6.5 Output RF spectrum emissions

Unwanted emissions are divided into "Out-of-band emission" and "Spurious emissions" in 3GPP RF specifications. This notation is in line with ITU-R recommendations such as SM.329 [7] and the Radio Regulations [TBD].

ITU defines:

Out-of-band emission = Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

Spurious emission = Emission on a frequency, or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions.

Unwanted emissions = Consist of spurious emissions and out-of-band emissions.

The UE transmitter spectrum emission consists of the three components; the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

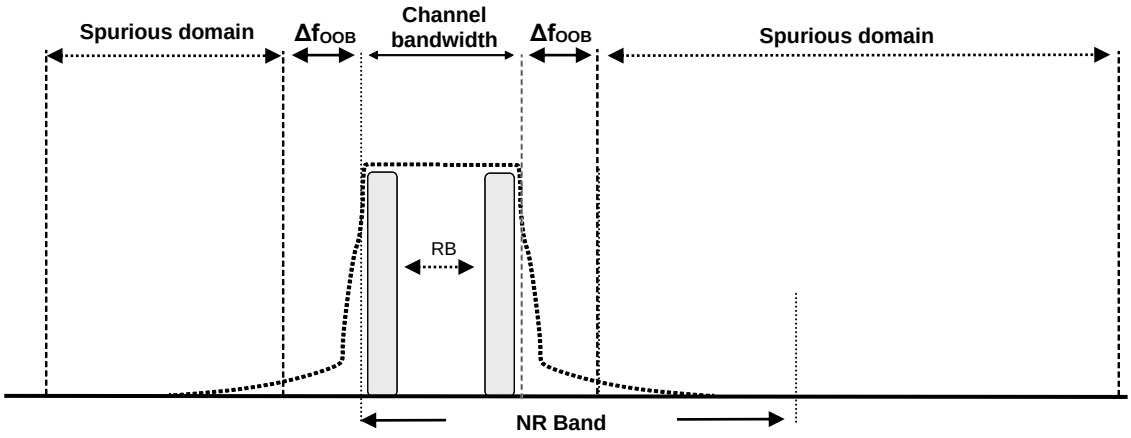

Figure 6.5-1: Transmitter RF spectrum

6.5.1 Occupied bandwidth

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainty is FFS for n259.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.

6.5.1.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits

6.5.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

6.5.1.3 Minimum conformance requirements

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.5.1.3-1.

The occupied bandwidth is defined as a directional requirement. The requirement is verified in beam locked mode with the test metric of OBW (Link=TX beam peak direction, Meas=Link angle).

Table 6.5.1.3-1: Occupied channel bandwidth

	Occupied channel bandwidth / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
Channel bandwidth (MHz)	50	100	200	400

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5.1.

6.5.1.4 Test description

6.5.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] clause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] clause 4.3.1		All	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	-	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM QPSK	Outer_full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and clause A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.1.4.3

6.5.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (Note 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (Note 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure the EIRP spectrum distribution within 1.5-times or more frequency range over the requirement for Occupied Bandwidth specification centring on the current carrier frequency. The characteristics of the filter shall be approximately Gaussian (typical spectrum analyser filter). The measuring duration is one active uplink subframe. EIRP is captured from both polarizations, theta and phi.

6. Calculate the total EIRP from both polarizations, theta and phi, within the range of all frequencies measured in step 5 and save this value as "Total EIRP". EIRP measurement procedure is defined in Annex K.

7. Identify the measurement window whose centre is aligned on the centre of the channel for which the sum of the power measured in theta and phi polarization is 99% of the “Total EIRP”.

8. The “Occupied Bandwidth” is the width of the measurement window obtained in step 7.

6.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.5.1.5 Test requirement

The measured Occupied Bandwidth shall not exceed values in Table 6.5.1.5-1.

Table 6.5.1.5-1: Occupied channel bandwidth

	Occupied channel bandwidth / Channel bandwidth			
	50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
Channel bandwidth (MHz)	50 + R	100 + R	200 + R	400 + R
NOTE 1: R is relaxation : R for each frequency and channel bandwidth is specified in Table 6.5.1.5-2.				

Table 6.5.1.5-2: Relaxation due to testability limit (Occupied channel bandwidth)

	Occupied channel bandwidth / Channel bandwidth			
	50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
n257, n258, n261	0	0	0	0
n260	0	0	0	0
n259	TBD	TBD	TBD	TBD

6.5.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission

limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio. Additional requirements to protect specific bands are also considered.

The requirements in clause 6.5.2.1 only apply when both UL and DL of a UE are configured for single CC operation, and they are of the same bandwidth. For a UE that is configured for single CC operation with different channel bandwidths in UL and DL, the requirements in clause 6.5A.2.1 apply.

All out of band emissions for range 2 are TRP.

6.5.2.1 Spectrum Emission Mask

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.

6.5.2.1.1 Test purpose

To verify that the power of any UE emission shall not exceed specified lever for the specified channel bandwidth.

6.5.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.5.2.1.3 Minimum conformance requirements

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. For frequencies offset greater than F_{OOB} as specified in Table 6.5.2.1.3-1 the spurious requirements in clause 6.5.3 are applicable.

