**3GPP TSG-RAN4 Meeting #97-e *R4-2017121***

**Electronic Meeting, 2 – 13 November, 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.133** | **CR** | 6976 | **rev** | **1** | **Current version:** | **16.7.0** |  |
|  |
| *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)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | CR on EMR requirements in 36.133 |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, MediaTek |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | LTE\_NR\_DC\_CA\_enh-Core |  | ***Date:*** | 2020-09-21 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | Core requirements for LTE-NR inter-RAT EMR are incomplete.  |
|  |  |
| ***Summary of change:*** | Introduce the remaining core requirements for LTE-NR inter-RAT EMR. |
|  |  |
| ***Consequences if not approved:*** | Core requirements for LTE-NR inter-RAT EMR are incomplete. |
|  |  |
| ***Clauses affected:*** | 4.2.2, 4.2.2.5.6, 4.9 |
|  |  |
|  | **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:*** |  |

<Start of Change 1>

### 4.2.2 Requirements

The UE shall search every layer of higher priority at least every Thigher\_priority\_search = (60 \* Nlayers) seconds when the UE is not configured with eDRX\_IDLE cycle, and at least every Thigher\_priority\_search = MAX(60 \* Nlayers, one eDRX\_IDLE cycle) when UE is configured with eDRX\_IDLE cycle, where Nlayers is the sum of the total number of configured higher priority E-UTRA, UTRA FDD, UTRA TDD, CDMA2000 1x and HRPD carrier frequencies and is additionally increased by one if one or more groups of GSM frequencies is configured as a higher priority without early measurement reporting configured, and if configured, the number of NR inter-RAT carriers for early measurement reporting.

In the requirements of Section 4.2.2 for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, Section B.4.2.

For a UE which supports increased carrier monitoring E-UTRA or increased carrier monitoring UTRA, the reselection performance for different carriers may be configured by higher layers to be either normal or reduced. The following definitions are used in the requirements:

Kcarrier : Total number of interfrequency carriers in the neighbour cell list

Kcarrier,normal =Kcarrier- Kcarrier,reduced: Number of interfrequency carriers to be monitored in the normal performance group

Kcarrier,normal,FDD : Number of interfrequency FDD carriers to be monitored in the normal performance group

Kcarrier,normal,TDD : Number of interfrequency TDD carriers to be monitored in the normal performance group

Kcarrier,reduced : Number of interfrequency carriers to be monitored in the reduced performance group

NUTRA\_carrier: Total number of configured UTRA FDD carriers in the neighbour cell list

NUTRA\_carrier,normal= NUTRA\_carrier - NUTRA\_carrier,reduced: Number of UTRA FDD carriers to be monitored in the normal performance group

NUTRA\_carrier,reduced: Number of UTRA FDD carriers to be monitored in the reduced performance group

NUTRA\_carrier\_TDD : Total number of configured UTRA TDD carriers in the neighbour cell list

NUTRA\_carrier\_TDD,normal= NUTRA\_carrier\_TDD - NUTRA\_carrier\_TDD,reduced: Number of UTRA TDD carriers to be monitored in the normal performance grop

NUTRA\_carrier\_TDD,reduced: Number of UTRA TDD carriers to be monitored in the reduced performance group

