**3GPP TSG-RAN4 Meeting #102e *R4-2207118***

**Electronic Meeting, 21 February - 3 March, 2022**

|  |
| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **36.133** | **CR** |  | **rev** |  | **Current version:** | **17.4.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | Big CR RRM requirements for Rel-17 NR FeRRM |
|  |  |
| ***Source to WG:*** | Apple |
| ***Source to TSG:*** | RAN4 |
|  |  |
| ***Work item code:*** |  NR\_RRM\_enh2-Core  |  | ***Date:*** | 2022-03-04 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | The requirements of R17 RRM further enhancements are missing in TS36.133. FeRRM WI includes: SRS antenna port switching, HO with PSCell, and PUCCH SCell activation. This big CR reflects the endoresed draft CRs:**Endorsed in 102-e**:

|  |  |  |
| --- | --- | --- |
| TDoc Endorsed CR  | CR title | Source companies |
| R4-2206862 | Interruption requirement to LTE serving cell, and impacts to other LTE RRM | CATT |
| R4-2206866 | Draft CR on requirements for HO with PSCell from EN-DC to EN-DC | Huawei, Hisilicon |
| R4-2206873  | Draft CR on Interruption requirements to LTE serving cell | Ericsson |

 |
|  |  |
| ***Summary of change:*** | Introduce requirement for FeRRM WI, including: SRS antenna port switching, HO with PSCell, and PUCCH SCell activation. |
|  |  |
| ***Consequences if not approved:*** | The requirements of R17 RRM further enhancements are missing in TS36.133. |
|  |  |
| ***Clauses affected:*** | 7.32.1, new 7.32.2.17, 7.36.1, new 7.36.2.16, 5.x, 7.32.1, 7.32.2.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.533 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

Start of Change 1

## 7.32 Interruptions with EN-DC

### 7.32.1 Introduction

This section contains the requirements related to the interruptions on PCell, and MCG SCell when

NR PSCell is added or released, or

transitions between active and non-active during NR PSCell DRX, or

transitions from NR PSCell non-DRX to DRX, or

SCell in either E-UTRA MCG or NR SCG is added or released, or

SCell(s) in either E-UTRA MCG or NR SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG, or

a downlink bandwidth part (BWP) and/or an uplink BWP is switched in NR PSCell or in any NR SCell, or

UE dynamic Tx switches between two uplink carriers, or

NR SRS carrier based switching is performed, or

NR SRS transmission with antenna port switching.

The requirements shall apply for EN-DC.

This section contains interruption requirements when the victim cell is PCell or SCell belonging to MCG. Requirements for interruptions where victim cell is the NR PSCell or an NR SCell belonging to SCG are specified in [50].

For a UE which does not support per-FR measurement gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on FR1 only.

End of Change 1

Start of Change 2

##### 7.32.2.17 Interruptions due to NR SRS antenna port switching

SRS transmission with antenna port switching can be configured on a NR SCell. When a UE needs to transmit SRS with antenna port switching on a NR serving cell, the UE can perform SRS transmitssion with antenn port switching, provided that:

- the SRS is not colliding with any other transmission with higher priority defined in TS 38.214 [51].

- the semi-persistent and periodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and L1-RSRP/L1-SINR measurement on cells in the same carrier or same CG.

- the aperiodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and semi-persistent and periodic L1-RSRP/L1-SINR measurement on cells in the same carrier or same CG.

- the semi-persistent and periodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and L1-RSRP/L1-SINR measurement on the carriers belonging to the band of IE *txSwitchImpactToRx*.

- the aperiodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and semi-persistent and periodic L1-RSRP/L1-SINR measurement on the carriers belonging to the band of IE *txSwitchImpactToRx*.

The UE shall not perform SRS transmission with antenna port switching if the above conditions cannot be met.

When SRS transmission with antenna port switching is performed in a slot, the UE is allowed interruptions on any active serving cell reception if the cell frequency belongs to the IE *txSwitchImpactToRx* indication, or interruptions on any active serving cell transmittion if the cell frequency belongs to the IE *txSwitchWithAnotherBand* indication overlapped with the SRS transmission, regardless of per-FR MG capability.

When only one SRS symbol is configured to transmit with antenna port switching in a slot, the interruption on PCC or each of the activated E-UTRA SCCs are synchronised with the NR carrier during UE transmit SRS with antenna port switching shall not exceed the symbols number as defined in Table 7.32.2.17-1.