The power of any UE emission shall not exceed the levels specified in Table 6.5.2.1.3-1 for the specified channel bandwidth. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 6.5.2.1.3-1: General NR spectrum emission mask for Range 2.

Spectrum emission limit (dBm)/ Channel bandwidth					
Δf_{OOB} (MHz)	50 MHz	100 MHz	200 MHz	400 MHz	Measurement bandwidth
± 0-5	-5	-5	-5	-5	1 MHz
± 5-10	-13	-5	-5	-5	1 MHz
± 10-20	-13	-13	-5	-5	1 MHz
± 20-40	-13	-13	-13	-5	1 MHz
± 40-100	-13	-13	-13	-13	1 MHz
± 100-200		-13	-13	-13	1 MHz
± 200-400			-13	-13	1 MHz
± 400-800				-13	1 MHz

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5.2.1.

6.5.2.1.4 Test description

6.5.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.2.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	-	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM PI/2 BPSK	Outer_Full
2		DFT-s-OFDM QPSK	Outer_Full
3		DFT-s-OFDM 16 QAM	Outer_Full
4		DFT-s-OFDM 64 QAM	Outer_Full
5		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: All test points in this table must also exist in Table 6.2.2.4.1-1, Table 6.2.2.4.1-2, Table 6.2.2.4.1-3 (MPR) for PC1 or Table 6.2.2.4.1-7, Table 6.2.2.4.1-8, Table 6.2.2.4.1-9 (MPR) for PC2, PC3 and PC4.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and clause A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5.2.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.2.1.4.3

6.5.2.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.2.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.
3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.
4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.
5. Measure the TRP of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.2.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. TRP shall be recorded for each step. The measurement period shall capture the active time slots. Total radiated power is measured according to TRP measurement procedure defined in Annex K. The measurement grid used for TRP measurement defined in Annex M. TRP is calculated considering both polarizations, theta and phi.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.5.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.5.2.1.5 Test requirement

The measured TRP of any UE emission derived in step 5, shall fulfil requirements in Table.6.5.2.1.5-1.

Table 6.5.2.1.5-1: General NR spectrum emission mask for Range 2

Spectrum emission limit (dBm)/ Channel bandwidth					
Δf_{OOB} (MHz)	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**	**Measurement bandwidth**
± 0-5	-5 + TT	-5 + TT	-5 + TT	-5 + TT	1 MHz
± 5-10	-13 + TT	-5 + TT	-5 + TT	-5 + TT	1 MHz
± 10-20	-13 + TT	-13 + TT	-5 + TT	-5 + TT	1 MHz
± 20-40	-13 + TT	-13 + TT	-13 + TT	-5 + TT	1 MHz
± 40-100	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 100-200		-13 + TT	-13 + TT	-13 + TT	1 MHz
± 200-400			-13 + TT	-13 +TT	1 MHz
± 400-800				-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.1.5-1a NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.					

Table 6.5.2.1.5-1a: Test Tolerance (Spectrum emission mask)

Test Metric	23.45GHz ≤ f ≤ 32.125GHz	32.125GHz < f ≤ 40.8GHz
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.5.2.2 Void

6.5.2.3 Adjacent channel leakage ratio

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Testability for power class 1, 2 and 4 are FFS.

6.5.2.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR).

6.5.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.5.2.3.3 Minimum conformance requirements

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirement is specified for a scenario in which adjacent carrier is another NR channel.

NR Adjacent Channel Leakage power Ratio (NR_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.5.2.3.3-1.

If the measured adjacent channel power is greater than –35 dBm then the NR_{ACLR} shall be higher than the value specified in Table 6.5.2.3.3-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 6.5.2.3.3-1: General requirements for NR_{ACLR}

	Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
NR_{ACLR} for band n257, n258, n261	17 dB	17 dB	17 dB	17 dB
NR_{ACLR} for band n260	16 dB	16 dB	16 dB	16 dB
NR channel Measurement bandwidth (MHz)	47.58	95.16	190.20	380.28
Adjacent channel centre frequency offset [MHz]	+50 / -50	+100 / -100	+200 / -200	+400 / -400

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5.2.3.

6.5.2.3.4 Test description

6.5.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.2.3.4.1-1 and Table 6.5.2.3.4.1-2. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.2.3.4.1-1: Test Configuration Table (Power Class 1)

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1					Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1					Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 5.3.5-1					Lowest, Highest	
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	-	**Modulation**	**RB allocation (NOTE 1)**
1	Low				DFT-s-OFDM PI/2 BPSK	8@0
2	High				DFT-s-OFDM PI/2 BPSK	8@N_{RB}-8
3	Mid				DFT-s-OFDM PI/2 BPSK	Outer_Full
4	Low				DFT-s-OFDM QPSK	8@0
5	High				DFT-s-OFDM QPSK	8@N_{RB}-8
6	Mid				DFT-s-OFDM QPSK	Outer_Full
7	Low				DFT-s-OFDM 16 QAM	8@0
8	High				DFT-s-OFDM 16 QAM	8@N_{RB}-8
9	Mid				DFT-s-OFDM 16 QAM	Outer_Full
10	Low				DFT-s-OFDM 64 QAM	8@0
11	High				DFT-s-OFDM 64 QAM	8@N_{RB}-8
12	Mid				DFT-s-OFDM 64 QAM	Outer_Full
13	Low				CP-OFDM QPSK	8@0
14	High				CP-OFDM QPSK	8@N_{RB}-8
15	Mid				CP-OFDM QPSK	Outer_Full

NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-2 for PC1.
NOTE 2: Following Test IDs shall be skipped for FR2b
- FFS
NOTE 3: All test points in this table must also exist in Table 6.2.2.4.1-1, Table 6.2.2.4.1-2, Table 6.2.2.4.1-3 (MPR).

