|  |
| *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:***  | Running CR to 36300 for Multi-USIM devices support |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | LTE\_NR\_MUSIM-Core |  | ***Date:*** | 2021-10-21 |
|  |  |  |  |  |
| ***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:*** | Feature addition for Multi-USIM devices support |
|  |  |
| ***Summary of change:*** | * Add new abbreviation for MUSIM
* Add new section for “Support for Multi-USIM devices”
* Add new clause for “General”
* Add new clause for “Paging Collision Avoidance”
* Add new clause for “UE notification on Network Switching”
* Add new clause for “Busy Indication”
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|  |  |
| ***Consequences if not approved:*** | Multi-USIM devices operation is not clarified in stage-2 |
|  |  |
| ***Clauses affected:*** | 3.2 AbbreviationsX Support for Multi-USIM devicesX.1 GeneralX.2 Paging Collision AvoidanceX.3 UE notification on Network SwitchingX.4 Busy Indication |
|  |  |
|  | **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:*** | The Running CR is based on TS36.300\_v16.6.0 |
|  |  |
| ***This CR's revision history:*** |  |

START OF FIRST CHANGE

## 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].

1xCSFB Circuit Switched Fallback to 1xRTT

5GC 5G Core Network

ABS Almost Blank Subframe

AC Access Category

ACK Acknowledgement

ACLR Adjacent Channel Leakage Ratio

AM Acknowledged Mode

AMBR Aggregate Maximum Bit Rate

ANDSF Access Network Discovery and Selection Function

ANR Automatic Neighbour Relation

ARP Allocation and Retention Priority

ARQ Automatic Repeat Request

AS Access Stratum

AUL Autonomous Uplink

BCCH Broadcast Control Channel

BCH Broadcast Channel

BL Bandwidth reduced Low complexity

BR-BCCH Bandwidth Reduced Broadcast Control Channel

BSR Buffer Status Report

C/I Carrier-to-Interference Power Ratio

CA Carrier Aggregation

CAZAC Constant Amplitude Zero Auto-Correlation

CBC Cell Broadcast Center

CC Component Carrier

CG Cell Group

CHO Conditional Handover

CIF Carrier Indicator Field

CIoT Cellular Internet of Things

CMAS Commercial Mobile Alert Service

CMC Connection Mobility Control

C-plane Control Plane

C-RNTI Cell RNTI

CoMP Coordinated Multi Point

CP Cyclic Prefix

CQI Channel Quality Indicator

CRC Cyclic Redundancy Check

CRE Cell Range Extension

CRS Cell-specific Reference Signal

CSA Common Subframe Allocation

CSG Closed Subscriber Group

CSI Channel State Information

CSI-IM CSI interference measurement

CSI-RS CSI reference signal

DAPS Dual Active Protocol Stack

DC Dual Connectivity

DCCH Dedicated Control Channel

DCN Dedicated Core Network

DeNB Donor eNB

DFTS DFT Spread OFDM

DL Downlink

DMTC Discovery Signal Measurement Timing Configuration

DRB Data Radio Bearer

DRS Discovery Reference Signal

DRX Discontinuous Reception

DTCH Dedicated Traffic Channel

DTX Discontinuous Transmission

DwPTS Downlink Pilot Time Slot

E-CID Enhanced Cell-ID (positioning method)

