**3GPP TSG-RAN WG4 Meeting #97-e R4-2017256**

**Electronic Meeting, 2-13 Nov., 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** |  | **rev** | **1** | **Current version:** | **16.5.0** |  |
|  |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <http://www.3gpp.org/Change-Requests>.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | [draft CR] 2-step RACH test case |
|  |  |
| ***Source to WG:*** | ZTE Corporation |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_2step\_RACH-Perf |  | ***Date:*** | 2020-11-20 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Add test cases corresponding to core requirements for 2 step RA, in specific, for FR1 NR cells in NR SA under Non-contention based RA and FR2 NR cells in EN-DC under Non-contention based RA. Correct the titles in the current test cases for 4-step RA. |
|  |  |
| ***Summary of change:*** | Add test cases corresponding to core requirements for 2 step RA for FR1 NR cells in NR SA under Non-contention based RA and FR2 NR cells in EN-DC under Non-contention based RA. Correct the titles in the current test cases for 4-step RA. |
|  |  |
| ***Consequences if not approved:*** | No test cases are included in the specification for 2 step random access.The titles in current test cases for 4-step RA are vague. |
|  |  |
| ***Clauses affected:*** | A.6.3.2.2.1, A.6.3.2.2.2, A.6.3.2.2.4 (new), A.5.3.2.2.2, A.5.3.2.2.4(new) |
|  |  |
|  | **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:*** | Revised from R4-2014008 |

*<start of the change 1>*

#### A.6.3.2.2 Random Access

##### A.6.3.2.2.1 4-step RA type Contention based random access test in FR1 for NR standalone

A.6.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.1.1-1. UE capble of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.1.1-2.

Table A.6.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | 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 depending on UE capability |

<unchanged content omitted>

##### A.6.3.2.2.2 4-step RA type Non-Contention based random access test in FR1 for NR standalone

*<end of the change 1>*

*<start of the change 2>*

##### A.6.3.2.2.4 2-step RA type SSB based non-contention based test in FR1 for NR standalone

A.6.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.4.1-2.

Table A.6.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

|  |  |
| --- | --- |
| 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 depending on UE capability |

**Table A.6.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Test-1 | Test-2 | Comments |
| SSB Configuration | Config 1 |  | SSB pattern 2 in FR1 | SSB pattern 2 in FR1 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| Number of SSBs per SS-burst |  | 2 | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index |  | 0,1 | 0,1 | Different from the definition in A.3.10 |
| Duplex Mode for Cell 1 | Config 1 |  | TDD | TDD |  |
| TDD Configuration | Config 1 |  | TDDConf.1.2 | TDDConf.1.2 |  |
| OCNG Pattern Note 1  |  | OCNG pattern 1 | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 4 | Config 1 |  | SR.2.1 TDD | SR.2.1 TDD | As defined in A.3.1.1. |
| NR RF Channel Number |  | 1 | 1 |  |
| EPRE ratio of PSS to SSS | dB | 0 | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | dB |  |
| EPRE ratio of PBCH to PBCH\_DMRS | dB |  |
| EPRE ratio of PDCCH\_DMRS to SSS | dB |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS | dB |  |
| EPRE ratio of PDSCH\_DMRS to SSS | dB |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS | dB |  |
| msgA-*RSRP-ThresholdSSB* | dBm | RSRP\_69 +ΔDL | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| SSB with index 0 |  | dB | 3 | 3 | Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB* |
|  | Config 1 | dBm/15kHz | -101 | -101 |
|  | dB | 3 | 3 |
| SS-RSRP Note 3 | dBm/ SCS | -95 | -95 |
| SSB with index 1 |  | dB | -17 | -17 | Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB* |
|  | Config 1 | dBm/15kHz | -101 | -101 |
|  | dB | -17 | -17 |
| SS-RSRP Note 3 | dBm/ SCS | -115 | -115 |
| Io Note 2 | Config 1 | dBm | -62.2/38.16MHz | -62.2/38.16MHz | For symbols without SSB index 1 |
| ss-PBCH-BlockPower | dBm/ SCS | -5 | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power () | dBm | 23 | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| MsgA Configuration |  | FR1 MsgA configuration 1 | FR1 MsgA configuration 2 | As defined in A.3.x.2.1 and A.3.x.2.2. |
| Propagation Condition  | - | AWGN | AWGN |  |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.Note 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.Note 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.Note 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value.  |