Table 6.5.2.3.4.1-2: Test Configuration Table (Power Class 2, 3 and 4)

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1					Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1					Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 5.3.5-1					Lowest, Highest	
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	-	**Modulation**	**RB allocation (NOTE 1)**
1	Low				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
2	High				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
3	Mid				DFT-s-OFDM PI/2 BPSK	Outer_Full
4	Low				DFT-s-OFDM QPSK	Outer_1RB_Left
5	High				DFT-s-OFDM QPSK	Outer_1RB_Right
6	Mid				DFT-s-OFDM QPSK	Outer_Full
7	Low				DFT-s-OFDM 16 QAM	Outer_1RB_Left
8	High				DFT-s-OFDM 16 QAM	Outer_1RB_Right
9	Mid				DFT-s-OFDM 16 QAM	Outer_Full
10	Low				DFT-s-OFDM 64 QAM	Outer_1RB_Left
11	High				DFT-s-OFDM 64 QAM	Outer_1RB_Right
12	Mid				DFT-s-OFDM 64 QAM	Outer_Full
13	Low				CP-OFDM QPSK	Outer_1RB_Left
14	High				CP-OFDM QPSK	Outer_1RB_Right
15	Mid				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4. NOTE 2: Following Test IDs shall be skipped for FR2b and PC3 - All Test IDs for FR2b 400MHz Channel Bandwidth - Test ID 10-15 for FR2b 200MHz Channel Bandwidth - Test ID 10-12 for FR2b 100MHz Channel Bandwidth NOTE 3: All test points in this table must also exist in Table 6.2.2.4.1-7, Table 6.2.2.4.1-8, Table 6.2.2.4.1-9 (MPR).						

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.5.2.3.4.1-1 and Table 6.5.2.3.4.1-2.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.2.3.4.3

6.5.2.3.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.2.3.4.1-1 and Table 6.5.2.3.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure EIRP of the transmitted signal in the Tx beam peak direction for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1. EIRP measurement procedure defined in Annex K. EIRP is calculated considering both polarizations, theta and phi.

6. Measure EIRP of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively using a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1. EIRP measurement procedure defined in Annex K. EIRP is calculated considering both polarizations, theta and phi.

7. Calculate the ratios of the power between the values measured in step 5 over step 6 for lower and upper NR ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the Table 6.5.2.3.4.1-1 and Table 6.5.2.3.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.5.2.3.5 Test requirement

The measured NR ACLR, derived in step 7, shall be higher than the limits in Table 6.5.2.3.5-1.

Table 6.5.2.3.5-1: General requirements for NR_{ACLR}

	Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
NR_{ACLR} for band n257, n258, n261	17 - TT – R dB	17 - TT – R dB	17 - TT – R dB	17 - TT – R dB
NR_{ACLR} for band n260	16 - TT dB	16 - TT dB	16 - TT dB	16 - TT dB
NR channel Measurement bandwidth (MHz)	47.58	95.16	190.20	380.28
Adjacent channel centre frequency offset [MHz]	+50 / -50	+100 / -100	+200 / -200	+400 / -400
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1a NOTE 2: R for each frequency, channel bandwidth and test point is specified in Table 6.5.2.3.5-1b				

Table 6.5.2.3.5-1a: Test Tolerance (Adjacent channel leakage ratio)

		Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	Test ID	50 MHz	100 MHz	200 MHz	400 MHz
NR_{ACLR} for band n257, n258, n261	1-2, 4-5	4.10	4.49	4.66	5.06
	3, 6	4.08	4.45	4.59	5.06
	7-9	4.15	4.59	4.85	3.34
	10-12	4.36	4.98	4.06	1.46
	13-15	4.17	4.62	4.91	2.99
NR_{ACLR} for band n260	1-2, 4-5	4.48	4.65	4.97	-
	3, 6	4.45	4.58	4.84	-
	7-9	4.58	4.84	5.31	-
	10-12	4.97	-	-	-
	13-15	4.62	4.90	-	-

Table 6.5.2.3.5-1b: Relaxation due to testability limit (Adjacent channel leakage ratio)

		Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	Test ID	50 MHz	100 MHz	200 MHz	400 MHz
NR_{ACLR} for band n257, n258, n261	1-6	0	0	0	0
	7	0	0	0	2.5
	8	0	0	0	2.5
	9	0	0	0	2.5
	10	0	0	1.5	5.5
	11	0	0	1.5	5.5
	12	0	0	1.5	5.5
	13	0	0	0	3
	14	0	0	0	3
	15	0	0	0	3
NOTE 1: Relaxation value is derived by Table 6.5.2.3.5-1c for FR2a. NOTE 2: Relaxation value is 0 for FR2b.					

