**3GPP TSG-RAN WG4 Meeting #102-e *R4-2207130***

**Electronic meeting, February 21 – March 3, 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.133** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **15.15.0** |  |
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| *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:*** | Big CR to TS 36.133: LTE RRM maintenance (Rel-15) | | | | | | | | | |
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| ***Source to WG:*** | MCC, Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_feMTC-Core, NR\_newRAT-Core, TEI14 | | | | |  | ***Date:*** | | | 2022-03-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *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 can be 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:*** | | This big CR merge the endorsed draft CR. The reason for change in each endorsed draft CR is copied below.  - R4-2205348, CR to eMTC inter-frequency measurement requirements in Idle mode R15   * The margin is defined as 8dB for newly detectable cell but 6dB for already detected cell. In addition, for connected mode, the relative RSRP accuracy requirements in section 9.1.21 for mode B is 8dB.   - R4-2203726, CR: Correction on SyncRef UE Frequency Offset in Synchronization Reference Selection/Reselection Test   * SyncRef UE1 and SyncRef UE2 should have the same frequency offset in this test, because they are with the same synchronization source, GNSS, directly or indirectly to GNSS: * SyncRef UE1 has SSID=168, according to 36.331, it synchronizes indirectly to GNSS * SyncRef UE2 has SSID=0, according to 36.331, it synchronizes directly to GNSS * During T3, when UE synchronizes to SyncRef UE1 and search for SyncRef UE2, the assumption is SyncRef UE1 and 2 are synchronized. If they have synchornized timing, frequency should be synchronized, too.   - R4-2203732, CR: Correction on Synchronization Reference Selection/Reselection SyncRefUE Frequency Offset Side Condition for LTE-V2X   * In 36.101, SL transmission frequency error requirement only applies to SL UEs synchronized to a reference source, but not to SL UEs without a reference source * *The UE modulated carrier frequency for V2X sidelink transmissions shall be accurate to within ±0.1 PPM observed over a period of one time slot (0.5 ms) compared to the absolute frequency in case of using GNSS synchronization source. The same requirements applied over a period of one time slot (0.5 ms) compared to the relative frequency in case of using the E-UTRA Node B or V2X UE sidelink synchronization signals.* * Therefore, the frequency error from a SyncRef UE can be unbounded if it doesn’t synchronize to any source, and an SL UE can not search for SLSS in a unbounded frequency range. Therefore, adding a side condition on frequency error range for SLSS search requirement is necessary. We propose to apply the frequency error configuration in Synchronization Reference Selection/Reselection Test in clause 12.3 as a side condition for Selection/Reselection to Intra-frequency SyncRef UE requirement.   - R4-2204308, Draft CR to maintain inter-RAT measurements in TS 36.133   * Cell-ranking criteria should not be applicable to inter-RAT measurement. Cell-ranking criteria is only applicable to intra-frequency or inter-frequency measurement with equal priority, while inter-RAT measurement cannot be configured with the same priority.   - R4-2206792, Draft CR on core part maintenance for TS36.133 R15   * In the NR inter-RAT measurement for LTE SA UE (section 8.1.2.4.21.1.1), the DRX configuration shall be based on the LTE serving cell but not based on a NR MO. The note 1 in corresponding tables shall refer to TS36.133 section 5: DRX status definition.   - R4-2206801, CR on RSTD measurement requirements 36133 R15   * In 3.6.2, it is specified that the inter-frequency RSTD requirements in clause 8.1.2.6 defined for LTE SA apply for EN-DC. However, the inter-frequency RSTD measurement requirements for EN-DC are defined in clause 8.17.15. * There are [] in requirements for inter-frequency RSTD requirements for LTE SA. | | | | | | | | |
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| ***Summary of change:*** | | The summary of change in each each endorsed draft CR is copied below.  - R4-2205348, CR to eMTC inter-frequency measurement requirements in Idle mode R15   * Change the margin in clause 4.7.2.2.3 from 6dB to 8dB. * Remove [] around margin values in clause 4.7.2.1.3.   - R4-2203726, CR: Correction on SyncRef UE Frequency Offset in Synchronization Reference Selection/Reselection Test   * Align frequency offsets of SyncRef UE1 and SyncRef UE2   - R4-2203732, CR: Correction on Synchronization Reference Selection/Reselection SyncRefUE Frequency Offset Side Condition for LTE-V2X   * Amend the necessary side condition for Selection/Reselection to Intra-frequency SyncRef UE requirement   - R4-2204308, Draft CR to maintain inter-RAT measurements in TS 36.133   * Remove the cell-ranking criteria for inter-RAT measurements.   - R4-2206792, Draft CR on core part maintenance for TS36.133 R15   * Correct the note 1 in tables of section 8.1.2.4.21.1.1 for correct reference to TS36.133 section 5: DRX status definition.   - R4-2206801, CR on RSTD measurement requirements 36133 R15   * Correct the clause number for the applicable requirements for inter-frequency RSTD measurement in EN-DC. * Remove [] in requirements for inter-frequency RSTD requirements for LTE SA. | | | | | | | | |
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| ***Consequences if not approved:*** | | The consequences if not approved for each endorsed draft CR are coppied below.  - R4-2205348, CR to eMTC inter-frequency measurement requirements in Idle mode R15   * eMTC inter-frequency measurement requirements in idle mode are incorrect.   - R4-2203726, CR: Correction on SyncRef UE Frequency Offset in Synchronization Reference Selection/Reselection Test   * Frequency offset setting is inconsistent with test configuration   - R4-2203732, CR: Correction on Synchronization Reference Selection/Reselection SyncRefUE Frequency Offset Side Condition for LTE-V2X   * Side conditions for Selection/Reselection to Intra-frequency SyncRef UE requirement are incomplete   - R4-2204308, Draft CR to maintain inter-RAT measurements in TS 36.133   * The requirements for inter-RAT measurements will be incorrect.   - R4-2206792, Draft CR on core part maintenance for TS36.133 R15   * In the NR inter-RAT measurement for LTE SA UE (section 8.1.2.4.21.1.1), the DRX configuration referecne is incorrect.   - R4-2206801, CR on RSTD measurement requirements 36133 R15   * Wrong requirements are applied to inter-frequency RSTD measurement in EN-DC. * Requirements for inter-frequency RSTD requirements for LTE SA are not complete with []. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | - R4-2205348, CR to eMTC inter-frequency measurement requirements in Idle mode R15   * 4.7.2.1.3, 4.7.2.2.3   - R4-2203726, CR: Correction on SyncRef UE Frequency Offset in Synchronization Reference Selection/Reselection Test   * A.12.3.1   - R4-2203732, CR: Correction on Synchronization Reference Selection/Reselection SyncRefUE Frequency Offset Side Condition for LTE-V2X   * B.6.4   - R4-2204308, Draft CR to maintain inter-RAT measurements in TS 36.133   * 4.2.2.5.6   - R4-2206792, Draft CR on core part maintenance for TS36.133 R15   * 8.1.2.4.21.1.1   - R4-2206801, CR on RSTD measurement requirements 36133 R15   * 3.6.2, 8.1.2.6.1, 8.1.2.6.2, 8.1.2.6.3, 8.1.2.6.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 36.521-3 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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3.6.2 Applicability of requirements for EN-DC operation

