**3GPP TSG-RAN4 Meeting #99-e *R4-21xxxxx***

**Electronic Meeting, May 19 – 27, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **36.133** | **CR** | **7082** | **rev** | **1** | **Current version:** | **16.9.0** |  |
|  |
| *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 | **X** | Core Network |  |

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|  |
| ***Title:***  | Time synchronization assumption for RSS-based neighbor cell measurements |
|  |  |
| ***Source to WG:*** | Qualcomm Incorporated |
| ***Source to TSG:*** | RAN WG4 |
|  |  |
| ***Work item code:*** | LTE\_eMTC5-Core |  | ***Date:*** | 2021-05-11 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | In response to LS R4-2103657 on timing of neighbor cell RSS-based measurements, both RAN1 (R1-2104033) and RAN2 (R2-2104391) responded that:1. A UE is not required to acquire neighbor cell SFN for the purpose of neighbor cell RSS measurements
2. A UE can calculate the frame offset of the start of RSS transmission on neighbor cells from RRC signaling in the serving cell. The frame offset is relative to the serving cell SFN.

Furthermore, RAN1 added the following condition for feasibility of RSS-based measurements on neighbor cells:“A UE can assume that the start of RSS transmission on neighbor cells is within a window of +/- 5ms around the calculated frame offset. RAN1 specifications do not capture this synchronization requirement. RAN1 considers that RSS measurements for neighbor cell are only feasible for the case where the network can guarantee that the start of the neighbor cell RSS is within this time window.” |
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| ***Summary of change:*** | Add the time synchronization assumption above as a pre-condition for performing RSS-based measurements on neighbor cells. |
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| ***Consequences if not approved:*** | Core requirements for RSS-based measurements on neighbor cells would be incomplete. |
|  |  |
| ***Clauses affected:*** | 4.7.2.1.2, 4.7.2.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2109868 |

**< Start of change >**

4.7.2.1.2 Measurements of intra-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 intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- the UE supports measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the paging MPDCCH narrowband for Tevaluate, E-UTRAN\_Intra\_NC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, or

- the UE does not support measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the same RB location as the RSS RB location of the serving cell for Tevaluate, E-UTRAN\_Intra\_NC\_RSS successive DRX cycles,  and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, and

- UE is not configured with eDRX\_IDLE cycle, and

- RSS power offset (PRSS) with respect to CRS as defined in *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

If UE performs RSRP measurement based on RSS on detected intra-frequency cell, it is not expected to perform RSRP measurement based on CRS on that measured cell.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the network can guarantee that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Intra\_NCwhen that Treselection= 0. An intra frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.3 for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_Intra\_NC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-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\_Intra\_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 intra-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 intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_Intra\_NC when Treselection = 0, provided that the cell is at least 4dB better ranked for Cat-M1 UE. For neigbor cell measured with RSS, the Tevaluate,E-UTRAN\_Intra\_NC\_RSS as defined in Table 4.7.2.1.2-1 applies.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving cell, the UE shall evaluate this intra-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\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC are specified in Table 4.7.2.1.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC are specified in Table 4.7.2.1.2-2, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC when multiple PTWs are used.

**Table 4.7.2.1.2-1 : Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate, E-UTRAN\_Intra\_NC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,EUTRAN\_Intra\_NC [s] (number of DRX cycles)** | **Tmeasure,EUTRAN\_Intra\_NC [s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_NC****[s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_NC\_RSS****[s] (number of DRX cycles)** |
| 0.32 | 11.52 (36) | 1.28 (4) | 5.12 (16) | 3.84 (12) |
| 0.64 | 17.92 (28) | 1.28 (2) | 5.12 (8) | 3.84 (6) |
| 1.28 | 32(25) | 1.28 (1) | 6.4 (5) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) | 7.68 (3) |
| NOTE 1: Void |

**Table 4.7.2.1.2-2: Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_Intra\_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\_Intra\_NC [s] (number of DRX cycles)** | **Tmeasure,EUTRAN\_Intra\_NC [s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_NC****[s] (number of DRX cycles)** |
| 5.12 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) |  (23) | 0.32 (1) | 0.64 (2) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | 1.28 (2) |
| 1.28 | ≥2.56 (2) | 1.28 (1) | 2.56 (2) |
| 2.56 | ≥5.12 (4) | 2.56 (1) | 5.12 (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: Void |

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 intra-frequency measurement is not required to meet Tdetect,EUTRAN\_Intra\_NC, Tmeasure,EUTRAN\_Intra\_NC and Tevaluate,E-UTRAN\_intra\_NC as defined in Table 4.7.2.1.2-1 and Table 4.7.2.1.2-2.

**< End of change >**

**< Start of change >**

4.7.2.2.2 Measurements of intra-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 intra-frequency cells and perform RSRP and RSRQ measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

The UE is allowed to perform RSRP measurements based on RSS signals provided UE is configured with *rss-ConfigCarrierInfo* [2] and following conditions are met:

- the UE supports measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the paging MPDCCH narrowband for Tevaluate, E-UTRAN\_Intra\_EC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, or

- the UE does not support measuring neighbour cell RSS on the same paging MPDCCH narrowband, and RSS of the measured cell are available within the same RB location as the RSS RB location of the serving cell for Tevaluate, E-UTRAN\_Intra\_EC\_RSS successive DRX cycles, and the last subframe of the RSS occasion of the measured cell is in the window [n-5, n-1] where n is the first subframe of paging MPDCCH, and

- UE is not configured with eDRX\_IDLE cycle, and

- RSS power offset (PRSS) with respect to CRS as defined in *rss-MeasPowerBias* [2], where PRSS ≥ 0 dB.