Table 6.5.2.3.5-1c: Relaxation value for FR2a ACLR

	CA bandwidth class		
MPR	100 MHz	200 MHz	400 MHz
0	0	0	0
0.5	0	0	0
1	0	0	0
1.5	0	0	0
2	0	0	0
2.5	0	0	0
3	0	0	0
3.5	0	0	0.5
4	0	0	1
4.5	0	0	2.5
5	0	0	3
5.5	0	1.5	4.5
6	0	2	5
6.5	0	2.5	5.5
7	0	3	6
7.5	0.5	3.5	6.5
8	1	4	7
8.5	1.5	4.5	7.5
9	2	5	8

6.5.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions. The spurious emission limits are specified in terms of general requirements in line with SM.329 [7] and *NR* operating band requirement to address UE co-existence. Spurious emissions are measured as TRP.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.5.3.1 Transmitter Spurious emissions

Editor's Note: This clause is complete for Band n257, n258, n260 and n261 and PC3. The following aspects of the clause are for future consideration:

- TRP Measurement uncertainty is TBD for above 80 GHz.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5.3.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5.3.1.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

6.5.3.1.3 Minimum conformance requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.5.3.1.3-1 starting from the edge of the assigned *NR* channel bandwidth. The spurious emission limits in Table 6.5.3.1.3-2 apply for all transmitter band configurations (NRB) and channel bandwidths. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5.3.1.3-1: Boundary between *NR* out of band and spurious emission domain

Channel bandwidth	50 MHz	100 MHz	200 MHz	400 MHz
OOB boundary F_{OOB} (MHz)	100	200	400	800

The spurious emission limits in table 6.5.3.1.3-2 apply for all transmitter band configurations (RB) and channel bandwidths.

Table 6.5.3.1.3-2: Spurious emissions limits

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band in GHz	-13 dBm	1 MHz	

The normative reference for this requirement is TS 38.101-2 subclause 6.5.3.

6.5.3.1.4 Test description

6.5.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.3.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1		Low range, High range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1		Highest	
Test SCS as specified in Table 5.3.5-1		120kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1	-	DFT-s -OFDM QPSK	Inner_Full for PC2, PC3 and PC4 Inner_Full_Region1 for PC1
2		DFT-s -OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} – \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$). NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC2, PC3 and PC4 or Inner_Partial_Left_Region1 for PC1 and when testing High range configure uplink RB to Inner_1RB_Right for PC2, PC3 and PC4 or Inner_Partial_Right_Region1 for PC1.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.5.3.1.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.3.1.4.3.

6.5.3.1.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.

2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

7. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4). Step (a) is optional and applicable only if SNR (test requirement level in Table 6.5.3.1.5-1 minus offset value minus noise floor of the test system) $\geq$ 0 dB is guaranteed.

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5.3.1.5-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5.3.1.5-1 may be applied. The measurement period shall capture the active time slots. For each spurious emission frequency with coarse TRP identified to be less than an offset dB from the TRP limit according to Table 6.5.3.1.5-1, continue with fine TRP procedures according to step (b).

   The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element, excluding the influence of noise. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

Table 6.5.3.1.4.2-1: Typical offset values for coarse TRP measurement step 7(a)

Grid	Frequency Range	Offset Value
Constant Density	6 GHz ≤ f < 12.75 GHz	5.13
	12.75 GHz ≤ f < 23.45GHz	5.09
	23.45 GHz ≤ f < 40.8GHz	5.38
	40.8 GHz ≤ f < 66GHz	7.31
	66 GHz ≤ f ≤ 80GHz	7.61
Constant-Step Size	6 GHz ≤ f < 12.75 GHz	5.26
	12.75 GHz ≤ f < 23.45GHz	5.23
	23.45 GHz ≤ f < 40.8GHz	5.52
	40.8 GHz ≤ f < 66GHz	7.43
	66 GHz ≤ f ≤ 80GHz	7.73
NOTE 1: These offset values are the upper limit values when fine TRP measurement uncertainty of the test system is same as maximum test system uncertainty in Annex F and when using the coarse measurement grid with minimum number of points as specified in Table M.4.5-3. NOTE 2: It is allowed to use the offset values derived based on test system's actual measurement uncertainty budget and denser measurement grid as specified in Table M.4.5-3.		

(b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5.3.1.5-1.

8. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5.3.1.5-1 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

NOTE 5: The coarse TRP measurement grid and corresponding offset dB value referred in step 7(a) above, for some valid grids can be found in TR 38.903[20] section B.18.

6.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.5.3.1.5 Test requirement

This clause specifies the requirements for the specified *NR* band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5.3.1.5-1.

