**3GPP TSG-RAN4 Meeting #98-e *R4-2103529***

**Electronic Meeting, Jan 25-Feb 05, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **DraftCR** | **rev** | **1** | **Current version:** | **16.6.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | UE timing tests for NR-U |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** |  NR\_unlic-Perf |  | ***Date:*** | 2021-02-02 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | To define UE timing test cases for NR-U when SpCell is subject to CCA |
|  |  |
| ***Summary of change:*** | Following test cases are defined:* Test case to verify UE transmit timing requirements when SpCell is PSCell which is subject to CCA in EN-DC operation.
* Test case to verify UE transmit timing requirements when SpCell is PCell which is subject to CCA.
* Test case to verify UE timing advance adjustment requirements when SpCell is PSCell which is subject to CCA in EN-DC operation.
* Test case to verify UE timing advance adjustment requirements when SpCell is PCell which is subject to CCA.
 |
|  |  |
| ***Consequences if not approved:*** | UE transmit timing and TA accuracy requirements when SpCell is subject to CCA cannot be verified. This may lead to incorrect UE transmission time leading to reception problem at the base station. |
|  |  |
| ***Clauses affected:*** | A.10.2.1, A.10.2.1.1, A.10.2.1.1.1, A.10.2.1.1.2, A.10.2.2, A.10.2.2, A.10.2.2.1, A.10.2.2.2, A.10.2.2.3, A.11.3.1, A.11.3.1.1, A.11.3.1.1.1, A.11.3.1.1.2, A.11.3.2, A.11.3.2.1, A.11.3.2.1.1, A.11.3.12.1.2, |
|  |  |
|  | **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:*** |  |

**----------------------START OF CHANGES----------------------------**

### A.10.2.1 UE transmit timing

A.10.2.1.1 UE Transmit Timing Test with PSCell under DL CCA

A.10.2.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb when PSCell is subject to DL CCA 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. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in Table 10.2.1.1.1-1.

**Table A.10.2.1.1.1-1: Supported test configurations for UE transmit timing test**

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| 2 | LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| Note 1: 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, which is subject to DL CCA. The configuration for E-UTRA is given in A.3.7.2.1. Table A.10.2.1.1.1-2 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.10.2.1.1.1-3.

**Table A.10.2.1.1.1-2: Cell Specific Test Parameters for UE Transmit Timing test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Test1** | **Test2** |
| SSB ARFCN |  | 1,2 | Freq1 | Freq1 |
| TDD configuration |  | 1,2 | TBD |
| BWchannel | MHz | 1,2 | 40: NRB,c = 106 |
| Initial BWP Configuration |  | 1,2 | DLBWP.0.1ULBWP.0.1 |
| Dedicated BWP Configuration |  | 1,2 | DLBWP.1.1ULBWP.1.1 |
| DRX Cycle | ms | 1,2 | N/A | DRX.8Note5 |
| DL CCA model |  | 1,2 | As specified in clause A.3.20.2.1 |
| UL CCA model |  | 1,2 | As specified in clause A.3.20.2.2 |
| PDSCH Reference  |  | 1,2 | TBD |
| CORESET Reference |  | 1,2 | TBD |
| OCNG Patterns |  | 1,2 | OCNG pattern 1 |
| SSB configuration |  | 1,2 | TBD |
| SMTC configuration |  | 1,2 | TBD |
| TRS configuration |  | 1,2 | TBD |
| DL CCA probability PCCA |  | 1,2 | TBD | TBD |
| UL CCA probability PCCA |  | 1,2 | 1 | 1 |
| 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 | 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/30 kHz | 1,2 | -95 | -95 |
|  |  | 1,2 | 3 | 3 |
|  |  | 1,2 | 3 | 3 |
| SS-RSRPNote3 | dBm/30 kHz | 1,2 | -92 | -92 |
| IoNote3 | dBm/38.1MHz | 1,2 | -59.2 | -59.2 |
| Propagation condition |  | 1,2 | AWGN |
| SRS Config |  | 1,2 | 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.10.2.1.1.1-3 |

**Table A.10.2.1.1.1-3: SRS Configuration for UE transmit timing**

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

A.10.2.1.1.2 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.10.2.1.1.1-1.

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.

