**3GPP TSG-RAN4 Meeting #96-e *R4-2012100***

**Online, , 17th Aug 2020 - 28th Aug 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **36.133** | **CR** | **6931** | **rev** | **1** | **Current version:** | **16.6.0** |  |
|  |
| *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 to TS 36.133 to address NR-U inter-RAT measurements |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | RAN4 |
|  |  |
| ***Work item code:*** | NR\_unlic-Core |  | ***Date:*** | 2020-08-07 |
|  |  |  |  |  |
| ***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)* |
|  |  |
| ***Reason for change:*** | Currently there are no requirements for E-UTRA Inter-RAT NR measurements when configured and not configured with E-UTRA-NR Dual Connectivity Operation when CCA is used in NR.  |
|  |  |
| ***Summary of change:*** | Three new subclauses are added, which are 8.1.2.4.21A, 8.1.2.4.22A and 8.17.4A. Additionally, clause 2 is changed to include a new reference |
|  |  |
| ***Consequences if not approved:*** | The specification is incomplete.  |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | This CR is based on the endorsed document in R4-2008578 |
|  |  |
| ***This CR's revision history:*** | ***R4-2010595*** |

<Start of Change 1>

# 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 TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode"

[2] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[3] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"

[4] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements"

[5] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"

[6] 3GPP TS 25.302: "Services provided by the Physical Layer".

[7] 3GPP TS 25.331: "RRC Protocol Specification".

[8] 3GPP TS 45.008: "Radio subsystem link control".

[9] 3GPP TS 45.005: "Radio transmission and reception".

[10] 3GPP TS 45.010: "Radio subsystem synchronization".

[11] 3GPP2 C.S0024-B: "cdma2000 High Rate Packet Data Air Interface Specification".

[12] 3GPP2 C.S0002-D: "Physical Layer Standard for cdma2000 Spread Spectrum Systems - Release A".

[13] 3GPP2 C.S0033-B: "Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Terminal".

[14] 3GPP2 C.S0011-C: "Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations".

[15] 3GPP2 C.S0005-D: Upper Layer (Layer 3) Signaling Specification for cdma2000 Spread Spectrum Systems

[16] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation”

[17] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[18] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[19] 3GPP TS 25.123: "Requirements for Support of Radio Resource Management (TDD)".

[20] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[21] 3GPP TS 36. 212 "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding".

[22] 3GPP TS 36.302: "Evolved Universal Terrestrial Radio Access (E-UTRA); Services provided by the physical layer".

[23] 3GPP TS 36.521-3: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management conformance testing".

[24] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[25] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2"

[26] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[27] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2"

[28] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[29] 3GPP TS 25.101: "UE Radio transmission and reception (FDD)".

[30] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[31] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".

[32] IEEE Standard 802.11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications.

[33] 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based services (ProSe); Stage 2".

[34] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[35] 3GPP TS 36.171: " Requirements for Support of Assisted Global Navigation Satellite System (A-GNSS)".

[36] 3GPP TS 36.305: " Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".

[37] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[38] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[39] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[40] 3GPP TS 37.340: “Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity”, Stage 2.

[41] 3GPP TS 38.101: "NR; User Equipment (UE) radio transmission and reception".

[42] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[43] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[44] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[45] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer".

[46] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[47] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[48] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[49] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[50] 3GPP TS 38.133: "NR; Requirements for support of radio resource management "

[51] 3GPP TS 38.214: " New Radio (NR); Physical layer procedures".

[52] 3GPP TS 38.101-1: “NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone”.

[53] 3GPP TS 38.101-2: “NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone”.

[54] 3GPP TS 38.101-3: “NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios”.

[55] 3GPP TS 38.101-4: “NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements”.

[56] 3GPP TS 24.368: “Non-Access Stratum (NAS) configuration Management Object (MO)”

[57] 3GPP TS 37.213: “Physical layer procedures for shared spectrum channel access”

[58] 3GPP TS 38.215: "NR; Physical layer measurements".