Requirements for EN-DC operation are applicable for the UE which has been configured with the following number of E-UTRA CCs and NR CCs:

- up to 5 E-UTRA DL CCs in total with 1 E-UTRA UL CC in MCG. The applicable number of NR CC for EN-DC in the SCG is specified in clause 3.6.2 of TS 38.133 [50].

In addition to the requirements explicitly defined for a UE configured with EN-DC the following requirements shall also apply for the UE configured with EN-DC:

- Handover requirements in sections 5.1, 5.3.1, 5.3.2 and 5.3.3,

- RRC Re-establishment requirements in section 6.1,

- Random access requirements in section 6.2,

- RRC connection release with redirection requirements in section 6.3,

- UE transmit timing requirements defined in section 7.1 for UE configured with only pTAG,

- UE timer accuracy requirements in section 7.2,

- Timing advance requirements defined in section 7.3 for 1ms TTI and 4 subframe HARQ processing,

- Radio link monitoring requirements in section 7.6,

- SCell activation and deactivation delay requirements for E-UTRA carrier aggregation defined in section 7.7 for 1ms TTI and 4 subframe HARQ processing except those for CA with frame structure # 3,

- Requirements on received time difference between the PCell and SCell or between SCells defined in sections 7.9 except those defined for CA with frame structure # 3, .