Table 7.32.2.17-1: Interruption at NR SRS transmit with antenn port switching

|  |  |
| --- | --- |
|  | Aggressor NR CC SCS (kHz) |
| **15** | **30** | **60** |
| Interrupted symbol number on victime E-UTRA carrier | 3 | 2 | 2 |

When only one SRS symbol is configured to transmit with antenna port switching in a slot, and the PCC or other E-UTRA carriers are unsynchronised with the NR carrier, or more than one SRS symbols is configured to transmit with antenna port switching in a slot, the interruption on PCC and each of the activated E-UTRA SCCs during UE transmit SRS with antenna port switching shall not exceed 2 subframes.

End of Change 2

Start of Change 3

## 7.36 Interruptions with NE-DC

### 7.36.1 Introduction

This clause contains the requirements related to the interruptions on PSCell and SCG SCells when

transitions between active and non-active during NR PCell DRX, or

transitions from NR PCell non-DRX to DRX, or

SCell in either NR MCG or E-UTRA SCG is added or released, or

SCell(s) in either NR MCG or E-UTRA SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either NR MCG or E-UTRA SCG, or

a downlink bandwidth part (BWP) and/or an uplink BWP is switched in NR PCell or in any NR SCell, or

NR SRS carrier based switching is performed, or

NR SRS transmission with antenna port switching.

The requirements shall apply for NE-DC.

This clause contains interruption requirements when the victim cell is PSCell or SCell belonging to SCG. Requirements for interruptions where victim cell is the NR PCell or an NR SCell belonging to MCG are specified in TS 38.133 [50].

For a UE which does not support per-FR measurement gaps, interruptions to the PSCell or active SCG SCells may be caused by NR PCell or NR SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PSCell or active SCG SCells may be caused by NR PCell or NR SCells on FR1 only.

End of Change 3

Start of Change 4

##### 7.36.2.16 Interruptions due to NR SRS antenna port switching

SRS transmission with antenna port switching can be configured on a NR Cell. When a UE needs to transmit SRS with antenna port switching on a NR serving cell, the UE can perform SRS transmitssion with antenn port switching, provided that:

- the SRS is not colliding with any other transmission with higher priority defined in TS 38.214 [51].

- the semi-persistent and periodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and L1-RSRP/L1-SINR measurement on cells in the same carrier or same CG.

- the aperiodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and semi-persistent and periodic L1-RSRP/L1-SINR measurement on cells in the same carrier or same CG.

- the semi-persistent and periodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and L1-RSRP/L1-SINR measurement on the carriers belonging to the band of IE *txSwitchImpactToRx*.

- the aperiodic SRS is not colliding with any L3 measurements, RLM/BFD/CBD, and semi-persistent and periodic L1-RSRP/L1-SINR measurement on the carriers belonging to the band of IE *txSwitchImpactToRx*.

The UE shall not perform SRS transmission with antenna port switching if the above conditions cannot be met.

When SRS transmission with antenna port switching is performed in a slot, the UE is allowed interruptions on any active serving cell reception if the cell frequency belongs to the IE *txSwitchImpactToRx* indication, or interruptions on any active serving cell transmittion if the cell frequency belongs to the IE *txSwitchWithAnotherBand* indication overlapped with the SRS transmission, regardless of per-FR MG capability.

When only one SRS symbol is configured to transmit with antenna port switching in a slot, the interruption on each of the activated E-UTRA SCCs are synchronised with the NR carrier during UE transmit SRS with antenna port switching shall not exceed the symbols number as defined in Table 7.36.2.16-1.

Table 7.36.2.16-1: Interruption at NR SRS transmit with antenn port switching

|  |  |
| --- | --- |
|  | Aggressor NR CC SCS (kHz) |
| **15** | **30** | **60** |
| Interrupted symbol number on victime E-UTRA carrier | 3 | 2 | 2 |

When only one SRS symbol is configured to transmit with antenna port switching in a slot, and the E-UTRA carriers are unsynchronised with the NR carrier, or more than one SRS symbols is configured to transmit with antenna port switching in a slot, the interruption on each of the activated E-UTRA SCCs during UE transmit SRS with antenna port switching shall not exceed 2 subframes.

End of Change 4

Start of Change 5

## 5.x EN-DC Handover with PSCell

### 5.x.y Introduction

When the UE receives a RRC message implying handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within DHOwithPSCel\_PCell seconds from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on target NR PSCell within DHOwithPSCell\_PSCell seconds and from the end of the last TTI containing the RRC command.

Where

DHOwithPSCel\_PCell equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [2] plus the interruption time stated in clause 5.x.y.1.

DHOwithPSCel\_PSCell is the PSCell addition delay stated in clause 5.x.y.2.

##### 5.x.y.1 Handover with PSCell Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

When Handover with PSCell is commanded, the interruption time shall be less than Tinterrupt

 Tinterrupt = Tsearch + TIU + Tprocessing­­­ ms

Where:

Tsearch is same as the Tsearch defined in section 6.1.2.1.3

TIU is same as the one defined in section 6.1.2.1.3.

Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing­­­ = 25 ms if source NR PSCell and target NR PSCell are in the same FR. Tprocessing­­­ = 45 ms if source NR PSCell and target NR PSCell are in the different FR.

NOTE: The actual value of TIU shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 8.1.2.2.1 for intra-frequency handover and Clause 8.1.2.3.1 for inter-frequency handover.

##### 5.x.y.2 Handover with PSCell - NR PSCell Changing Delay requirements

When Handover with PSCell is commanded, the NR PSCell changing delay shall be less than DHOwithPSCel\_PSCell:

DHOwithPSCel\_PSCell = TRRC\_delay + Tprocessing + Tsearch + T∆ + TPSCell\_ DU + TPCell\_DU + 2 ms

TRRC\_delay is maximum RRC procedure delay to be defined in clause 11.2 in TS 36.331 [2].

Tprocessing is the SW processing time needed by UE, including RF warm up period. Tprocessing­­­ = 25 ms if source NR PSCell and target NR PSCell are in the same FR. Tprocessing­­­ = 45 ms if source NR PSCell and target NR PSCell are in the different FR.

Tsearch is same as Tsearch in section 7.31.2

T∆ is same as T∆ in section 7.31.2.

TPSCell\_ DU is same as TPSCell\_ DU in section 7.31.2.

TPCell\_DU is the delay uncertainty due to PCell RACH preamble transmission defined in TS 38.213 [39].

Trs is same as Trs in section 7.31.2.

In FR1 and FR2, the NR PSCell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the HO with PSCell command:

- the UE has sent a valid measurement report for the NR PSCell being configured and

- One of the SSBs measured from the NR PSCell being configured remains detectable according to the cell identification conditions specified in section 9.3 of TS 38.133 [50],

- One of the SSBs measured from NR PSCell being configured also remains detectable during the NR PSCell configuration delay according to the cell identification conditions specified in section 9.3 of TS 38.133 [50].

otherwise it is unknown.

End of Change 5

Start of Change 6

### 7.32.1 Introduction

This section contains the requirements related to the interruptions on PCell, and MCG SCell when

NR PSCell is added or released, or

transitions between active and non-active during NR PSCell DRX, or

transitions from NR PSCell non-DRX to DRX, or

SCell in either E-UTRA MCG or NR SCG is added or released, or

SCell(s) in either E-UTRA MCG or NR SCG is activated or deactivated, or

PUCCH SCell in NR SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG, or

a downlink bandwidth part (BWP) and/or an uplink BWP is switched in NR PSCell or in any NR SCell, or

UE dynamic Tx switches between two uplink carriers, or

NR SRS carrier based switching is performed.

The requirements shall apply for EN-DC.

This section contains interruption requirements when the victim cell is PCell or SCell belonging to MCG. Requirements for interruptions where victim cell is the NR PSCell or an NR SCell belonging to SCG are specified in [50].

For a UE which does not support per-FR measurement gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PCell or active MCG SCells may be caused by NR PSCell or NR SCells on FR1 only.

End of Change 6

Start of Change 7

7.32.2.5 Interruptions at SCell activation/deactivation

When one SCell belonging to MCG is activated or deactivated:

- the requirements in clause 7.8.2.8 shall apply.

When one NR SCell or NR SCell configured with PUCCH belonging to SCG is activated or deactivated

- an interruption on PCell or activated SCell in MCG shall not exceed X1 subframes for synchronous intraband EN-DC, X1+1 subframes for asynchronous intraband EN-DC, 1 subframe for synchronous interband EN-DC or 2 subframes for asynchronous interband EN-DC. For SCell activation X1 is equal to the duration of the SMTC of the SCell being activated + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot.For SCell deactivation X1 is equal to 1ms.

When multiple NR SCells in SCG is activated or deactivated by a single MAC CE

- an interruption on PCell or activated SCell in MCG shall not exceed X1 subframes if the PCell or activated SCell is in the same band as any of the NR SCell being activated with synchronous EN-DC, X1+1 subframes if the PCell or activated SCell is in the same band as any of the NR SCell being activated with asynchronous EN-DC, 1 subframe if the PCell or activated SCell is not the same band as any of the NR SCell being activated with synchronous EN-DC, or 2 subframes if the PCell or activated SCell is not the same band as any of the NR SCell being activated with asynchronous EN-DC. For SCell activation X1 is equal to the longest duration of the SMTC of the NR SCells being activated in the same band as the interrupted cell + 1 ms. The interruption is based on assumption that the cell specific reference signals from both cells are available in the same slot. For SCell deactivation X1 is equal to 1ms.

End of Change 7