**3GPP TSG-WG4 Meeting #111 *R4-2407675***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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:***  |  |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | Introduce the test cases of UE transmit timing from two TRPs in FR1 |
|  |  |
| ***Summary of change:*** | Change #1: Add test case of UE transmit timing from two TRPs in EN-DC, PSCell is in FR1Change #2: Add test case of UE transmit timing from two TRPs in SA, PCell is in FR1 |
|  |  |
| ***Consequences if not approved:*** | Test cases of UE transmit timing from two TRPs in FR1 are missing. |
|  |  |
| ***Clauses affected:*** | A.4.4.1.X A.6.4.1.X |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.533 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

----------------------------------------Start Change #1-------------------------

#### A.4.4.1.X NR UE Transmit Timing Test for two TRPs in FR1

##### A.4.4.1.X.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timings change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits for both TRPs. The test is configured with two TRPs in NR PSCell. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in Table 4.4.1.X.1-1.

Table A.4.4.1.X.1-1: Supported test configurations for FR1 PSCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | LTE FDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 2 | LTE FDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 3 | LTE FDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| 4 | LTE TDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 5 | LTE TDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 6 | LTE TDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| Note: The UE is only required to be tested in one of the supported test configurations  |

The test consists of E-UTRA PCell and NR PSCell. For NR PSCell, two TRPs are configured. The configuration for E-UTRA is given in A.3.7.2.1. Table A.4.4.1.X.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.4.4.1.X.1-3.

Table A.4.4.1.X.1-2: Cell Specific Test Parameters for UL Transmit Timing test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Test1 | Test2 | Test3 | Test4 | Band Group |
| TRP#1 | TRP#2 | TRP#1 | TRP#2 | TRP#1 | TRP#2 | TRP#1 | TRP#2 |
| SSB ARFCN |  | 1,2,3,4,5,6 | Freq1 |  |
| Duplex Mode |  | 1,4 | FDD |  |
|  |  | 2,3,5,6 | TDD |  |
| TDD configuration |  | 1,4 | Not Applicable |  |
|  |  | 2,5 | TDDConf.1.1 |  |
|  |  | 3,6 | TDDConf.2.1 |  |
| BWchannel | MHz | 1,4 | 10: NRB,c = 52 |  |
|  |  | 2,5 | 10: NRB,c = 52 |  |
|  |  | 3,6 | 40: NRB,c = 106 |  |
| Initial BWP Configuration |  | 1,2,3,4,5,6 | DLBWP.0.1ULBWP.0.1 |  |
| Dedicated BWP Configuration |  | 1,2,3,4,5,6 | DLBWP.1.1ULBWP.1.1 |  |
| DRx Cycle | ms | 1,2,3,4,5,6 | N/A | DRX.8Note5 |  |
| PDSCH Reference  |  | 1,4 | SR.1.1 FDD |  |
| measurement channel |  | 2,5 | SR.1.1 TDD |  |
|  |  | 3,6 | SR.2.1 TDD |  |
| RMSI CORESET Reference |  | 1,4 | CR.1.1 FDD |  |
| Channel |  | 2,5 | CR.1.1 TDD |  |
|  |  | 3,6 | CR.2.1 TDD |  |
| Dedicated CORESET Reference Channel |  | 1,4 | CCR.1.1 FDD  |  |
|  | 2,5 | CCR.1.1 TDD |  |
|  | 3,6 | CCR.2.1 TDD |  |
| coresetPoolIndex for dedicated CORESET Reference Channel  |  | 1,2,3,4,5,6 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |  |
| Timing difference compared to TRP#1 | us | 1,2,4,5 | 0 | 3 | 0 | 70 | 0 | 3 | 0 | 70 |  |
| 3,6 | 1.5 | 35 | 1.5 | 35 |
| OCNG Patterns |  | 1,2,3,4,5,6 | OP.1 |  |
| SSB configuration |  | 1,4 | SSB.3 FR1 |  |
|  |  | 2,5 | SSB.3 FR1 |  |
|  |  | 3,6 | SSB.4 FR1 |  |
| SSB index |  | 1,4 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |  |
| 2,5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 3,6 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| SMTC configuration |  | 1,2,3,4,5,6 | SMTC.2 |  |
| TRS configuration |  | 1,4 | TRS.1.1 FDD |  |
|  |  | 2,5 | TRS.1.1 TDD |  |
|  |  | 3,6 | TRS.1.2 TDD |  |
| PDSCH/PDCCH | kHz | 1,2,4,5 | 15 |  |
| subcarrier spacing |  | 3,6 | 30 |  |
| EPRE ratio of PSS to SSS |  |  |  |  |  |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS | dB | 1,2,3,4,5,6 | 0 | 0 |  |
| EPRE ratio of PDSCH DMRS to SSS  |  |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH  |  |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  |  |  |
| Note2 | dBm/15 kHz | 1,2,3,4,5,6 | -98 | -98 |  |
| Note2 | dBm/SCS | 1,2,4,5 | -98 | -98 |  |
|  | 3,6 | -95 | -95 |  |
|  |  | 1,2,3,4,5,6 | 3 | 3 |  |
|  |  | 1,2,3,4,5,6 | 3 | 3 |  |
| SS-RSRPNote3 | dBm/SCS | 1,2,4,5 | -95 | -95 |  |
|  |  | 3,6 | -92 | -92 |  |
| IoNote3 | dBm/9.36MHz | 1,2,4,5 | -65.2 | -65.2 |  |
|  | dBm/38.1MHz | 3,6 | -59.2 | -59.2 |  |
| Propagation condition |  | 1,2,3,4,5,6 | AWGN |  |
| SRS Config |  | 1,2,4,5 | SRSConf.1Note6 | SRSConf.3Note6 |  |
|  |  | 3, 6 | SRSConf.1Note6 | SRSConf.2Note6 |  |
| Note 1: OCNG shall be used such that both cells are 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: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.Note 5: DRx related parameters are given in Table A.3.3.8-1Note 6: SRS configs are given in Table A.4.4.1.X.1-3 |