- E-UTRAN intra frequency measurement requirements in section 8.1.2.2, except requirements specified for UE configured with *highSpeedEnhancedMeasFlag*

- E-UTRAN OTDOA intra-frequency RSTD measurements requirements defined in section 8.1.2.5 except those for UE category 1bis,

- E-UTRAN E-CID measurements requirements in section 8.1.2.7,

- Requirements on measurements for E-UTRA carrier aggregation in section 8.3,

- OTDOA RSTD measurement requirements for E-UTRAN carrier aggregation in section 8.4,

- Requirements in Section 9 for intra-frequency RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for PCell carrier frequency,

- Requirements in Section 9 for inter-frequency RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for non-serving E-UTRA carrier frequencies,

- Requirements in Section 9 for carrier aggrgation RSRP, RSRQ, RS-SINR, and RSTD measurements accuracy for PCC, SCC, or both,

- Requirements in Section 9 for inter-RAT E-UTRA−UTRA measurements accuracy and inter-RAT E-UTRA−GSM measurements accuracy for UTRA and GSM carriers,

- Power headroom requirements in Section 9 for PSCell and SCell(s).

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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 total number of configured NR carriers in the neighbour frequency list. 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) \* TdetectNR when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 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) \* TmeasureNR 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) \* TevaluateNR when Treselection = 0as specified in Table 4.2.2.5.6-1 provided that the reselection criteria is met by a margin of at least 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. | | | | | |

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##### 4.7.2.1.3 Measurements of inter-frequency cells for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency 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-frequency layers of higher, equal or 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 layers shall be the same as that defined below.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Kcarrier\*Tdetect,EUTRAN\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking or 8 dB for RSRP reselections based on absolute priorities or 5.5 dB for RSRQ reselections based on absolute priorities. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_NC . 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 clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA 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 measure RSRP or RSRQ at least every Kcarrier\*Tmeasure,EUTRAN\_Inter\_NC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA 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 measure RSRP or RSRQ at least every Tmeasure,EUTRAN\_Inter\_NC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA 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 filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency 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 Tmeasure,EUTRAN\_Inter\_NC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency 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 the inter-frequency cell has met reselection criterion defined TS 36.304 within Kcarrier\*Tevaluate,E-UTRAN\_Inter\_NC, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 7B for reselections based on ranking or 7dB for RSRP reselections based on absolute priorities or 5dB for RSRQ reselections based on absolute priorities.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC are specified in Table 4.7.2.1.3-2. Additionally, the requirements in Table 4.7.2.1.3-2 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_Inter\_NC when multiple PTWs are used.

Table 4.7.2.1.3-1 : Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_Inter\_NC

|  |  |  |  |
| --- | --- | --- | --- |
| DRX cycle length [s] | Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_Inter\_NC  [s] (number of DRX cycles) |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |

Table 4.7.2.1.3-2: Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate, E-UTRAN\_inter\_NC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Inter\_NC [s] (number of DRX or eDRX cycles Note 3) | Tmeasure,EUTRAN\_Inter\_NC [s] (number of DRX or eDRX cycles Note 3) | Tevaluate,E-UTRAN\_inter\_NC  [s] (number of DRX or eDRX cycles Note 3) |
| 5.12 | N/A | N/A | 117.76 (23) | 5.12 (1) | 10.24 (2) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | (23) | 0.32 (1) | (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | (2) |
| 1.28 | ≥1.28 (1) | 1.28 (1) | (2) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | (2) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | |

For higher priority cells, a UE may optionally use a shorter value forTmeasure,EUTRAN\_Inter\_NC,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE's inter-frequency measurement is not required to meet Tdetect,EUTRAN\_Inter\_NC, Tmeasure,EUTRAN\_Inter\_NC and Tevaluate,E-UTRAN\_inter\_NC as defined in Table 4.7.2.1.3-1 and Table 4.7.2.1.3-2.