<End of Change 1>

<Start of Change 2>

8.1.2.4.21.1.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

8.1.2.4.21.2 Void

##### 8.1.2.4.21A E-UTRAN FDD – NR measurements when CCA is used

Requirements in this clause shall apply for NR capable UE, when NR is in carrier frequencies with CCA and not configured with EN-DC.

The UE shall be able to identify new RAT E-UTRAN FDD-NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

8.1.2.4.21A.1 E-UTRAN FDD – NR measurements

8.1.2.4.21A.1.1 Identification of a new NR cell

When measurement gaps are scheduled, the UE shall be able to identify a new detectable cell within Tidentify\_irat\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise, UE shall be able to identify a new detectable inter-RAT frequency cell within Tidentify\_irat\_cca\_with\_index. The UE shall be able to identify a new detectable inter-RAT frequency SSB of an already detected cell within Tidentify\_irat\_cca\_without\_index.

 Tidentify\_irat\_cca\_without\_index = (TPSS/SSS\_sync\_irat\_cca + T SSB\_measurement\_period\_irat\_cca) ms

 Tidentify\_irat\_cca\_with\_index = (TPSS/SSS\_sync\_irat\_cca + T SSB\_measurement\_period\_irat\_cca + TSSB\_time\_index\_irat\_cca) ms

Where:

 TPSS/SSS\_sync\_irat\_cca: it is the time period used in PSS/SSS detection given in table 8.1.2.4.21A.1.1-1.

 TSSB\_time\_index\_irat\_cca: it is the time period used to acquire the index of the SSB being measured given in table 8.1.2.4.21A.1.1-2.

 T SSB\_measurement\_period\_irat\_cca: equal to a measurement period of SSB based measurement given in table 8.1.2.4.21A.1.1-3.

Nfreq is defined in clause 8.1.2.1.1.

Table 8.1.2.4.21A.1.1-1: Time period for PSS/SSS detection, in NR carrier frequencies with CCA

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TPSS/SSS\_sync\_irat\_cca |
| No DRX |  Max(600ms, (8 +LPSS/SSS,gaps)× Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil((8+LPSS/SSS,gaps) ×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (8+LPSS/SSS,gaps) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50].NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: LPSS/SSS,gaps is the number of SMTC periods not available at the UE during TPSS/SSS\_sync\_irat\_cca, where LPSS/SSS,gaps ≤ LPSS/SSS,gaps,max.NOTE 4:   LPSS/SSS,gaps = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms LPSS/SSS,gaps = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and LPSS/SSS,gaps = 5 for DRX cycle > 320 ms. |

Upon exceeding LPSS/SSS,gaps,max, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

*Editor’s note: the definition of SMTC period not available at the UE is FFS.*

Table 8.1.2.4.21A.1.1-2: Time period for time index detection, in NR carrier frequencies with CCA

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TSSB\_time\_index\_irat\_cca |
| No DRX | Max(120ms, ([3] + Lind,gaps) × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(120ms, ceil((3+ Lind,gaps) x 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (3+ Lind,gaps) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: Lind,gaps is the number of SMTC periods not available at the UE during TSSB\_time\_index\_irat\_cca, where Lind,gaps ≤ Lind,gaps,maxNOTE 4:   Lind,gaps,max = 5 for Max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lind,gaps,max = 3 for Max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lind,gaps,max = 2 for DRX cycle > 320 ms. |

The UE shall restart the time index detection upon exceeding Lind,gaps,max. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

*Editor’s note: the definition of SMTC period not available at the UE is FFS.*

In the requirements, an NR cell is considered to be detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in TBD of TS 38.133 [50].