The minimum performance requirements for a UE which supports Increased UE carrier monitoring E-UTRA [2, 31] are calculated as defined in section 4.2.2.4 provided that Kcarrier,normal ≤3 for a UE capable of either FDD E-UTRA carrier monitoring or TDD E-UTRA carrier monitoring or Kcarrier,normal ≤6 for a UE capable of both FDD and TDD E-UTRA carrier monitoring provided Kcarrier,normal,FDD ≤3 and Kcarrier,normal,TDD ≤3and the minimum performance requirements for a UE which supports Increased UE carrier monitoring UTRA [2, 31] are calculated as defined in section 4.2.2.5 provided that NUTRA\_carrier\_normal≤3 and NUTRA\_carrier\_TDD,normal≤3. In case the limits for the number of normal performance carriers is exceeded considering the broadcast neighbour cell list and the bands supported by the UE, the UE which supports Increased UE carrier monitoring E-UTRA shall measure at least 3 interfrequency carriers with normal performance and the UE which supports Increased UE carrier monitoring UTRA shall measure at least 3 UTRA carriers with normal performance. For a UE capable of monitoring E-UTRAN FDD and TDD carriers, in case the limits for the number of normal performance carriers is exceeded considering the broadcast neighbour cell list and the bands supported by the UE, the UE shall measure at least 3 FDD and 3 TDD E-UTRAN interfrequency carriers with normal performance. Additionally, reduced performance requirements shall be met for carriers for which the *Reduced measurement performance* IE is indicated, up to the UE measurement capability in section 4.2.2.9a.The minimum performance requirements for a UE which does not support Increased UE carrier monitoring E-UTRA [2,31] are calculated assuming all E-UTRA carriers required to be monitored for such UE, are having normal performance and are in normal performance group, i.e. Kcarrier,normal =Kcarrier and Kcarrier,reduced=0. The minimum performance requirements for a UE which does not support Increased UE carrier monitoring UTRA [2,31] are calculated assuming all UTRA carriers required to be monitored for such UE, are having normal performance and are in normal performance group, i.e. NUTRA\_carrier,normal= NUTRA\_carrier, NUTRA\_carrier\_TDD,normal= NUTRA\_carrier\_TDD and NUTRA\_carrier,reduced =0 and NUTRA\_carrier\_TDD,reduced =0. No reduced performance carrier requirement applies to a UE not supporting Increased UE carrier monitoring E-UTRA or UTRA [2, 31]. Capabilities for number of carriers to monitor for a UE which does not support Increased carrier monitoring E-UTRA or Increased carrier monitoring UTRA are specified in section 4.2.2.9

<End of Change 1>

<Start of Change 2>

##### 4.2.2.5.6 Measurements of NR cells

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT NR layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT NR layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT NR layers shall be the same as that defined below for lower priority RATs.

The requirements in this section apply for inter-RAT NR measurements. When the measurement rules indicate that inter-RAT NR cells are to be measured, the UE shall measure SS-RSRP and SS-RSRQ of detected NR cells in the neighbour frequency list at the minimum measurement rate specified in this section. The parameter NNR\_carrier is the sum of the number of configured NR carriers indicated to meet non high speed requirement in the neighbour frequency list, and if configured, the number of NR inter-RAT carriers for early measurement reporting that is not configured for reselection. NNR\_carrier\_HST is the number of configured carriers for reselection indicated to meet high speed requirements. The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured NR cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

The UE shall be able to evaluate whether a newly detectable inter-RAT NR cell meets the reselection criteria defined in TS 36.304 [1] within NNR\_carrier\_HST \* Tdetect, NR\_HST + NNR\_carrier \* Tdetect, NR

 when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this section shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT NR cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

Cells which have been detected shall be measured at least every NNR\_carrier\_HST \* Tmeasure, NR\_HST + NNR\_carrier \* Tmeasure, NR when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT NR cell has met reselection criterion defined in TS 36.304 [1] within NNR\_carrier\_HST \* Tevaluate, NR\_HST + NNR\_carrier \* Tevaluate, NR when Treselection = 0as specified in Table 4.2.2.5.6-1 and table 4.2.2.5.6-2 provided that the reselection criteria is met by a margin of at least 5dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-RAT NR cell is satisfied with the reselection criteria which are defined in TS 36.304 [1], the UE shall evaluate this NR cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.5.6-1: Tdetect,NR, TmeasureNR, and Tevaluate,NR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | Tdetect,NR [s] (number of DRX cycles) | Tmeasure,NR [s] (number of DRX cycles) | Tevaluate,NR[s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | 11.52 x 1.5 x N1(36 x 1.5 x N1) | 1.28 x 1.5 x N1(4 x 1.5 x N1) | 5.12 x 1.5 x N1(16 x 1.5 x N1) |
| 0.64 | 5 | 17.92 x N1(28 x N1) | 1.28 x N1(2 x N1) | 5.12 x N1(8 x N1) |
| 1.28 | 4 | 32 x N1(25 x N1) | 1.28 x N1(1 x N1) | 6.4 x N1(5 x N1) |
| 2.56 | 3 | 58.88 x N1(23 x N1) | 2.56 x N1(1 x N1) | 7.68 x N1(3 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. |

Table 4.2.2.5.6-2: Tdetect,NR\_HST, TmeasureNR\_HST, and Tevaluate,NR\_HST when UE supports and is configured with high speed reselection from LTE to NR