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##### 4.7.2.2.3 Measurements of inter-frequency cells for UE category M1 in enhanced coverage

The requirements in this subclause apply if UE is in the enhanced coverage area of the serving cell. The UE is considered to be in enhanced coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-frequency 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-frequency layers of higher, equal or 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 layers shall be the same as that defined below.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Kcarrier\*Tdetect,EUTRAN\_Inter\_EC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_EC . 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 clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a E-UTRA 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 measure RSRP or RSRQ at least every Kcarrier\*Tmeasure,EUTRAN\_Inter\_EC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA 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 filter RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter\_EC/2.

The UE shall not consider a E-UTRA neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency 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 the inter-frequency cell has met reselection criterion defined TS 36.304 within Kcarrier\*Tevaluate,E-UTRAN\_Inter\_EC, when Treselection = 0 provided that the reselection criteria is met by a margin of at least 8 dB for reselections based on ranking.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC are specified in Table 4.7.2.2.3-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC are specified in Table 4.7.2.2.3-3. Additionally, the requirements in Table 4.7.2.2.3-3 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC when multiple PTWs are used.

Table 4.7.2.2.3-1: Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate,E-UTRAN\_Inter\_EC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCH Ês/Iot of neighboring cell: Q2 [dB] | DRX cycle length [s] | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tmeasure,EUTRAN\_Inter\_EC [s] (number of DRX cycles) | Tevaluate,E-UTRAN\_inter\_EC  [s] (number of DRX cycles) |
| **-15≤ Q2 < -6** | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) |
| **Q2≥-6** | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) |

Table 4.7.2.2.3-2: Void

Table 4.7.2.2.3-3: Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC for UE configured with eDRX\_IDLE cycle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| eDRX\_IDLE cycle length [s] | DRX cycle length [s] | PTW length [s] (number of 1.28s periods) | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) for neighboring cell with SCH Es/IoT:  -15≤ Q2 < -6 [dB] | Tdetect,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) for neighboring cell with SCH Es/IoT:  Q2≥-6 [dB] | Tmeasure,EUTRAN\_Inter\_EC [s] (number of DRX or eDRX cycles Note 4) | Tevaluate,E-UTRAN\_inter\_EC  [s] (number of DRX or eDRX cycles Note 4) |
| 5.12 | N/A | N/A | 2078.72 (406) | 133.12 (26) | 5.12 (1) | 30.72 (6) |
| 10.24 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (406) | Note 3 (26) | 0.32 (1) | Note 3 (6) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | Note 3 (6) |
| 1.28 | ≥1.28 (1) | 1.28 (1) | Note 3 (6) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | Note 3 (6) |
| NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.  NOTE 2: The eDRX\_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [34].  NOTE 3: The detection period and the evaluation period depend on the number *N* of DRX cycles and are calculated according to the formula below:  .  NOTE 4: Number of eDRX cycles when eDRX\_IDLE cycle length equals 5.12s, number of DRX cycles otherwise. | | | | | | |

For higher priority cells, a UE may optionally use a shorter value forTmeasure,EUTRAN\_Inter\_EC,which shall not be less than Max(0.64 s, one DRX cycle).

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, being configured with eDRX\_IDLE cycle, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE has to meet the requirement corresponding to the second state.

If all the relaxed monitoring criteria defined in clause 5.2.4.12 of TS 36.304 [1] are fulfilled then the UE's inter-frequency measurement is not required to meet Tdetect,EUTRAN\_Inter\_EC, Tmeasure,EUTRAN\_Inter\_EC and Tevaluate, E-UTRAN\_inter\_EC as defined in Table 4.7.2.2.3-1 and Table 4.7.2.2.3-3.

<Unchanged Text Skipped>

8.1.2.4.21 E-UTRAN FDD – NR measurements

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

The UE shall be able to identify new inter-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.

8.1.2.4.21.1 E-UTRAN FDD – NR measurements

8.1.2.4.21.1.1 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\_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 cell within Tidentify\_irat\_with\_index. The UE shall be able to identify a new detectable inter-RAT SS block of an already detected cell within Tidentify\_irat\_without\_index.

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

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

Where:

TPSS/SSS\_sync\_irat: it is the time period used in PSS/SSS detection given in table 8.1.2.4.21.1.1-1 and table 8.1.2.4.21.1.1-2.

TSSB\_time\_index\_irat: it is the time period used to acquire the index of the SSB being measured given in table 8.1.2.4.21.1.1-3 and table 8.1.2.4.21.1.1-4.