E-RAB E-UTRAN Radio Access Bearer

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EAB Extended Access Barring

ECGI E-UTRAN Cell Global Identifier

ECM EPS Connection Management

EDT Early Data Transmission

EHC Ethernet Header Compression

eHRPD enhanced High Rate Packet Data

eIMTA Enhanced Interference Management and Traffic Adaptation

EMM EPS Mobility Management

eNB E-UTRAN NodeB

EPC Evolved Packet Core

EPDCCH Enhanced Physical Downlink Control Channel

EPS Evolved Packet System

ETWS Earthquake and Tsunami Warning System

FDD Frequency Division Duplex

FDM Frequency Division Multiplexing

G-RNTI Group RNTI

GBR Guaranteed Bit Rate

GERAN GSM EDGE Radio Access Network

GNSS Global Navigation Satellite System

GP Guard Period

GRE Generic Routing Encapsulation

GSM Global System for Mobile communication

GUMMEI Globally Unique MME Identifier

GUTI Globally Unique Temporary Identifier

GWCN GateWay Core Network

GWUS Group Wake Up Signal

H-SFN Hyper System Frame Number

HARQ Hybrid ARQ

(H)eNB eNB or HeNB

HO Handover

HPLMN Home Public Land Mobile Network

HRPD High Rate Packet Data

HSDPA High Speed Downlink Packet Access

ICIC Inter-Cell Interference Coordination

IDC In-Device Coexistence

IP Internet Protocol

ISM Industrial, Scientific and Medical

KPAS Korean Public Alert System

L-GW Local Gateway

LAA Licensed-Assisted Access

LB Load Balancing

LBT Listen Before Talk

LCG Logical Channel Group

LCR Low Chip Rate

LCS LoCation Service

LHN Local Home Network

LHN ID Local Home Network ID

LIPA Local IP Access

LMU Location Measurement Unit

LPPa LTE Positioning Protocol Annex

LTE Long Term Evolution

LWA LTE-WLAN Aggregation

LWAAP LTE-WLAN Aggregation Adaptation Protocol

LWIP LTE WLAN Radio Level Integration with IPsec Tunnel

LWIP-SeGW LWIP Security Gateway

MAC Medium Access Control

MBMS Multimedia Broadcast Multicast Service

MBR Maximum Bit Rate

MBSFN Multimedia Broadcast multicast service Single Frequency Network

MCCH Multicast Control Channel

MCE Multi-cell/multicast Coordination Entity

MCG Master Cell Group

MCH Multicast Channel

MCS Modulation and Coding Scheme

MDT Minimization of Drive Tests

MeNB Master eNB

MGW Media Gateway

MIB Master Information Block

MIMO Multiple Input Multiple Output

MME Mobility Management Entity

MMTEL Multimedia telephony

MO-EDT Mobile Originated Early Data Transmission

MPDCCH MTC Physical Downlink Control Channel

MSA MCH Subframe Allocation

MSI MCH Scheduling Information

MSP MCH Scheduling Period

MT-EDT Mobile Terminated Early Data Transmission

MTC Machine-Type Communications

MTCH Multicast Traffic Channel

MTSI Multimedia Telephony Service for IMS

MUSIM Multi-Universal Subscriber Identity Module

N2 Reference point between the NG-RAN and the AMF

NACK Negative Acknowledgement

NAS Non-Access Stratum

NB-IoT Narrow Band Internet of Things

NCC Next Hop Chaining Counter

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NG-RAN NG Radio Access Network

NH Next Hop key

NNSF NAS Node Selection Function

NPBCH Narrowband Physical Broadcast channel

NPDCCH Narrowband Physical Downlink Control channel

NPDSCH Narrowband Physical Downlink Shared channel

NPRACH Narrowband Physical Random Access channel

NPUSCH Narrowband Physical Uplink Shared channel

NPRS Narrowband Positioning Reference Signal

NPSS Narrowband Primary Synchronization Signal

NR NR Radio Access

NRT Neighbour Relation Table

NSSS Narrowband Secondary Synchronization Signal

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OPI Offload Preference Indicator

OTDOA Observed Time Difference Of Arrival (positioning method)

P-GW PDN Gateway

P-RNTI Paging RNTI

PA Power Amplifier

PAPR Peak-to-Average Power Ratio

PBCH Physical Broadcast CHannel

PBR Prioritised Bit Rate

PCC Primary Component Carrier

END OF FIRST CHANGE

START OF SECOND CHANGE

# X Support for Multi-USIM devices

Editor’s note: Whether a separate section is used for MUSIM can be further discussed

## X.1 General

E-UTRAN may support one or more of the following enhancements for MUSIM UE operation:

- Paging Collision Avoidance, as described in clause X.2;

- UE notification on Network Switching, as described in clause X.3;

- Busy Indication, as described in clause X.4;

## X.2 Paging Collision Avoidance

The purpose of paging collision avoidance is to address the overlap of paging occasions on both USIMs when a MUSIM (e.g. dual USIM device) is in RRC\_IDLE/RRC\_INACTIVE state in both the networks (e.g. Network A and Network B) associated with respective USIMs.