When measurement gaps are scheduled for NR measurements the UE physical layer shall be capable of reporting NR SS-RSRP, SS-RSRQ, and SS-SINR measurements to higher layers with measurement accuracy as specified in clause TBD, with measurement period as shown in table 8.1.2.4.21A.1.1-3:

Table 8.1.2.4.21A.1.1-3: Measurement period for inter-RAT measurements

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | T SSB\_measurement\_period\_irat\_cca |
| No DRX | Max(200ms, (8+ Lmeas) × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, ceil((8+ Lmeas) x 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | (8+ Lmeas) × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1 of TS 38.133 [50]NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: Lmeas is the number of SMTC periods not available at the UE during T SSB\_measurement\_period\_irat\_cca, where Lmeas ≤ Lmeas,maxNOTE 4:   Lmeas,max = 12 for Max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lmeas,max = 8 for Max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lmeas,max = 5 for DRX cycle > 320 ms. |

The UE shall restart the measurement upon exceeding Lmeas,max. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

The UE shall be capable of performing SSB based SS-RSRP, SS-RSRQ, and SS-SINR for up to [7] NR carrier frequencies.

For each RAT E-UTRAN FDD-NR layer on, in carrier frequencies with CCA, the UE shall be capable of monitoring at least 4 cells.

For each RAT E-UTRAN FDD-NR layer on FR1, in carrier frequencies with CCA, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB indexes and/or PCI on the RAT E-UTRAN FDD-NR layer.

The NR SS-RSRP measurement accuracy for all measured cells shall be as specified in clause TBD. The NR SS-RSRQ measurement accuracy for all measured cells shall be as specified in clause TBD. The NR SS-SINR measurement accuracy for all measured cells shall be as specified in clause TBD.

8.1.2.4.21A.1.2 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 9.

8.1.2.4.21A.1.3 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 9.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than Tidentify\_irat\_cca\_without\_index or Tidentify\_irat\_cca\_with\_index defined in Clause 8.1.2.4.21A.1.1 for the minimum requirements.When L3 filtering is used or IDC autonomous denial or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

If a cell which has been detectable at least for the time period Tidentify\_irat\_cca\_without\_index or Tidentify\_irat\_cca\_with\_index defined in clause 8.1.2.4.21A.1.1 for the minimum requirements and then triggers the measurement report as per TS 36.331 [2], the event triggered measurement reporting delay shall be less than Tmeasurement\_NR\_cca\_FDD defined in clause 8.1.2.4.21A.1.1 provided the timing to that cell has not changed more than ±3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used or IDC autonomous denial is configured or the UE is performing reception and/or transmission for ProSe Direct Discovery and/or ProSe Direct Communication, or the UE is configured to perform SRS carrier based switching, an additional delay can be expected.

8.1.2.4.21A.1.4 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 9.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.1.2.4.21A.1.3.

8.1.2.4.21A.1.5 NR inter-RAT RSSI measurements

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [58], on one or more inter-RAT carriers operating with CCA, TS 37.213 [57], if the carrier(s) are indicated by higher layers [38], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [38] occurring with a configured RSSI measurement timing configuration periodicity, *rmtc-Periodicity,* according to [38].

**Table 8.1.2.4.21A.1.5-1: Measurement period for inter-RAT RSSI measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T RSSI\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should fulfilled:

Entire RSSI measurement duration should be contained in the measurement gap.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section TBD in TS 38.133 [50].

##### 8.1.2.4.21A.1.6 NR inter-RAT channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

**Table 8.1.2.4.21A.1.6-1: Measurement period for inter-RAT Channel Occupancy measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T CO\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section TBD of TS 38.133 [50].

##### 8.1.2.4.22 E-UTRAN TDD – NR measurements

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC.

The requirements in clause 8.1.2.4.21 also apply for this section.

##### 8.1.2.4.22A E-UTRAN TDD – NR measurements when CCA is used

Requirements in this clause shall apply for NR capable UE when not configured with EN-DC, considering NR carrier frequencies with CCA.

The requirements in clause 8.1.2.4.21A also apply for this section.

<End of Change 2>

<Start of Change 3>

#### 8.17.4.2 E-UTRAN TDD – NR measurements when configured with E-UTRA-NR Dual connectivity

The requirements in clause 8.17.4.1 also apply for this section.