The maximum TRP power of spurious emission, measured using RMS detector, shall not exceed the described value in Table 6.5.3.1.5-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.5.3.1.3-1 starting from the edge of the assigned *NR* channel bandwidth. The spurious emission limits in Table 6.5.3.1.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5.3.1.5-1: Spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
6 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band in GHz	-13 dBm	1 MHz	
NOTE 1: Applies for Band n257, n258, n260, n261			

6.5.3.2 Spurious emission band UE co-existence

Editor's note: This clause is complete for Band n257, n258, n260 and n261 and PC3. The following aspects of the clause are for future consideration:

- TRP Measurement uncertainty is TBD for PC1, PC2 and PC4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5.3.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5.3.2.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

6.5.3.2.3 Minimum conformance requirements

This clause specifies the requirements for the specified NR band, for co-existence with protected bands. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

The spurious emission UE co-existence limits in Table 6.5.3.2.3-1 apply for all transmitter band configurations (RB) and channel bandwidths.

Table 6.5.3.2.3-1: Spurious emissions UE co-existence limits

NR Band	Spurious emission						
	Protected band/frequency range	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n257	NR Band n260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	57000	-	66000	2	100	
	Frequency range	23600	-	24000	1	200	3

n258	Frequency range	57000	-	66000	2	100	
n259	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	n259
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	36000	-	37000	7	1000	
	Frequency range	57000	-	66000	2	100	
n260	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	57000	-	66000	2	100	
n261	NR Band 260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	57000	-	66000	2	100	
NOTE 1: F_{DL_low} and F_{DL_high} refer to each NR frequency band specified in Table 5.2-1. NOTE 2: Void. NOTE 3: The protection of frequency range 23600-24000 MHz is meant for protection of satellite passive services.							

The normative reference for this requirement is TS 38.101-2 subclause 6.5.3.1.

6.5.3.2.4 Test description

6.5.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.3.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.2.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1		Low range, High range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1		Highest	
Test SCS as specified in Table 5.3.5-1		120kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1	-	DFT-s-OFDM QPSK	Inner_Full for PC2, PC3 and PC4 Inner_Full_Region1 for PC1
2		DFT-s-OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} - \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$). NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC2, PC3 and PC4 or Inner_Partial_Left_Region1 for PC1 and when testing High range configure uplink RB to Inner_1RB_Right for PC2, PC3 and PC4 or Inner_Partial_Right_Region1 for PC1.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.5.3.2.4.1-1

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.3.2.4.3.

6.5.3.2.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.

2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

7. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4):

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5.3.2.3-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5.3.2.3-1 may be applied as long as the SNR (ratio of test limit to floor noise of test equipment) ≥ 10dB is guaranteed. The measurement period shall capture the active time slots. For each spurious emission frequency with coarse TRP identified to be less than an offset dB (NOTE 2) from the TRP limit according to Table 6.5.3.2.3-1, continue with fine TRP procedures according to step (b).

   The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

   (b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5.3.2.3-1.

8. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5.3.2.3-1 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: The coarse TRP measurement grid and corresponding offset dB value referred in step 7(a) above, for some valid grids can be found in TR 38.903 section B.18.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

6.5.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.5.3.2.5 Test requirement

This clause specifies the requirements for the specified *NR* band for Transmitter Spurious emissions for UE co-existence requirement with frequency range as indicated in Table 6.5.3.2.5-1.

The maximum TRP power of spurious emission for UE co-existence, measured using RMS detector, shall not exceed the described value in Table 6.5.3.2.5-1.

The spurious emission UE co-existence limits in Table 6.5.3.2.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5.3.2.5-1: Spurious emissions UE co-existence test requirements

NR Band	Spurious emission						
	Protected band/frequency range	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n257	NR Band n260	F_{DL_low}	-	F_{DL_high}	-2 + 5.0	100	NOTE 3
	Frequency range	57000	-	66000	2	100	
	Frequency range	23600	-	24000	1 + 0.3	200	NOTE 6
n258	Frequency range	57000	-	66000	2	100	
n259	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5 + 3.3	100	n259, NOTE 4
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5 + 3.3	100	NOTE 4
	Frequency range	36000	-	37000	7 + 6.0	1000	NOTE 5
	Frequency range	57000	-	66000	2	100	
n260	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5 + 3.3	100	NOTE 4
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5 + 3.3	100	NOTE 4
	Frequency range	57000	-	66000	2	100	
n261	NR Band 260	F_{DL_low}	-	F_{DL_high}	-2 + 5.0	100	NOTE 3
	Frequency range	57000	-	66000	2	100	

NOTE 1: F_{DL_low} and F_{DL_high} refer to each NR frequency band specified in Table 5.2-1.
NOTE 2: Void.
NOTE 3: 5.0 dB relaxation due to testability limit
NOTE 4: 3.3 dB relaxation due to testability limit
NOTE 5: 6.0 dB relaxation due to testability limit
NOTE 6: 0.3 dB relaxation due to testability limit

6.5.3.3 Additional spurious emissions

Editor's note: This clause is complete for Band n257 and n258 and PC3. The following aspects of the clause are for future consideration:

- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5.3.3.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5.3.3.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

6.5.3.3.3 Minimum conformance requirements

The additional spurious emission limits in Table 6.5.3.3.3-2 through Table 6.5.3.3.3-3 apply for all transmitter band configurations (RB) and channel bandwidths. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5.3.3.3-1: Void

When "NS_202" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3-2.