A MUSIM device UE may determine potential paging collision on two networks and may trigger actions to prevent potential paging collision. When Network A and Network B are both E-UTRAN, handling of the paging collision can be achieved by changing the time location of the PF/PO in one Network, adding an offset to the UE\_ID calculation formula*.*

Editor’s note: It is left to UE implementation as to how it selects one of the two RATs/networks for paging collision avoidance. FFS whether UE behavior is predictable for paging collision avoidance.

END OF SECOND CHANGE

Annex: RAN2 Agreements (LTE\_NR\_MUSIM-Core; leading WG: RAN2; REL-17; WID: RP-202895)

## RAN2#115-e

Agreement

1 RAN2 retains the agreement on NAS-based busy indication for RRC\_INACTIVE, and Reply SA2.

Agreements

Scenarios and supported gap types

1 RAN2 aims to support at least the below scenarios 1/2/3 in Rel-17 for cases when the UE is allowed to switch to network B without leaving connected state at network A.

- Scenarios 1: Periodic switching, including SSB detection/paging reception, serving cell measurement, neighboring cell measurement including intra-frequency,inter-frequency and inter-RAT measurement;

- Scenarios 2: SI receiving at network B;

- Scenarios 3: Aperiodic (one-shot) switching with both transmission and reception at network B but will not enter RRC-connected state in NW B (e.g. no RRC connection Resume/Setup) at network B, including On-demand SI request;

2 For switching without leaving connected state at network A, support gap types 2a (Normal periodic gap) and 2b (Normal aperiodic gap) in Rel-17.

3 Only per UE level scheduling gap is supported in Rel-17 for non-DC. FFS if we support MR-DC.

The scenarios will only be used for deriving RRC parameters. No need to capture them in e.g. Stage-2.

Agreements

Gap configuration and activation

5 The network is allowed to configure at most 3 gap patterns (for any MUSIM purpose).

6 Only a single aperiodic gap (for MUSIM) is supported in Rel-17. At most two periodic “gaps” (for MUSIM) and a single aperiodic gap (for MUSIM) is supported in Rel-17. FFS if signalling supports more.

7 The SFN and subframe of the PCell of the network A is used in the gap configuration to calculate the gap.

Agreements

Periodic/Aperiodic/autonomous Gap configuration and activation

8: The switching gap configuration will explicitly provide the gap starting position (e.g. offset value or start SFN and subframe explicitly), gap length and gap repetition period.

10: Switching Gaps (of any type) are configured or released by RRC signalling (e.g. RRCReconfiguration message) in Rel-17. FFS if gap can be released autonomously by UE after N repetitions.

Gap configuration assistance information

16 UE is allowed to include assistance information for setup or release of gaps for both 1) periodic gaps and 2) aperiodic gap in one UEAssistanceInformation Msg.

18 To report the assistance information, the UE maps the timing info of the Gap on the network B to the network A and reports the mapped timing info to the network A.

20 For the gap assistance information, the Gap start time, Duration of the gap and gap repetition period (for periodic) may be included. FFS is other information is included (e.g. gap purpose).