### 8.17.4A E-UTRA Inter-RAT NR Measurements when CCA is used when Configured with E-UTRA-NR Dual Connectivity Operation

#### 8.17.4A.1 E-UTRAN FDD – NR measurements when configured with E-UTRA-NR Dual connectivity

Requirements in this clause apply for the NR capable UE configured with inter-RAT measurement on NR, when NR is in carrier frequencies with CCA. For UE supporting EN-DC operation, the requirements in this clause shall apply when NR PSCell is configured. When the UE is not configured with E-UTRA-NR dual connectivity mode then the E-UTRAN FDD-NR measurement requirements defined in section 8.1.2.4.21A shall apply.

The UE shall be able to identify new inter-RAT NR cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-RAT NR cells if carrier frequency information is provided by the PCell, even if no explicit neighbour list with physical layer cell identities is provided.

An NR cell is considered detectable when:

- NR SS-RSRP related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in clause TBD are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex TBD of TS 38.133 [50].

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause TBD, the NR SS-RSRQ measurement accuracy for all measured cells shall be as specified in clause TBD, and NR SS-SINR measurement accuracy for all measured cells shall be as specified in clause TBD.

##### 8.17.4A.1.1 NR Inter-RAT cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-RAT NR cell within Tidentify\_NR\_cca\_with\_index. The UE shall be able to identify a new detectable inter-RAT NR SSB of an already detected cell within Tidentify\_NR\_cca\_without\_index.

 Tidentify\_NR\_cca\_without\_index = (TPSS/SSS\_sync\_NR\_cca + TSSB\_measurement\_period\_NR\_cca) ms

 Tidentify\_NR\_cca\_with\_index = (TPSS/SSS\_sync\_NR\_cca + TSSB\_measurement\_period\_NR\_cca + TSSB\_time\_index\_NR\_cca) ms

Where:

 TPSS/SSS\_sync\_NR\_cca: it is the time period used in PSS/SSS detection given in table 8.17.4A.1.1 -1

 TSSB\_time\_index\_NR\_cca: it is the time period used to acquire the index of the SSB being measured given in table 8.17.4A.1.1-2

 TSSB\_measurement\_period\_NR\_cca: equal to a measurement period of SSB based measurement given in table 8.17.4A.1.2-1

 CSSFNR,EN-DC: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i defined in clause 9.1.5.2.1 of TS 38.133 [50] for measurement conducted within measurement gaps in EN-DC mode.

Table 8.17.4A.1.1-1: Time period for PSS/SSS detection

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TPSS/SSS\_sync\_NR\_cca |
| No DRX |  Max(600ms, (8 +LPSS/SSS,gaps) × Max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(600ms, ceil((8+LPSS/SSS,gaps) × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (8 +LPSS/SSS,gaps) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50]are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: LPSS/SSS,gaps is the number of SMTC periods not available at the UE during TPSS/SSS\_sync\_NR\_cca, where LPSS/SSS,gaps ≤ LPSS/SSS,gaps,max.NOTE 4:   LPSS/SSS,gaps = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms LPSS/SSS,gaps = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and LPSS/SSS,gaps = 5 for DRX cycle > 320 ms. |

Upon exceeding LPSS/SSS,gaps,max, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

*Editor’s note: the definition of SMTC period not available at the UE is FFS.*

Table 8.17.4A.1.1-2: Time period for time index detection

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | TSSB\_time\_index\_NR\_cca |
| No DRX | Max(120ms, (3 + Lind,gaps)× max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(120ms, ceil((3 + Lind,gaps) × 1.5) × max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (3 + Lind,gaps) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: Lind,gaps is the number of SMTC periods not available at the UE during TSSB\_time\_index\_NR\_cca, where Lind,gaps ≤ Lind,gaps,maxNOTE 4:   Lind,gaps,max = 5 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lind,gaps,max = 3 for max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lind,gaps,max = 2 for DRX cycle > 320 ms. |

The UE shall restart the time index detection upon exceeding Lind,gaps,max. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