Table A.4.4.1.X.1-3: SRS Configuration for Timing Accuracy Test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Field | SRSConf.1 | SRSConf.2 | SRSConf.3 | Comments |
| SRS- | srs-ResourceSetId | 0 | 0 | 0 |  |
| ResourceSet | srs-ResourceIdList | 0 | 0 | 0 |  |
|  | resourceType | Periodic | Periodic | Periodic |  |
|  | Usage | Codebook | Codebook | Codebook |  |
| SRS-Resource | SRS-ResourceId | 0 | 0 | 0 |  |
|  | nrofSRS-Ports | Port1 | Port1 | Port1 |  |
|  | transmissionComb  | n2 | n2 | n2 |  |
|  | combOffset-n2 | 0 | 0 | 0 |  |
|  | cyclicShift-n2 | 0 | 0 | 0 |  |
|  | resourceMappingstartPosition | 0 | 0 | 0 |  |
|  | resourceMappingnrofSymbols  | n1 | n1 | n1 |  |
|  | resourceMappingrepetitionFactor | n1 | n1 | n1 |  |
|  | freqDomainPosition | 0 | 0 | 0 |  |
|  | freqDomainShift | 0 | 0 | 0 |  |
|  | freqHoppingc-SRS | 14 for test configuration 1,2,4,525 for test configuration 3,6 | 25 | 14 | Matches NRB,c |
|  | freqHoppingb-SRS | 0 | 0 | 0 |  |
|  | freqHoppingb-hop | 0 | 0 | 0 |  |
|  | groupOrSequenceHopping | Neither | Neither | Neither |  |
|  | resourceType | Periodic | Periodic | Periodic |  |
|  | periodicityAndOffset-p | sl1, 0 | sl640, 5 | sl320, 3 | Offset to align with DRx periodicity  |
|  | sequenceId | 0 | 0 | 0 | Any 10 bit number |

##### A.4.4.1.X.2 Test requirements

The test sequence shall be carried out in RRC\_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in Table A.3.7.2.1-1 and setup NR PSCell according to parameters given in Table A.4.4.1.X.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within (NTA + NTA\_offset)×Tc ± Te of the first detected path of DL SSB of TRP#1 and TRP#2.