* Do not support autonomous gaps for MUSIM in Rel-17.
* 1 UE can indicate it wants to leave RRC\_CONNECTED in assistance information for MUSIM (FFS for signalling details, e.g. UAI).
* 3: UEAssistanceInformation message is extended for switching notification in both network switching procedures for leaving RRC\_CONNECTED state and without leaving RRC\_CONNECTED state.
* 6: UE is configured to provide assistance info for switching notification via otherConfig of RRCReconfiguration message
* 8: Introduce a new RRC timer for the “configured time”, used for the UE to leave RRC\_CONNECTED without a response.
* FFS if it's possible to configure UE to always wait for the network response (e.g. "infinite" waiting time)
* 7: UE is not allowed to enter RRC\_INACTIVE state if no NW response message is received within a certain configured time period after the network switching notification message is sent.
* 9: As baseline, how to handle the case, that UE performs switching without the response from network for a configured time during switching procedure without leaving RRC\_CONNECTED state, is not specified. Can re-discuss if there are serious issues found.

## RAN2#114-e

* 1: Send an LS to SA2 to inform that RAN2 majority would support, but there is no consensus to support NAS assistant information (similar to UE ID offset for LTE), so RAN2 thinks this issue should be discussed and decided by SA2.
* 2: RAN2 does not introduce RRC assistant information for paging collision issue for IDLE and INACTIVE. (Can revisit if serious problems are found.)
* 1: RRC signaling for network switching without leaving RRC\_Connected state should allow multiple configurations of periodic “gaps” with different parameters (e.g. periodicities and durations). FFS is multiple can be active at the same time. FFS if multiple aperiodic gaps are supported.
* 4: UE provides assistance information to the gNB of NW A in Connected state based on the configuration of USIM of NW B for the gNB to determine the necessary switching parameters. Up to network what is the action based on UE assistance information. FFS what assistance information is needed.
* 1: AS -based solution for network switching includes two steps: 1-) If configured, UE can send an RRC message to leave RRC\_CONNECTED for MUSIM purpose 2-) gNB may release the UE to Idle/Inactive.
* 2: Include the following RAN2#113bis-e agreement in the LS:

During switching procedure for leaving RRC\_CONNECTED state, UE is allowed to enter RRC\_IDLE state if it does not receive response message from network within a certain configured time period. FFS for RRC\_INACTIVE state

* 3: The “configured time” for AS-based solution for the UE to leave RRC\_CONNECTED without a response is configured by the gNB. Indicate RAN2 is still discussing this for AS-based solution in the LS.
* 4: Indicate that RAN2 has not discussed the interaction between AS-based solution and any SA2 agreement on NAS messages or NAS-based solution for network switching.

## RAN2#113-bis-e

Agreements

1: For the EPS PO/PF calculation, include the UE\_offset to the UE\_ID calculation formula.

2: No additional modification for the EPS eDRX case.

Agreements

1 Only support NAS-based busy indication (for IDLE and INACTIVE)

Agreements

1 RRC signalling is used for switching procedure without leaving RRC\_CONNECTED state in network A for UE temporarily switching to network B as a baseline. FFS on additional need of MAC signalling.

2 During switching procedure for leaving RRC\_CONNECTED state, UE is allowed to enter RRC\_IDLE state if it does not receive response message from network within a certain configured time period. FFS for RRC\_INACTIVE state.

* 1: RAN2 works to support the MUSIM paging cause feature that SA2 is working on and also addresses the paging cause issue raised by SA2 LS.
* 2: RAN2 attempts to reply LS to SA2 once we progress on solution and agree on CR(s) that support/address the above feature/issue.
* 5: If RAN2 agrees to add a paging cause value (or any other information that could lead to a specific paging cause) in Uu paging message, RAN2 specifies the relevant UE behavior (i.e. inform or passing to the upper layer) upon its reception in both LTE and NR specifications.
* RAN2 does not intend to introduce alternative paging IDs for MUSIM paging (unless requested by SA2).

## RAN2#113-e

* There is support for solution 1 (for 5GS) with something else, either solution 3 or 2b.

Agreement

1. Option 2b is the preferred solution to address paging collision for “LTE + LTE”.

Agreements

1 MUSIM UE determines potential paging collision on two networks and triggers actions on potential paging collision avoidance.