*Editor’s note: the definition of SMTC period not available at the UE is FFS.*

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4A.1.2 NR Inter-RAT measurement

When measurement gaps are provided for inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses TBD, TBD, and TBD, respectively, with a measurement period given by:

Table 8.17.4A.1.2-1: Measurement period for NR inter-RAT measurements with gaps

|  |  |
| --- | --- |
| Condition NOTE1,2,3,4 | T SSB\_measurement\_period\_NR\_cca |
| No DRX | Max(200ms, (8+ Lmeas) × max(MGRP, SMTC period)) × CSSFNR,EN-DC |
| DRX cycle ≤ 320ms | Max(200ms, ceil((8+ Lmeas) x 1.5) × max(MGRP, SMTC period, DRX cycle)) × CSSFNR,EN-DC |
| DRX cycle > 320ms | (8+ Lmeas) × DRX cycle × CSSFNR,EN-DC |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 of TS 38.133 [50] are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.NOTE 3: Lmeas is the number of SMTC periods not available at the UE during T SSB\_measurement\_period\_NR\_cca, where Lmeas ≤ Lmeas,maxNOTE 4:   Lmeas,max = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, Lmeas,max = 8 for max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and Lmeas,max = 5 for DRX cycle > 320 ms. |

The UE shall restart the measurement upon exceeding Lmeas,max. The requirements apply provided that any two closest SSB occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

*Editor’s note: the definition of SMTC period not available at the UE is FFS.*

When SCG DRX is in use the applicable DRX cycle is the SCG DRX cycle.

##### 8.17.4A.1.3 NR Inter-RAT measurement reporting

8.17.4.1.3.1 Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

8.17.4A.1.3.2 Event-triggered Periodic Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 8.17.4A.1.3.3.

8.17.4A.1.3.3 Event-triggered Reporting

Reported NR SS-RSRP, NR SS-RSRQ, and NR SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses TBD, TBD and TBD, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within Tidentify\_NR\_cca\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable NR cell within Tidentify\_NR\_cca\_with\_index. Both Tidentify\_NR\_cca\_without\_index and Tidentify\_NR\_cca\_with\_index are defined in clause 8.17.4A.1.1.When L3 filtering is used an additional delay can be expected.

If an NR cell which has been detectable at least for the time period Tidentify\_NR\_cca\_without\_index or Tidentify\_NR\_cca\_with\_index defined in clause 8.17.4A.1.1 and then triggers the measurement report as per TS 38.331 [38], the event triggered measurement reporting delay shall be less than TSSB\_measurement\_period\_NR\_cca defined in clause 8.17.4A.1.2 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

##### 8.17.4A.1.4 NR inter-RAT RSSI measurements

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [58], on one or more inter-RAT carriers operating with CCA, TS 37.213 [57], if the carrier(s) are indicated by higher layers [38], and reporting the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [38] occurring with a configured RSSI measurement timing configuration periodicity, *rmtc-Periodicity,* according to [38].

**Table 8.17.4A.1.4-1: Measurement period for inter-RAT RSSI measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T RSSI\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

Entire RSSI measurement duration should be contained in the measurement gap.

The RSSI measurement performed and reported according to this section shall meet the RSSI measurement accuracy requirement in Section TBD.

##### 8.17.4A.1.5 NR inter-RAT channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

**8.17.4A.1.5-1: Measurement period for inter-RAT Channel Occupancy measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1,2,3,4** | **T CO\_measurement\_period\_NR\_cca** |
| No DRX | max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x CSSFNR,EN-DC) |
| DRX | max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x CSSFNR,EN-DC) |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 of TS 38.133 [50]. |

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements.

The channel occupancy measurement performed and reported according to this section shall meet the channel occupancy measurement accuracy requirements in Section TBD of TS 38.133 [50].

#### 8.17.4A.2 E-UTRAN TDD – NR measurements when configured with E-UTRA-NR Dual connectivity

The requirements in clause 8.17.4A.1 also apply for this section.

<End of Change 3>