Table 6.5.3.3.3-2: Additional spurious emissions (NS_202) test limits

Frequency Range	Maximum Level	Measurement bandwidth
7.25 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band	-10 dBm	100 MHz
23.6 GHz ≤ f ≤ 24.0 GHz	+1 dBm	200 MHz
NOTE 1: This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth. The protection of frequency range 23600 - 24000 MHz is meant for protection of satellite passive services.		

When "NS_203" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3-3. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

Table 6.5.3.3.3-3: Additional spurious emissions (NS_203) test limits

Frequency band (GHz)	Spectrum emission limit (dBm)	Measurement bandwidth
$23.6 \leq f \leq 24.0$	+1	200 MHz

The normative reference for this requirement is TS 38.101-2 subclause 6.5.3.2.

6.5.3.3.4 Test description

6.5.3.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5.3.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.3.4.1-1: Test Configuration Table for NS_202

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1		Low range, High range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1		Highest	
Test SCS as specified in Table 5.3.5-1		120kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1 (NOTE 5)	-	DFT-s-OFDM QPSK	Inner_Full
2		DFT-s-OFDM QPSK	Inner_1RB_Left for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)
3 (NOTE 4)		DFT-s-OFDM 64QAM	Outer_Full

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.
NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} - \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$).
NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC2, PC3 and PC4 or Inner_Partial_Left_Region1 for PC1 and when testing High range configure uplink RB to Inner_1RB_Right for PC2, PC3 and PC4 or Inner_Partial_Right_Region1 for PC1.
NOTE 4: Test ID only applicable to PC1
NOTE 5: Test ID not applicable to PC1.

Table 6.5.3.3.4.1-2: Test Configuration Table for NS_203

Initial Conditions					
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1			Low range		
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1			Highest		
Test SCS as specified in Table 5.3.5-1			120kHz		
Test Parameters					
Test ID	**Frequency**	**Channel Bandwidth**	**Downlink Configuration**	**Uplink Configuration**	
				Modulation	**RB allocation (NOTE 1)**
1	Default	Default	-	DFT-s-OFDM QPSK	Inner_Full
2	Default	Default		DFT-s-OFDM QPSK	Inner_1RB_Left for PC2, PC3 and PC4 Inner_Partial_Left_Region1 for PC1
3 (NOTE 2)	Low range + Channel Bandwidth (NOTE 3)	Default		DFT-s-OFDM QPSK	Inner_Partial_Left_Region1
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Test ID only applicable to PC1. NOTE 3: Test frequency for test ID 3 is sepecified in Table 6.2.3.4.1-4.					

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5.3.3.4.1-1
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5.3.3.4.3.

6.5.3.3.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.
2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.
3. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.3.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
4. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

7. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4). Step (a) is optional and applicable only if SNR (test requirement level in Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3, minus offset value minus noise floor of the test system) ≥ 0 dB is guaranteed.

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3 may be applied. The measurement period shall capture the active time slots. For each spurious emission frequency with coarse TRP identified to be less than an offset dB from the TRP limit according to Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3, continue with fine TRP procedures according to step (b).

   The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

   (b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3.

8. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5.3.3.5-2 through Table 6.5.3.3.5-3 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: The coarse TRP measurement grid and corresponding offset dB value referred in step 7(a) above, for some valid grids can be found in TR 38.903 [20] section B.18.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

6.5.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with the following exceptions:

Information element additionalSpectrumEmission is set to NS_202. This can be set in SIB1 as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.5.3.3.4.3-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_202"

Derivation Path: TS 38.508-1 [10] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_202)		

Information element additionalSpectrumEmission is set to NS_203. This can be set in SIB1 as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.5.3.3.4.3-2: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_203"

Derivation Path: TS 38.508-1 [10] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	3 (NS_203)		

6.5.3.3.5 Test requirement

This clause specifies the requirements for the specified *NR* band for Transmitter Additional Spurious emissions requirement with frequency range as indicated in Table 6.5.3.3.5-2 and Table 6.5.3.3.5-3.

The maximum TRP power of spurious emission for Transmitter Additional Spurious emissions, measured using RMS detector, shall not exceed the described value in Table 6.5.3.3.5-2 and Table 6.5.3.3.5-3.

The Transmitter Additional Spurious emissions limits in Table 6.5.3.3.5-2 and Table 6.5.3.3.5-3 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5.3.3.5-1: Void

Table 6.5.3.3.5-2: Additional spurious emissions (NS_202) test requirements

Frequency Range	Maximum Level (dBm)	Measurement bandwidth	NOTE
7.25 GHz ≤ f ≤ 12.75 GHz	-10	100 MHz	
12.75 GHz ≤ f ≤ 23.45 GHz	-10 + 13	100 MHz	NOTE 1
23.45 GHz ≤ f ≤ 40.8 GHz	-10 + 13	100 MHz	NOTE 1
40.8 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band	-10 + 13	100 MHz	NOTE 1
23.6 GHz ≤ f ≤ 24.0 GHz	+1 +0.3	200 MHz	NOTE 2
NOTE 1: 13 dB relaxation due to testability limit NOTE 2: 0.3 dB relaxation due to testability limit			

Table 6.5.3.3.5-3: Additional spurious emissions (NS_203) test requirements

Frequency band (GHz)	Spectrum emission limit (dBm)	Measurement bandwidth	NOTE
23.6 ≤ f ≤ 24.0	+1 + 0.3	200 MHz	NOTE 1
NOTE 1: 0.3 dB relaxation due to testability limit			

6.5A Output RF spectrum emissions for CA

6.5A.1 Occupied bandwidth for CA

6.5A.1.0 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5A.1.