TSSB\_measurement\_period\_irat: equal to a measurement period of SSB based measurement given in table 8.1.2.4.21.1.1-5 and table 8.1.2.4.21.1.1-6.

Mpss/sss\_sync\_irat: For a UE supporting FR2 power class 1, Mpss/sss\_sync\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mpss/sss\_sync\_irat = 40 samples. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_irat = 40 samples.

MSSB\_index\_irat: For a UE supporting FR2 power class 1, MSSB\_index\_irat = 40 samples. For a UE supporting FR2 power class 2 (vehicle mounted), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 3 (handheld), MSSB\_index\_irat = 24 samples. For a UE supporting FR2 power class 4, MSSB\_index\_irat = 24 samples.

Mmeas\_period\_irat: For a UE supporting FR2 power class 1, Mmeas\_period\_irat = 64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 3 (handheld), Mmeas\_period\_irat = 40 samples. For a UE supporting FR2 power class 4, Mmeas\_period\_irat = 40 samples.

Nfreq is defined in clause 8.1.2.1.1

For per-FR measurement gap capable UE, when serving cells are in E-UTRA and measurement objects are only in FR2,

- UE can perform such measurements without gap, and

- UE fulfils the requirements for FR2 measurement objects based on effective MGRP = 20 ms.

**Table 8.1.2.4.21.1.1-1: Time period for PSS/SSS detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_irat** |
| No DRX | Max(600ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, Ceil(8×1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × 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]. | |

**Table 8.1.2.4.21.1.1-2: Time period for PSS/SSS detection (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TPSS/SSS\_sync\_irat** |
| No DRX | Max(600ms, Mpss/sss\_sync\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(600ms, (1.5 × Mpss/sss\_sync\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mpss/sss\_sync\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

**Table 8.1.2.4.21.1.1-3: Time period for time index detection (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_irat** |
| No DRX | Max(120ms, 3 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 3 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

**Table 8.1.2.4.21.1.1-4: Time period for time index detection (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_time\_index\_irat** |
| No DRX | Max(200ms, MSSB\_index\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, (1.5 × MSSB\_index\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | MSSB\_index\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

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

- NR SS-RSRP related conditions in the accuracy requirements in Section 9.11.1 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-RSRQ related conditions in the accuracy requirements in Section 9.11.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 of TS 38.133 [50],

- NR SS-SINR related conditions in the accuracy requirements in Section 9.11.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 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 9.11, with measurement period as shown in table 8.1.2.4.21.1.1-5 and 8.1.2.4.21.1.1-6:

**Table 8.1.2.4.21.1.1-5: Measurement period for inter-RAT measurements (Frequency range FR1)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_measurement\_period\_irat** |
| No DRX | Max(200ms, 8 × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | 8 × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5 | |

**Table 8.1.2.4.21.1.1-6: Measurement period for inter-RAT measurements (Frequency range FR2)**

|  |  |
| --- | --- |
| **Condition NOTE1,2** | **TSSB\_measurement\_period\_irat** |
| No DRX | Max(400ms, Mmeas\_period\_irat × Max(MGRP, SMTC period)) × Nfreq |
| DRX cycle ≤ 320ms | Max(400ms, (1.5 × Mmeas\_period\_irat) × Max(MGRP, SMTC period, DRX cycle)) × Nfreq |
| DRX cycle > 320ms | Mmeas\_period\_irat × DRX cycle × Nfreq |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 5. | |

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

For each RAT E-UTRAN FDD-NR layer on FR1 or FR2, the UE shall be capable of monitoring at least 4 cells.

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

For each RAT E-UTRAN FDD-NR layer on FR2, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the RAT E-UTRAN FDD-NR layer. The UE shall be capable of monitoring at least one SSB per cell.

The NR SS-RSRP measurement accuracy for all measured NR cells shall be as specified in clause 9.11.1. The NR SS-RSRQ measurement accuracy for all measured NR cells shall be as specified in clause 9.11.2. The NR SS-SINR measurement accuracy for all measured NR cells shall be as specified in clause 9.11.3.

NOTE: When inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, gap pattern 0 is assumed and requirements in this clause are derived assuming MGRP=80ms is used.