A.6.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.6.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be [X] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB’s contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be [X] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

*<end of the change 2>*

*<start of the change 3>*

##### A.5.3.2.2.2 4- step RA type non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

*<end of the change 3>*

*<start of the change 4>*

##### A.5.3.2.2.4 2-step RA type SSB based non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.4.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.4.1-2 and Table A.5.3.2.2.4.1-3 for SSB-based non-contention based random access test.

Table A.5.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

|  |  |
| --- | --- |
| Config | Description |
| 1 | LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability |

Table A.5.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test-1 | **Comments** |
| SSB Configuration | Config 1 |  | SSB.1 FR2 | As defined in A.3.10 |
| Duplex Mode for Cell 2 | Config 1 |  | TDD |  |
| TDD Configuration | Config 1 |  | TDDConf.3.1 |  |
| BWchannel | Config 1 | MHz | 100: NRB,c = 24 |  |
| OCNG Pattern Note 1  |  | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH Reference Channel Note 2 | Config 1 |  | SR3.1 TDD | As defined in A.3.1.1. |
| RMSI CORESET Reference Channel | Config 1 |  | CR.3.1 TDD | As defined in A.3.1.2 |
| NR RF Channel Number |  | 1 |  |
| EPRE ratio of PSS to SSS | dB | 0 |  |
| EPRE ratio of PBCH\_DMRS to SSS | dB |  |  |
| EPRE ratio of PBCH to PBCH\_DMRS | dB |  |  |
| EPRE ratio of PDCCH\_DMRS to SSS | dB |  |  |
| EPRE ratio of PDCCH to PDCCH\_DMRS | dB |  |  |
| EPRE ratio of PDSCH\_DMRS to SSS | dB |  |  |
| EPRE ratio of PDSCH to PDSCH\_DMRS | dB |  |  |
| ss-PBCH-BlockPower | dBm/ SCS | +20 +ΔUL | As defined in TS 38.331 [2].ΔUL is derived from the uplink calibration process Note 3 |
| Configured UE transmitted power () | dBm | maximum value configurable for certain power class  | As defined in clause 6.2.4 in TS 38.101-2 [19] |
| MsgA Configuration |  | FR2 MsgA configuration 1 | As defined in A.3.x.3.1, with exceptions as defined below |
| msgA-*RSRP-ThresholdSSB* | dBm | RSRP\_69 +ΔDL | RSRP\_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4 |
| preambleReceivedTargetPower | dBm | -100 | As defined in TS 38.331 [2] |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.Note 3: The ΔUL value is calculated as -ROUND(PPRACH0 -1), where PPRACH0 is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.Note 4: The ΔDL value is calculated as (RSRP\_REP – RSRP\_76), where RSRP\_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP\_x, x is treated as a positive integer value.  |

**Table A.5.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test-1** | **Comments** |
| AoA setup |  | Setup 1 | As defined in A.3.15.1 |
| Assumption for UE beamsNote 2 |  | Rough |  |
| SSB with  | Es Note1 | dBm/SCS | -80.6 | Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB* |
| index 0 | SSB\_RP | dBm/SCS | -80.6 |
|  | Es/IotBB | dB | 21.09 |  |
|  | Io | dBm/95.04 MHz | -56.01 | Io in symbols containing SSB index 0 |
| SSB with  | Es Note1 | dBm/SCS | -95.0 | Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB* |
| index 1 | SSB\_RP | dBm/SCS | -95.0 |
|  | Es/IotBB | dB | 6.69 |  |
|  | Io | dBm/95.04 MHz | -70.41 | Io in symbols containing SSB index 1 |
| Propagation Condition  | - | AWGN |  |
| Note 1: No articial noise is applied in this test.Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation |

A.5.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.5.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be [X] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.4.2.3 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR MAC subPDU.

The UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitoring contention resolution as described in clause 8.2A in TS 38.213 [3].

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.4.2.4 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be [X] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

*<end of the change 4>*