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.10.2.1.1.2-1

**Table A.10.2.1.1.2-1: Adjustment Value for DL Timing**

|  |  |
| --- | --- |
| **SCS of SSB signals (kHz)** | **Adjustment Value** |
|  | Test1 | Test2 |
| 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. Skip this step for test 2 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 detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.10.2.2 Timing advance

A.10.2.2.1 UE Timing Advance Adjustment Accuracy with PSCell under DL CCA

A.10.2.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.10.2.2.1.2 Test Parameters

Supported test configurations are shown in table A.10.2.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.10.2.2.1.2-2, A.10.2.2.1.2-3 and A.10.2.2.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell which is subject to DL CCA is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.10.2.2.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.10.2.2.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

**Table A.10.2.2.1.2-1: Supported test configurations for timing advance test**

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| 2 | LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |
| Note 1: The UE is only required to be tested in one of the supported test configurations. |

**Table A.10.2.2.1.2-2: General test parameters for timing advance test**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| RF channel number |  | Cell 1: 1Cell 2: 2 | 1 for E-UTRAN PCell2 for NR PSCell |
| Initial DL BWP |  | DLBWP.0.1 | As specified in Table A.3.9.2.1-1 |
| Dedicated DL BWP |  | DLBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| Initial UL BWP |  | ULBWP.0.1 | As specified in Table A.3.9.3.1-1 |
| Dedicated UL BWP |  | ULBWP.1.1 | As specified in Table A.3.9.3.2-1 |
| Timing Advance Command (*TA*) value during T1 |  | 31 | *NTA\_new = NTA\_old* for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command (*TA*) value during T2 |  | 39 | *For 30 kHz SCS NTA\_new = NTA\_old + 4096\*Tc* (based on equation in clause 4.2 of TS 38.213 [3]) |
| T1 | s | 5 |  |
| T2 | s | 5 |  |

**Table A.10.2.2.1.2-3: Cell specific test parameters for timing advance test**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test1** |
|  |  | **T1** | **T2** |
| TDD configuration | Config 1,2 |  | TBD |
| BWchannel | Config 1,2 | MHz | 40: NRB,c = 106  |
| BWP BW | Config 1,2 | MHz | 40: NRB,c = 106  |
| DRX Cycle | Config 1,2 | ms | Not Applicable |
| DL CCA model | Config 1,2 |  | As specified in clause A.3.20.2.1 |
| UL CCA model | Config 1,2 |  | As specified in clause A.3.20.2.2 |
| PDSCH Reference  | Config 1,2 |  | TBD |
| CORESET Reference  | Config 1,2 |  | TBD |
| TRS configuration | Config 1,2 |  | TBD |
| OCNG Patterns | Config 1,2 |  | OCNG pattern 1 |
| SSB Configuration | Config 1,2 |  | TBD |
| SMTC configuration | Config 1,2 |  | TBD |
| DL CCA probability PCCA | Config 1,2 |  | 1 |
| UL CCA probability PCCA | Config 1,2 |  | 1 |
| 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 | 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 | Config 1,2 | dBm/30 kHz | -95 |
|  | Config 3,6 |  | -95 |
|  | dB | 3 |
|  | dB | 3 |
| IoNote3 | Config 1,2 | dBm/38.16MHz | -62.58 |
| Propagation condition | - | AWGN |
| 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: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

**Table A.10.2.2.1.2-4: Sounding Reference Symbol Configuration for timing advance test**

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| c-SRS | Config 1,2 | 24 | Frequency hopping is disabled |
| b-SRS | 0 |  |
| b-hop | 0 |  |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 |  |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=4 for SCS 30kHz | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | Codebook | Codebook based UL transmission |
| startPosition | 0 | resourceMapping setting: SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 |  |
| repetitionFactor | n1 |  |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 |  |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. |

A.10.2.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

**----------------------NEXT CHANGE----------------------------**

A.11.3.1 UE transmit timing

A.11.3.1.1 UE Transmit Timing Test with PCell under DL CCA

A.11.3.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb when PCell is subject to DL CCA 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. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 11.3.1.1.1-1

**Table A.11.3.1.1.1-1: Supported test configuration for UE transmit timing test**

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz |

For this test a single NR cell is used. Table A.11.3.1.1.1-2 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.11.3.1.1.1-3.