6.5A.1.0.0 General

The occupied bandwidth for UL CA is defined as a directional requirement. The requirement is verified in beam locked mode on beam peak direction. In case the CA configuration consists of a single UL CC, the occupied bandwidth requirement defined in subclause 6.5.1 applies.

6.5A.1.0.1 Occupied bandwidth for intra-band contiguous UL CA

For intra-band contiguous UL carrier aggregation, the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The occupied bandwidth for UL CA shall be less than the UL aggregated channel bandwidth defined in clause 5.3A.

6.5A.1.0.2 Occupied bandwidth for intra-band non-contiguous UL CA

TBD

6.5A.1.1 Occupied bandwidth for CA (2UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS
- For a transition period of 2 meeting cycles after the test case is complete, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

6.5A.1.1.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.1.4 Test description

6.5A.1.1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configuration specified in clause 5.5A. All of these configurations shall be tested with

applicable test parameters for each CA combination and subcarrier spacing, are shown in Table 6.5A.1.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.1.1.4.1-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.			Mid range			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.			Highest aggregated BW of the CA configuration			
Test SCS as specified in Table 5.3.5-1.			Lowest			
Test Parameters						
Test ID	**CC**	**ChBw(MHz)**	**Test frequency**	**DL RB allocation**	**UL Modulation**	**UL RB allocation (Note 1)**
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement Channel is set according to Table 6.5A.1.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.1.1.4.3.

6.5A.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2, and C.3.0 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.1.1.4.3.
3. Apply the test step based on the 5G NR UE Release:

   3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition ‘NR FR2 2CA’. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

   3b. For Release 15 5G NR UEs: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.2).
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.1.1.4.1-1 on both PCC and SCC(s). Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

   7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

   7b For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1. ; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. Measure the EIRP spectrum distribution over all component carriers within 1.5 times or more frequency range over the requirement for Occupied Bandwidth for CA specification centring on the centre of aggregated channel bandwidth. The characteristics of the filter shall be approximately Gaussian (typical spectrum analyser filter). The measuring duration is one active uplink subframe. EIRP is captured from both polarizations, theta and phi.

9. Calculate the total EIRP from both polarizations, theta and phi, within the range of all frequencies measured in step 4 and save this value as “Total EIRP”. EIRP measurement procedure is defined in Annex K.

10. Identify the measurement window whose centre is aligned on the centre of the channel for which the sum of the power measured in theta and phi polarization is 99% of the “Total EIRP”.

11. The “Occupied Bandwidth” is the width of the measurement window obtained in step 9.

12. Apply the test step based on the 5G NR UE Release:

    12a. For Release 16 and forward 5G NR UEs: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

    12a. For Release 15 5G NR UEs: No action.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.5A.1.1.4.3: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.1.1.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.2 Occupied bandwidth for CA (3UL CA)

Editor’s note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS

6.5A.1.2.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.2.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.2.4-1.

Table 6.5A.1.2.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.				Mid range		
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.				Highest aggregated BW of the CA configuration		
Test SCS as specified in Table 5.3.5-1.				Lowest		
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.2.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.3 Occupied bandwidth for CA (4UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS

- TP analysis is FFS
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.1.3.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.3.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.3.4-1.

Table 6.5A.1.3.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.			Mid range			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.			Highest aggregated BW of the CA configuration			
Test SCS as specified in Table 5.3.5-1.			Lowest			
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
	SCC3				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.3.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.4 Occupied bandwidth for CA (5UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS

6.5A.1.4.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.1.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.4.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.4.4-1.

Table 6.5A.1.4.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.			Mid range			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.			Highest aggregated BW of the CA configuration			
Test SCS as specified in Table 5.3.5-1.			Lowest			
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
	SCC3				CP-OFDM QPSK	Outer_Full
	SCC4				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.4.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.5 Occupied bandwidth for CA (6UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.1.5.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.1.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.5.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.5.4-1.

Table 6.5A.1.5.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.				Mid range		
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.				Highest aggregated BW of the CA configuration		
Test SCS as specified in Table 5.3.5-1.				Lowest		
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
	SCC3				CP-OFDM QPSK	Outer_Full
	SCC4				CP-OFDM QPSK	Outer_Full
	SCC5				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.5.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.6 Occupied bandwidth for CA (7UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS

6.5A.1.6.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.1.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.6.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.6.4-1.

Table 6.5A.1.6.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.				Mid range		
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.				Highest aggregated BW of the CA configuration		
Test SCS as specified in Table 5.3.5-1.				Lowest		
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
	SCC3				CP-OFDM QPSK	Outer_Full
	SCC4				CP-OFDM QPSK	Outer_Full
	SCC5				CP-OFDM QPSK	Outer_Full
	SCC6				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.						
NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.6.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.1.7 Occupied bandwidth for CA (8UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD
- Measurement Uncertainties and Test Tolerances are FFS
- TP analysis is FFS

- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.1.7.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5A.1.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.1.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.1.0.