<Unchanged Text Skipped>

8.1.2.6.1 E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

is the total time for detecting and measuring at least *n* cells,

 is the the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.1-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

<Unchanged Text Skipped>

8.1.2.6.2 E-UTRAN TDD-FDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.2-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.2-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| NOTE 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the FDD inter-frequency carrier frequency f2.  NOTE 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the FDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band,

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.2) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.2-2.

**Table 8.1.2.6.2-2: TDD uplink-downlink subframe configurations applicable for TDD-FDD inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16]. | |

<Unchanged Text Skipped>

8.1.2.6.3 E-UTRAN TDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.1-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.3-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving TDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The inter-frequency requirements in this clause (8.1.2.6.3) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.3-2.

**Table 8.1.2.6.3-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within  provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

<Unchanged Text Skipped>

8.1.2.6.4 E-UTRAN FDD-TDD Inter-Frequency OTDOA Measurements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-frequency RSTD, specified in TS 36.214 [4], for at least *n*=16 cells, including the reference cell, within *k* \*  ms as given below:

 ,

where

*k* = 2 if the UE is configured with inter-RAT measurement on one or more NR carriers, *k* = 1 otherwise,

 is the total time for detecting and measuring at least *n* cells,

 is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [16], among the measured *n* cells including the reference cell,

 is the number of PRS positioning occasions as defined in Table 8.1.2.6.4-1, where a PRS positioning occasion is as defined in clause 8.1.2.5.1,

 =  ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two carrier frequencies including a serving carrier frequency and one inter-frequency carrier.

**Table 8.1.2.6.4-1: Number of PRS positioning occasions within **

|  |  |  |
| --- | --- | --- |
| **Positioning subframe configuration period** | **Number of PRS positioning occasions** | |
| **f2 Note1** | **f1 and f2 Note2** |
| 160 ms | 16 | 32 |
| >160 ms | 8 | 16 |
| Note 1: When inter-frequency RSTD measurements are performed over the reference cell and neighbour cells, which belong to the TDD inter-frequency carrier frequency f2.  Note 2: When inter-frequency RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the serving FDD carrier frequency f1 and the TDD inter-frequency carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within , provided:

≥-6 dB for all Frequency Bands for the reference cell,

≥-13 dB for all Frequency Bands for neighbour cell *i*,

 and  conditions apply for all subframes of at least  PRS positioning occasions,

PRP 1,2|dBm according to Annex B.2.6 for a corresponding Band

 is as defined in Clause 8.1.2.5.1.

The time  starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message as specified in TS 36.355 [24], are delivered to the physical layer of the UE.

If the inter-frequency handover occurs while inter-frequency RSTD measurements are being performed, and the inter-frequency carrier on which RSTD is measured becomes the new serving carrier frequency after the inter-frequency handover, the UE shall complete the ongoing OTDOA measurement session. The UE shall also meet the inter-frequency OTDOA measurement and accuracy requirements. However in this case the RSTD measurement period () shall be according to the following expression:

,

where:

 is the number of times the inter-frequency handover occurs during,

 is the time during which the inter-frequency RSTD measurement may not be possible due to inter-frequency handover; it can be up to 45 ms.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in the sub-clause 9.1.10.2.

Furthermore, due to the inter-frequency handover the UE shall meet the RSTD measurement accuracy for a PRS bandwidth which is not larger than the minimum channel bandwidth of those PCells on whose carriers RSTD measurement is performed during the RSTD measurement period.

The inter-frequency requirements in this clause (8.1.2.6.4) shall apply for all TDD special subframe configurations specified in TS 36.211 [16] and for the TDD uplink-downlink configurations as specified in Table 8.1.2.6.4-2.

**Table 8.1.2.6.4-2: TDD uplink-downlink subframe configurations applicable for inter-frequency requirements**

|  |  |
| --- | --- |
| **PRS Transmission Bandwidth [RB]** | **Applicable TDD uplink-downlink configurations** |
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| Note 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [16].  Note2: For UEs capable of performing inter-frequency measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 8.1.2.5.2-2 shall apply. | |

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A.12.3 V2X Synchronization Reference Selection/Reselection Tests

A.12.3.1 V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority

A.12.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to SyncRef UE selection / reselection defined in clause 13.4, when GNSS is configured as the highest priority. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in Table A.12.3.1.1-1and A.12.3.1.1-2 below. There are no GNSS signals in this test. There are one active cell (PCell) and two active SyncRef UEs (SyncRef UE 1 and SyncRef UE 2) in this test. The test system shall emulate SyncRef UE 1 and SyncRef UE 2 to transmit SLSS and MIB-SL every SLSS period.