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,NR\_HST [s] (number of DRX cycles) | Tmeasure,NR\_HST [s] (number of DRX cycles) | Tevaluate,NR\_HST[s] (number of DRX cycles) |
|
| 0.32 | 4.16 x M2 (13 x M2)Note 2 | 0.64 x M3 (2 x M3)Note 2 | 0.96 x M4 (3 x M4) Note 2 |
| 0.64 | 7.68 (12)) | 1.28 (2) | 1.92 (3) |
| 1.28 | 12.8(10)  | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| Note 1: FR2 high speed requirements are not specified.Note 2: M2=1.5, M3=2 and M4=2 if SMTC periodicity of measured intra-frequency cell > 40 ms; otherwise M2=1. |

<End of Change 2>

<Start of Change 3>

## 4.9 Idle Mode CA Measurement

### 4.9.1 Introduction

A UE supporting *ca-IdleModeMeasurements* shall perform the idle mode measurement on the inter-frequency CA candidate frequencies/cells indicated by higher layers and meet the requirement specified in this section. A UE supporting *endc-IdleInactiveMeasFR1-r16* and/or *endc-IdleInactiveMeasFR2-r16* shall perform the idle mode measurement on the NR inter-RAT EN-DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this section.

Additionally, a UE supporting *ca-IdleModeMeasurements* or *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16* shall perform the idle mode measurement on serving cell and meet the requirement specified in this section.

A UE only supporting *ca-IdleModeMeasurements* shall fulfil the requirements defined for a UE supporting *ca-IdleModeMeasurements* as defined in this section.

A UE only supporting *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16* shall fulfil the requirements defined for a UE supporting *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16* as defined in this section.

A UE supporting both *ca-IdleModeMeasurements* and *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16* shall fulfil the requirements for a UE supporting *ca-IdleModeMeasurements* and *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16* as defined in this section.

The requirements in clause 4.9 apply provided that the UE is provided with a valid timer T331 by dedicated RRC signaling and T331 is running.

### 4.9.2 Requirement

For a UE which supports *ca-IdleModeMeasurements* the UE shall support the idle mode CA measurements on the serving cell, overlapping and non-overlapping carriers.

For inter-frequency idle mode measurements, an overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting and inter-frequency mobility measurements. A non-overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting while not configured for inter-frequency mobility measurements.

#### 4.9.2.1 Detected cell requirement during state transition and Idle mode

This subclause defines the requirements for the detected cell status for the idle mode CA measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode. The requirements are applicable to an E-UTRAN carrier aggregation or EN-DC capable UE which has been configured with one or more downlink SCells or NR PSCell and one or more downlink NR SCells during the Connected mode and which supports *ca-IdleModeMeasurements* or *endc-IdleInactiveMeasFR1-r16*/*endc-IdleInactiveMeasFR2-r16.* The requirements are applicable for E-UTRAN FDD and TDD SCell(s), and NR PSCell and SCells.

Upon releasing the connection and if the UE has been configured with idle mode CA measurement reporting, following requirements apply concerning the detected cells in Connected mode upon state transitioning to Idle mode and during Idle mode:

- A cell which is detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle mode and during Idle mode, provided that the following conditions are met:

- The UE has been provided with a list of cells and/or carrier frequencies for early measurement reporting by dedicated RRC signaling and

- The detected cell is among the list of cells or on a carrier frequency provided for early measurement reporting, and

- The UE is provided with a valid timer T331 by dedicated RRC signaling, and

- For inter-frequency carrier, the detected cell remains detectable until UE reconnects to the network and transmits the early measurement report, or for NR inter-RAT carrier, the detected cell and SSBs of the detected cell remains detectable until UE reconnects to the network and transmits the early measurement report.

- The carrier frequency of the detected cell and the carrier frequency of the serving cell are among the supported band combination of the UE.

An inter-frequency cell is considered detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.1 and Annex B.1.2 for a corresponding Band. An inter-RAT NR cell is considered detectable according to the conditions in B.1.3 of [50] for a corresponding band. An SSB of an inter-RAT NR cell is considered detectable according to SSB\_RP and SSB Ês/Iot defined in Annex B.1.3 of [50] for a corresponding Band.