a. The NTA offset value (in Tc units) is 25600

b. The Te values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.4.4.1.X.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.4.4.1.X.2-1: Adjustment Value for DL Timing

|  |  |
| --- | --- |
| SCS of SSB signals (kHz) | Adjustment Value |
|  | Test1&2 | Test3&Test4 |
| 15 | +64\*64Tc | +32\*64Tc |
| 30 | +32\*64Tc | +16\*64Tc |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within (NTA + NTA\_offset) ×Tc ± Te respective to the first detected path (in time) of DL SSB for TRP#1. For TRP#2, the test system shall verify there is no adjustment.

5) The test system shall verify that the UE transmit timing offset stays within (NTA + NTA\_offset) ×Tc ± Te of the first detected path of DL SSB of TRP#1.

For UE not support the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test2 and Test4.

----------------------------------------End Change #1-------------------------

----------------------------------------Start Change #2-------------------------

#### A.6.4.1.X NR UE Transmit Timing Test for two TRPs in FR1

##### A.6.4.1.X.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits for both TRPs. The test is configured with two TRPs in NR PCell. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table A.6.4.1.1.1-1.

Table A.6.4.1.X.1-1: Supported test configurations for FR1 PCell

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 2 | NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 3 | NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| Note: The UE is only required to be tested in one of the supported test configurations  |

For this test a single NR cell is used. Table A.6.4.1.X.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.6.4.1.X.1-3.

Table A.6.4.1.X.1-2: Cell Specific Test Parameters for UL Transmit Timing test

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Test1 | Test2 | Test3 | Test4 |
| TRP#1 | TRP#2 | TRP#1 | TRP#2 | TRP#1 | TRP#2 | TRP#1 | TRP#2 |
| SSB ARFCN |  | 1,2,3 | 1 |
| TDD configuration |  | 1 | Not Applicable |
|  |  | 2 | TDDConf.1.1 |
|  |  | 3 | TDDConf.2.1 |
| BWchannel | MHz | 1 | 10: NRB,c = 52 |
|  |  | 2 | 10: NRB,c = 52 |
|  |  | 3 | 40: NRB,c = 106 |
| Initial BWP Configuration |  | 1,2,3 | DLBWP.0.1ULBWP.0.1 |
| Dedicated BWP Configuration |  | 1,2,3 | DLBWP.1.1ULBWP.1.1 |
| DRx Cycle | ms | 1,2,3 | N/A | DRX.8Note5 |
| PDSCH Reference measurement channel |  | 1 | SR.1.1 FDD |
|  |  | 2 | SR.1.1 TDD |
|  |  | 3 | SR.2.1 TDD |
| RMSI CORESET Reference Channel |  | 1 | CR.1.1 FDD |
|  |  | 2 | CR.1.1 TDD |
|  |  | 3 | CR.2.1 TDD |
| Dedicated CORESET Reference Channel |  | 1 | CCR.1.1 FDD |
|  |  | 2 | CCR.1.1 TDD |
|  |  | 3 | CCR.2.1 TDD |
| coresetPoolIndex for dedicated CORESET Reference Channel |  | 1,2,3 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Timing difference compared to TRP#1 | us | 1, 2 | 0 | 3 | 0 | 70 | 0 | 3 | 0 | 70 |
| 3 | 1.5 | 35 | 1.5 | 35 |
| OCNG Patterns |  | 1,2,3 | OP.1 |
|  |  |
| SSB configuration |  | 1,2 | SSB.3 FR1 |
|  |  | 3 | SSB.4 FR1 |
| SSB index |  | 1,2,3 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| SMTC Configuration |  | 1,2 | SMTC.1 |
|  |  | 3 | SMTC.2 |
| TRS configuration |  | 1 | TRS.1.1 FDD |
|  |  | 2 | TRS.1.1 TDD |
|  |  | 3 | TRS.1.2 TDD |
| EPRE ratio of PSS to SSS | dB | 1,2,3 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |  |  |
| EPRE ratio of PDSCH DMRS to SSS  |  |  |  |  |
| EPRE ratio of PDSCH to PDSCH  |  |  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |  |  |
| Note2 | dBm/15 kHz | 1,2,3 | -98 | -98 |
| Note2 | dBm/SCS | 1,2 | -98 | -98 |
|  |  | 3 | -95 | -95 |
|  |  | 1,2,3 | 3 | 3 |
|  |  | 1,2,3 | 3 | 3 |
| SS-RSRPNote3 | dBm/SCS | 1,2 | -95 | -95 |
|  |  | 3 | -92 | -92 |
| IoNote3 | dBm/9.36MHz | 1,2 | -65.2 | -65.2 |
|  | dBm/38.1MHz | 3 | -59.2 | -59.2 |
| Propagation condition |  | 1,2,3 | AWGN |
| SRS Config |  | 1,2 | SRSConf.1Note6 | SRSConf.3Note6 |
|  |  | 3 | SRSConf.1Note6 | SRSConf.2Note6 |
| Note 1: OCNG shall be used such that both cells are 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: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.Note 5: DRx related parameters are given in Table A.3.3.8-1Note 6: SRS configs are given in Table A.6.4.1.X.1-3 |