The test system can verify the selection / reselection of SyncRef UE by monitoring the SLSS ID used by the V2X UE for its SLSS+MIB-SL transmissions. When the V2X UE is not synchronized to any SyncRef UE, then the V2X UE shall use the SLSS ID pre-configured in the V2X UE. When the V2X UE is synchronized to a SyncRef UE, the V2X UE shall derive its SLSS ID from the SLSS ID of the SyncRef UE as per clause 5.10.7.3 of TS 36.331.

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. During T1, both SyncRef UE 1 and SyncRef UE 2 are powered off and the V2X UE will select PCell as synchronization source. During T2, SyncRef UE 1 is powered ON and the V2X UE will select SyncRef UE 1 as the synchronization source. During T3, a higher priority SyncRef UE 2 is additionally powered ON and the V2X UE will reselect to the higher priority SyncRef UE 2 as the synchronization source.

**Table A.12.3.1.1-1: Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** | **Comment** |
| Initial condition | Active synchronization source |  | Cell 1 | UE transmits for V2X Sidelink Communication and SLSS+MIB-SL with SLSS ID = 30 and in-coverage set as TRUE in MIB-SL. |
| T2 end condition | Active synchronization source |  | Sync Ref UE 1 | UE transmits for V2X Sidelink Communication and SLSS+MIB-SL with SLSS ID = 168 and in-coverage set as FALSE in MIB-SL. |
| Final condition | Active synchronization source |  | Sync Ref UE 2 | UE transmits for V2X Sidelink Communication and SLSS+MIB-SL with SLSS ID = 0 and in-coverage set as FALSE in MIB-SL. |
| Active SyncRef UEs | |  | SyncRef UE 1  SyncRef UE 2 | Transmitting SLSS+MIB-SL on RF channel number 1 (TDD carrier in Band 47) |
| Active cell | |  | Cell 1 | E-UTRA FDD Cell 1 on RF channel number 2 |
| Timing offset between SyncRef UE 1 and SyncRef UE 2 | | μs | 3 | Synchronous |
| Frequency offset of SyncRef UE 1 | | ppm | 0 |  |
| Frequency offset of SyncRef UE 2 | | ppm | 0 |  |
| V2X sidelink Communication configuration | |  | As specified in Table A.3.24.2-2  (Configuration #2) | IE values unless specified otherwise in this test. |
| typeTxSync | |  | *gnss* |  |
| slssid | |  | *30* |  |
| syncTxThreshIC | |  | +infinity |  |
| T1 | | s | 24 |  |
| T2 | | s | 16 |  |
| T3 | | s | 3.2 |  |

**Table A.12.3.1.1-2: SyncRef UE Specific Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **SyncRef UE 1** | | | **SyncRef UE 2** | | |
| **T1** | **T2** | **T3** | **T1** | **T2** | **T3** |
| E-UTRA RF Channel Number |  | 1 | | | | | |
| BWchannel Note 4 | MHz | 5 or 10 | | | | | |
| V2X Sidelink Communication resource pool configuration |  | As specified in Table A.3.24.2-1  (Configuration #1) | | | As specified in Table A.3.24.2-2  (Configuration #2) | | |
| networkControlledSyncTx |  | N/A | | | ON | | |
| syncTxThreshOoC | dBm/15 kHz | +infinity | | | N/A | | |
| slssid |  | 0 | | | 0 | | |
| inCoverage (in MIB-SL) |  | FALSE | | | TRUE | | |
| syncOffsetIndicator |  | syncOffsetIndicator2 | | | syncOffsetIndicator1 | | |
| Note1 | dBm/15 kHz | -95 | | | | | |
|  | dB | -infinity | 0 | 0 | -infinity | -infinity | 3 |
|  | dB | -infinity | 0 | -4.76 | -infinity | -infinity | 0 |
| S-RSRP Note2, Note 3 | dBm/15 kHz | -infinity | -95 | -95 | -infinity | -infinity | -92 |
| Propagation Condition |  | AWGN | | | | | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 2: S-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 3: SSSS Es/Iot is set the same as PSSS/PSBCH Es/Iot. | | | | | | | |