2 It is left to UE implementation as to how it selects one of the two RATs/networks for paging collision avoidance.

* FFS if we can make the UE behaviour predictable for paging collision avoidance

Agreements

1 Switching procedure can be used to notify network A that the UE has a preference to leave RRC\_CONNECTED state in network A.

2 The switching procedure can be used to notify network A that the UE has a preference to be kept in RRC\_CONNECTED state in network A while temporarily switching to network B.

Agreement

1 NAS signalling is baseline for UE reporting paging collision in 5GS side (to be confirmed by SA2).

2 It is FFS whether assistant information is needed for paging collision in 5GS side.

## RAN2#112-e

* Use: "Extending paging signalling is possible but RAN2 haven’t decided on overall feasibility of paging cause, including how it should be supported."
* With this change, the LS is approved in [R2-2011241](file:///C%3A%5CUsers%5Cterhentt%5CDocuments%5CTdocs%5CRAN2%5CRAN2_112-e%5CR2-2011241.zip) (unseen)
* From RAN2 point of view, Option 1 , 2a, 2b, and 3 are feasible to solve the paging collision issue in 5GS. Each have different effectiveness (as per analysis during the email discussion). When indicating reply to SA2, indicate both feasibility as well as effectiveness.
* Indicate to SA2 that RAN2 continues to further evaluate the pros and cons of options 1, 2a, 2b, 3.
* Option 4 is still allowed (but RAN2 will not specify UE implementation).
* Clarifying "No E-UTRA impact" can be done in RANP.
* Option 2c can be evaluated later as it doesn't work alone.
* Enhancement for 5GS should be prioritized since it can handle paging collision issue in both NR+NR and NR+LTE scenarios.
* Indicate to SA2 that the table 1 is a baseline on the discussion the expected time (in ms) required for UE to send a (NAS) busy indication to Network B.
* From RAN2 point of view, it is feasible that the busy indication is sent as an RRC message with security for RRC\_INACTIVE. FFS how this works.
* RAN2 will continue to discuss RRC-based switching/leaving and returning procedure in 5GS/NR when UE is in RRC\_CONNECTED. There may be different mechanisms (short/long, leaving/returning, etc.).
* Provide SA2 with information on paging cause costs based on the email discussion + contributions. Indicate that this may change if assumptions change.
* From RAN2 perspective, we haven't decided on paging cause feasibility yet.
* RAN2 will evaluate short/long time switching in this WI

**Agreements**

**1a: The sub-Case 3-1 is supported in WI, i.e., the switching/leaving and returning procedure in 5GS/NR when UE is in RRC\_CONNECTED includes the case where Dual-RX/Single-TX UE is in RRC\_CONNECTED state in NW A while performing only reception in NW B (i.e., in RRC\_idle State and RRC inactive state).**

**1b: For Sub-Case 3-1, whether the Rx capability coordination between UE and NW is needed can be decided after the RRC-based switching/leaving and returning procedure is defined.**

**2: The Sub-Case 3-2, i.e. Dual-RX/Single-TX UE stays in RRC\_CONNECTED mode in NW A while performing reception and transmission in NW B(in RRC\_ CONNECTED or during RRC setup/resume period ), is not considered in the WI from RAN2 viewpoint. Scheduling gap is not excluded.**

**4: FFS: The Sub-Case 4-1, i.e. Dual-RX/Dual-TX UE stays in RRC\_CONNECTED mode in NW A while performing both reception and transmission in NW B without changing into RRC\_CONNECTED state in NW B, is not considered in the WI from RAN2 viewpoint.**

**5: FFS: The Sub-Case 4-2, i.e. Dual-RX/Dual-TX UE stays in RRC\_CONNECTED state in NW A while performing both reception and transmission in RRC\_ CONNECTED in NW B, is not considered in the WI from RAN2 viewpoint.**

**=> FFS if/how to ensure UE doesn't disconnect from RRC\_CONNECTED during busy indication**

**=> Capability change is not precluded by proposals.**