In the absence or expiration of T331, it is up to UE implementation to apply the requirements on the detected cell status in this subclause.

#### 4.9.2.2 Measurements of inter-frequency CA candidate cells

While T331 is running, the UE shall perform measurement on the configured overlapping and non-overlapping inter-frequency carriers for idle mode measurement reporting.

A UE which supports *ca-IdleModeMeasurements* shall support the idle mode CA measurements of at least 1 non-overlapping inter-frequency carrier and 1 overlapping inter-frequency carrier.

For overlapping carriers, the inter-frequency measurement requirements in section 4.2.2.4 apply.

For non-overlapping carriers, at least prior to transmission of the idle mode measurement report, the UE shall perform at least a single measurement on detected cells on the non-overlapping inter-frequency carrier(s) configured to be measured for early measurement reporting.

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode CA measurement.

For overlapping carriers, the UE shall be capable of performing RSRP and RSRQ measurements of the overlapping carriers, and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the overlapping carriers to higher layers, with measurement accuracy as specified in sub-clauses 9.1.3B.2 and 9.1.6B.2, respectively. The UE shall be able to report idle mode CA measurements when idle mode CA measurement reporting is requested by the network.

#### 4.9.2.3 Measurements on serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in section 4.2.2.1 and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the serving cell to higher layers, with measurement accuracy as specified in sub-clauses 9.1.2B.2 and 9.1.5B.2, respectively.

4.9.2.4 Measurements of inter-RAT NR DC candidate cells

While T331 is running, the UE shall perform measurement on the configured NR inter-RAT carriers for idle mode measurement reporting.

In addition to the requirements defined in section 4.2.2.9 and 4.2.2.9a, a UE which supports *endc-IdleInactiveMeasFR1-r16 or endc-IdleInactiveMeasFR2-r16* shall be able to monitor at least a total of 8 NR inter-RAT carriers for early measurement reporting. UE shall be able to support at least 8 inter-RAT carriers which are also configured for inter-RAT mobility measurements. UE shall be able to support at least 2 inter-RAT carrier which are for early measurement reporting while not configured for inter-RAT mobility measurements.

For NR inter-RAT carriers, the NR inter-RAT measurement principles defined for inter-RAT NR layers of higher priority in clause 4.2.2.5.6 apply.

For UE supporting [Capability name for beam level EMR], if the UE is configured with *beamMeasConfigIdle-r16* for idle mode DC measurement, the UE shall be able to perform RSRP/RSRQ measurement and acquire the SSB index for a newly detectable inter-RAT NR cell within the requirements defined in clause 4.2.2.5.6 plus TSSB\_index,NR, where TSSB\_index,NR is the additional time period used to acquire the index of the SSB being measured as defined in Table 4.9.2.4-1.

**Table 4.9.2.4-1: TSSB\_index,NR**

|  |  |  |
| --- | --- | --- |
| DRX cycle length [s] | Scaling Factor (N1) | TSSB\_index,NR [s] (number of DRX cycles) |
| FR1 | FR2Note1 |
| 0.32 | 1 | 8 | N2 x 1.28 x 1.5 x N1(N2 x 4 x 1.5 x N1) |
| 0.64 | 5 | N2 x 1.28 x N1(N2 x 2 x N1) |
| 1.28 | 4 | N2 x 1.28 x N1(N2 x 1 x N1) |
| 2.56 | 3 | N2 x 2.56 x N1(N2 x 1 x N1) |
| NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.NOTE 2: N2 = 3 if the NR inter-RAT carrier for early measurement reporting is in FR1, and N2=5 otehrwise. |

For UE supporting [Capability name for beam level EMR], if the UE is configured with *beamMeasConfigIdle-r16* for idle mode DC measurement, the UE shall be capable of performing SS-RSRP, SS-RSRQ for at least

- 7 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR1,

- 10 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR2.

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode DC measurement.

The UE shall be capable of performing SS-RSRP and SS-RSRQ measurements of the carriers for early measurement reporting, and the UE physical layer shall be capable of reporting SS-RSRP and SS-RSRQ measurements of the carriers for early measurement reporting to higher layers, with measurement accuracy as specified in sub-clauses [TBD] and [TBD], respectively. The UE shall be able to report idle mode DC measurements when idle mode DC measurement reporting is requested by the network.

<End of Change 3>