Table A.6.4.1.X.1-3: SRS Configuration for Timing Accuracy Test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Field | SRSConf.1 | SRSConf.2 | SRSConf.3 | Comments |
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | 0 |  |
|  | srs-ResourceIdList | 0 | 0 | 0 |  |
|  | resourceType | Periodic | Periodic | Periodic |  |
|  | Usage | Codebook | Codebook | Codebook |  |
| SRS-Resource | SRS-ResourceId | 0 | 0 | 0 |  |
|  | nrofSRS-Ports | Port1 | Port1 | Port1 |  |
|  | transmissionComb  | n2 | n2 | n2 |  |
|  | combOffset-n2 | 0 | 0 | 0 |  |
|  | cyclicShift-n2 | 0 | 0 | 0 |  |
|  | resourceMappingstartPosition | 0 | 0 | 0 |  |
|  | resourceMappingnrofSymbols  | n1 | n1 | n1 |  |
|  | resourceMappingrepetitionFactor | n1 | n1 | n1 |  |
|  | freqDomainPosition | 0 | 0 | 0 |  |
|  | freqDomainShift | 0 | 0 | 0 |  |
|  | freqHoppingc-SRS | 14 for test configuration 1,225 for test configuration 3 | 25 | 14 | Matches NRB,c |
|  | freqHoppingb-SRS | 0 | 0 | 0 |  |
|  | freqHoppingb-hop | 0 | 0 | 0 |  |
|  | groupOrSequenceHopping | Neither | Neither | Neither |  |
|  | resourceType | Periodic | Periodic | Periodic |  |
|  | periodicityAndOffset-p | sl1, 0 | sl640, 0 | sl320, 0 | Offset to align with DRx periodicity  |
|  | sequenceId | 0 | 0 | 0 | Any 10 bit number |

##### A.6.4.1.X.2 Test requirements

The test sequence shall be carried out in RRC\_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in Table A.6.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within (NTA + NTA\_offset) ×Tc ± Te of the first detected path of DL SSB of TRP#1 and TRP#2.

a. The NTA offset value (in Tc units) is 25600

b. The Te values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.6.4.1.X.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.6.4.1.X.2-1: Adjustment Value for DL Timing

|  |  |
| --- | --- |
| SCS of SSB signals (KHz) | Adjustment Value |
|  | Test1&Test2 | Test3&Test4 |
| 15 | +64\*64Tc | +32\*64Tc |
| 30 | +32\*64Tc | +16\*64Tc |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within (NTA + NTA\_offset) ×Tc ± Te respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna for TRP#1. For TRP#2, the test system shall verify there is no adjustment. Skip this step for test 3&4 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within (NTA + NTA\_offset) ×Tc ± Te of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna of TRP#1. For Test 3&4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

For UE not support the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test2 and Test4.

----------------------------------------End Change #2-------------------------