If UE performs RSRP measurement based on RSS on detected intra-frequency cell, it is not expected to perform RSRP measurement based on CRS on that measured cell.

For performing RSRP measurement based on RSS on detected intra-frequency cells, UE assumes BL/CE DL subframe configuration of each neighbor cell is same as serving cell. The requirements for RSRP measurement based on RSS for a neighbour cell apply provided that BL/CE DL subframe configuration of the neighbor cell is same as serving cell.

Additionally, for performing RSS-based RSRP measurements on detected intra-frequency cells, the UE assumes that the RSS transmission of each neighbor cell starts in the radio frame that is closest in time, i.e. within a window of +/- 5ms, around the corresponding radio frame offset calculated from RRC signalling in the serving cell, as described in TS 36.331 subclause 6.3. The requirements for RSS-based RSRP measurements for neighbor cells apply provided that the network can guarantee that the RSS transmission of each neighbor cell starts in the radio frame within a window of +/- 5ms around the calculated radio frame offset of the serving cell.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Tdetect,EUTRAN\_Intra\_ECwhen that Treselection= 0. An intra-frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.3 for a corresponding Band.

The UE shall measure RSRP and RSRQ at least every Tmeasure,EUTRAN\_Intra\_EC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter RSRP and RSRQ measurements of each measured intra-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\_Intra\_EC/2.

The UE shall not consider an 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 intra-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 intra-frequency cell has met reselection criterion defined [1] within Tevaluate,E-UTRAN\_intra\_EC when Treselection = 0, provided that the cell is at least 5dB better ranked. For neigbor cell measured with RSS, the Tevaluate,E-UTRAN\_Intra\_EC\_RSS as defined in Table 4.7.2.2.2-1 and Table 4.7.2.2.2-2 applies.

If Treselection timer has a non zero value and the intra-frequency cell is better ranked than the serving cell, the UE shall evaluate this intra-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\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC are specified in Table 4.7.2.2.2-1. For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC are specified in Table 4.7.2.2.2-2. Additionally, the requirements in Table 4.7.2.2.2-2 apply provided that the serving cell is configured with eDRX\_IDLE and is the same in all PTWs during any of Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC when multiple PTWs are used.

**Table 4.7.2.2.2-1 : Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_EC**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCH Ês/Iot of neighboring cell: Q2 [dB]** | **DRX cycle length [s]** | **Tdetect,EUTRAN\_Intra\_EC [s] (number of DRX cycles)**  | **Tmeasure,EUTRAN\_Intra\_EC [s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_EC****[s] (number of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_EC\_RSS****[s] (number of DRX cycles)** |
| **-15≤ Q2 < -6** | 0.32 | 330.24 (1032) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 330.24 (516) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 524.8 (410) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 1039.36 (406) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| **Q2≥-6** | 0.32 | 16.64 (52) | 1.28 (4) | 10.24 (32) | 6.4 (20) |
| 0.64 | 23.04 (36) | 1.28 (2) | 10.24 (16) | 6.4 (10) |
| 1.28 | 38.4 (30) | 1.28 (1) | 12.8 (10) | 6.4 (5) |
| 2.56 | 66.56 (26) | 2.56 (1) | 15.36 (6) | 12.8 (5) |
| NOTE 1: Void |

**Table 4.7.2.2.2-2: Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate, E-UTRAN\_intra\_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\_Intra\_EC [s] (number *N* of DRX cycles) for neighboring cell with SCH Es/IoT:** **-15≤ Q2 < -6 [dB]** | **Tdetect,EUTRAN\_Intra\_EC [s] (number *N* of DRX cycles) for neighboring cell with SCH Es/IoT:****Q2≥-6 [dB]** | **Tmeasure,EUTRAN\_Intra\_EC [s] (number *N* of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_EC****[s] (number *N* of DRX cycles)** | **Tevaluate,E-UTRAN\_intra\_EC\_RSS****[s] (number *N* of DRX cycles)** |
| 5.12 ≤ eDRX\_IDLE cycle length ≤ 2621.44 | 0.32 | ≥1.28 (1) | Note 3 (406) | Note 3 (26) | 0.32 (1) | Note 3 (6) | Note 3 (5) |
| 0.64 | ≥1.28 (1) | 0.64 (1) | Note 3 (6) | Note 3 (5) |
| 1.28 | ≥2.28 (1) | 1.28 (1) | Note 3 (6) | Note 3 (5) |
| 2.56 | ≥2.56 (2) | 2.56 (1) | Note 3 (6) | Note 3 (5) |
| 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: Void |

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 intra-frequency measurement is not required to meet Tdetect,EUTRAN\_Intra\_EC, Tmeasure,EUTRAN\_Intra\_EC and Tevaluate,E-UTRAN\_intra\_EC as defined in Table 4.7.2.2.2-1 and Table 4.7.2.2.2-2.

**< End of change >**