**Table A.12.3.1.1-3: Cell Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Cell 1** | | |
| **T1** | **T2** | **T3** |
| E-UTRA RF Channel Number |  | 2 | | |
| BWchannel | MHz | 10 | | |
| PDCCH/PCFICH/PHICH Reference measurement channel defined in A.3.1.2.1 |  | R.6 FDD | | |
| OCNG Patterns defined in A.3.2.1.2 |  | OP.2 FDD | | |
| PBCH\_RA | dB | 0 | | |
| PBCH\_RB |
| PSS\_RA |
| SSS\_RA |
| PCFICH\_RB |
| PHICH\_RA |
| PHICH\_RB |
| PDCCH\_RA |
| PDCCH\_RB |
| PDSCH\_RA |
| PDSCH\_RB |
| OCNG\_RANote 1 |
| OCNG\_RBNote 1 |
| Note2 | dBm/15 kHz | -95 | | |
|  | dB | 4.5 | 4.5 | 4.5 |
| RSRP Note3 | dBm/15 kHz | -90.5 | -90.5 | -90.5 |
| SCH\_RP Note 3 | dBm/15 kHz | -90.5 | -90.5 | -90.5 |
| Propagation Condition |  | AWGN | | |
| Note 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.  Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 3: RSRP and SCH\_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | |

A.12.3.1.2 Test Requirements

1) During T2, SyncRef UE selection delay is defined as the time from the beginning of T2 to the time UE is synchronized to SyncRef UE 1 and changes its SLSS transmissions timing and SLSS ID to follow SyncRef UE 1 as the synchronization source. For the test configuration, the SLSS ID will be changed to 168 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T2.

The SyncRef UE selection delay shall be less than 8.8sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = Tdetect,SyncRef UE + Tevaluate,SLSS + SLSS period

Where

- Tdetect,SyncRef UE = 8sec (as specified in sub-clause 13.4)

- Tevaluate,SLSS = 0.64 (as specified in sub-clause 13.3.1.3)

- SLSS period = 160ms

This gives a total of 8.8seconds.

2) During T3, SyncRef UE reselection delay is defined as the time from the beginning of T3 to the time UE changes its synchronization source from SyncRef UE 1 to SyncRef UE 2, and changes its SLSS transmissions timing and SLSS ID to follow SyncRef UE 2 as the synchronization source. For the test configuration, the SLSS ID will still be 0 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T3.

The SyncRef UE reselection delay shall be less than 2.4sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = Tdetect,SyncRef UE + Tevaluate,SLSS + SLSS period

Where

- Tdetect,SyncRef UE = 1.6sec (as specified in sub-clause 13.4)

- Tevaluate,SLSS = 0.64 (as specified in sub-clause 13.3.1.3)

- SLSS period = 160ms

This gives a total of 2.4seconds.

The test system will verify that the V2X UE does not drop or delay more than 6% of its V2X data and SLSS transmissions during the duration of T2, and does not drop or delay more than 30% of its SLSS transmissions during the duration of T3.

The rate of correct SyncRef UE selection / reselection observed during repeated tests shall be at least 90%.

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B.6.4 Conditions for Selection/Reselection to Intra-frequency SyncRef UE

This clause defines the V2X SCH\_RP and SCH Ês/Iot applicable for a corresponding operating band.

The conditions for selection/reselection to intra-frequency SyncRef UE are defined in Table B.6.4-1.

**Table B.6.4-1: V2X synchronization measurements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **E-UTRA V2X operating band groups Note 2** | **Minimum V2X SCH\_RP Note 1** | **V2X SCH Ês/Iot Note 3** |
|  | **dBm/15kHz** | **dB** |
| TDD\_G | -120 | ≥ 0 |
| NOTE 1: This condition level is increased by ∆>0, when applicable, as described in Sections B.4.2 and B.4.3.  NOTE 2: E-UTRA V2X operating band groups are as defined in Section 3.5 for the corresponding E-UTRA operating bands.  NOTE 3: V2X SCH Ês/Iot for a SyncRef UE is the minimum of the Ês/Iot of PSSS/PSBCH and the Ês/Iot of SSSS  NOTE 4: The SyncRef UE transmission frequency shall be accurate to within ±5 PPM compared to the absolute frequency. | | | |

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