**Table A.11.3.1.1.1-2: Cell Specific Test Parameters for UE transmit timing test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Configuration** | **Test1** | **Test2** |
| SSB ARFCN |  | 1 | 1 | 1 |
| TDD configuration |  | 1 | TBD |
| BWchannel | MHz | 1 | 40: NRB,c = 106 |
| Initial BWP Configuration |  | 1 | DLBWP.0.1ULBWP.0.1 |
| Dedicated BWP Configuration |  | 1 | DLBWP.1.1ULBWP.1.1 |
| DRX Cycle | ms | 1 | N/A | DRX.8Note5 |
| DL CCA model |  | 1 | As specified in clause A.3.20.2.1 |
| UL CCA model |  | 1 | As specified in clause A.3.20.2.2 |
| PDSCH Reference measurement channel |  | 1 | TBD |
| RMSI CORESET Reference Channel |  | 1 | TBD |
| Dedicated CORESET Reference Channel |  | 1 | TBD |
| OCNG Patterns |  | 1 | OP.1 |
| SSB configuration |  | 1 | TBD |
| SMTC Configuration |  | 1 | TBD |
| DBT window configuration |  | 1 | TBD |
| TRS configuration |  | 1 | TBD |
| DL CCA probability PCCA |  | 1 | TBD |  |
| UL CCA probability PCCA |  | 1 | 1 | 1 |
| EPRE ratio of PSS to SSS | dB | 1 | 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/30 KHz | 1 | -95 | -95 |
|  |  | 1 | 3 | 3 |
|  |  | 1 | 3 | 3 |
| SS-RSRPNote3 | dBm/30 kHz | 1 | -92 | -92 |
| IoNote3 | dBm/38.1MHz | 1 | -59.2 | -59.2 |
| Propagation condition |  | 1 | AWGN |
| SRS Config |  | 1 | 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.11.3.1.1.1-3 |

**Table A.11.3.1.1.1-3: SRS Configuration for UE transmit timing test**

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

A.11.3.1.1.2 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.11.3.1.1.1-1.

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.

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.11.3.1.1.2-1

**Table A.11.3.1.1.2-1: Adjustment Value for DL Timing**

|  |  |
| --- | --- |
| **SCS of SSB signals (KHz)** | **Adjustment Value** |
|  | Test1 | Test2 |
| 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. Skip this step for test 2 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 detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

### A.11.3.2 Timing advance

#### A.11.3.2.1 UE Timing Advance Adjustment Accuracy with PCell under DL CCA

##### A.11.3.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

##### A.11.3.2.1.2 Test Parameters

Supported test configurations are shown in table A.11.3.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.11.3.2.1.2-2, A.11.3.2.1.2-3 and A.11.3.2.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.11.3.2.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.11.3.2.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.11.3.2.1.2-1: Supported test configuration for timing advance test

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations |

Table A.11.3.2.1.2-2: General test parameters for timing advance test

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF channel number |  | 1 |  |
| Initial DL BWP |  | DLBWP.0.1 | As specified in Table A.3.9.2.1-1 |
| Dedicated DL BWP |  | DLBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| Initial UL BWP |  | ULBWP.0.1 | As specified in Table A.3.9.3.1-1 |
| Dedicated UL BWP |  | ULBWP.1.1 | As specified in Table A.3.9.3.2-1 |
| Timing Advance Command (*TA*) value during T1 |  | 31 | *NTA\_new = NTA\_old* for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command (*TA*) value during T2 |  | 39 | For 30 kHz SCS *NTA\_new = NTA\_old + 4096\*Tc* (based on equation in clause 4.2 of TS 38.213 [3]) |
| T1 | s | 5 |  |
| T2 | s | 5 |  |

Table A.11.3.2.1.2-3: Cell specific test parameters for timing advance test

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test1 |
|  |  | T1 | T2 |
| TDD configuration | Config 1 |  | TBD |
| BWchannel | Config 1 | MHz | 40: NRB,c = 106 |
| BWP BW | Config 1 | MHz | 40: NRB,c = 106 |
| DRX Cycle | Config 1 | ms | Not Applicable |
| DL CCA model | Config 1 |  | As specified in clause A.3.20.2.1 |
| UL CCA model | Config 1 |  | As specified in clause A.3.20.2.2 |
| PDSCH Reference measurement channel  | Config 1 |  | TBD |
| CORESET Reference Channel | Config 1 |  | TBD |
| TRS configuration | Config 1 |  | TBD |
| OCNG Patterns | Config 1 |  | OCNG pattern 1 |
| SMTC configuration | Config 1 |  | TBD |
| SSB configuration | Config 1 |  | TBD |
| DL CCA probability PCCA | Config 1 |  | 1 |
| UL CCA probability PCCA | Config 1 |  | 1 |
| EPRE ratio of PSS to SSS | dB | 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 | Config 1 | dBm/30 kHz | -95 |
|  | dB | 3 |
|  | dB | 3 |
| IoNote3 | Config 1 | dBm/38.16MHz | -62.58 |
| Propagation condition | - | AWGN |
| 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: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

Table A.11.3.2.1.2-4: Sounding Reference Symbol Configuration for Timing Advance Accuracy Test

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| c-SRS | 24 | Frequency hopping is disabled |
| b-SRS | 0 |  |
| b-hop | 0 |  |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 |  |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=4 for SCS 30kHz | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | Codebook | Codebook based UL transmission |
| startPosition | 0 | resourceMapping setting: SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 |  |
| repetitionFactor | n1 |  |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 |  |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. |

##### A.11.3.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

**----------------------END OF CHANGES----------------------------**