6.5A.1.7.4 Test description

Same as in clause 6.5A.1.1.4 with following exceptions:

- Instead of Table 6.5A.1.1.4.1-1→ use Table 6.5A.1.7.4-1.

Table 6.5A.1.7.4-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes.			Mid range			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.			Highest aggregated BW of the CA configuration			
Test SCS as specified in Table 5.3.5-1.			Lowest			
Test Parameters						
Test ID	CC	ChBw(MHz)	Test frequency	DL RB allocation	UL Modulation	UL RB allocation (Note 1)
1	PCC	Default	Default	-	CP-OFDM QPSK	Outer_Full
	SCC1				CP-OFDM QPSK	Outer_Full
	SCC2				CP-OFDM QPSK	Outer_Full
	SCC3				CP-OFDM QPSK	Outer_Full
	SCC4				CP-OFDM QPSK	Outer_Full
	SCC5				CP-OFDM QPSK	Outer_Full
	SCC6				CP-OFDM QPSK	Outer_Full
	SCC7				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*".						

6.5A.1.7.5 Test requirement

The measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth defined in subclause 5.5A.

6.5A.2 Out of band emission for CA

6.5A.2.1 Spectrum Emission Mask for CA

6.5A.2.1.0 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5A.2.1.

6.5A.2.1.0.0 General

The requirements specified in this clause shall apply if the UE has at least one of UL or DL configured for CA or if the UE is configured for single CC operation with different channel bandwidths in UL and DL carriers. In case the CA configuration consists of a single UL CC, spectrum emission mask defined in subclause 6.5.2.1 applies. Spectral emission mask requirements do not apply at any frequency where IBE requirements of clause 6.4A.2.3 apply.

The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction).

6.5A.2.1.0.1 Spectrum emission mask for intra-band contiguous UL CA

For intra-band contiguous UL carrier aggregation, the spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the UL aggregated channel bandwidth (Table 5.3A.4-1). For any bandwidth class defined in Table 5.3A.4-1, the UE emission shall not exceed the levels specified in Table 6.5A.2.1.0.1-1.

Table 6.5A.2.1.0.1-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
± 0-0.1*$BW_{Channel\_CA}$	-5	1 MHz
± 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13	1 MHz
NOTE 1: (void)		

6.5A.2.1.0.2 Spectrum emission mask for intra-band non-contiguous UL CA

TBD

6.5A.2.1.1 Spectrum Emission Mask for CA (2UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.
- Test for DL intra-band non-contiguous configurations with UL intra-band contiguous configuration is FFS.

6.5A.2.1.1.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.2.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.1.4 Test description

6.5A.2.1.1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA combination and subcarrier spacing, are shown in Table 6.5A.2.1.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.2.1.1.4.1-1: Test Configuration Table

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes.			For intra-band contiguous CA: Mid range. For intra-band non-contiguous CA: FFS.			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE.			Highest aggregated BW of the CA configuration			
Test SCS as specified in Table 5.3.5-1.			Lowest, Highest			
Test Parameters						
Test ID	**CC**	**ChBw(MHz)**	**Test frequency**	**DL RB allocation**	**UL Modulation**	**UL RB allocation (Note 1)**
1	PCC	Default	Default	-	DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
	SCCs				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
2	PCC				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
	SCCs				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
3	PCC				DFT-s-OFDM PI/2 BPSK	Outer_Full
	SCCs				DFT-s-OFDM PI/2 BPSK	Outer_Full
4	PCC				DFT-s-OFDM QPSK	Outer_1RB_Left
	SCCs				DFT-s-OFDM QPSK	Outer_1RB_Left
5	PCC				DFT-s-OFDM QPSK	Outer_1RB_Right
	SCCs				DFT-s-OFDM QPSK	Outer_1RB_Right
6	PCC				DFT-s-OFDM QPSK	Outer_Full
	SCCs				DFT-s-OFDM QPSK	Outer_Full
7	PCC				DFT-s-OFDM 16QAM	Outer_1RB_Left
	SCCs				DFT-s-OFDM 16QAM	Outer_1RB_Left
8	PCC				DFT-s-OFDM 16QAM	Outer_1RB_Right
	SCCs				DFT-s-OFDM 16QAM	Outer_1RB_Right
9	PCC				DFT-s-OFDM 16QAM	Outer_Full
	SCCs				DFT-s-OFDM 16QAM	Outer_Full
10	PCC				DFT-s-OFDM 64QAM	Outer_1RB_Left
	SCCs				DFT-s-OFDM 64QAM	Outer_1RB_Left
11	PCC				DFT-s-OFDM 64QAM	Outer_1RB_Right
	SCCs				DFT-s-OFDM 64QAM	Outer_1RB_Right
12	PCC				DFT-s-OFDM 64QAM	Outer_Full
	SCCs				DFT-s-OFDM 64QAM	Outer_Full
13	PCC				CP-OFDM QPSK	Outer_1RB_Left
	SCCs				CP-OFDM QPSK	Outer_1RB_Left
14	PCC				CP-OFDM QPSK	Outer_1RB_Right

15	SCCs				CP-OFDM QPSK	Outer_1RB_Right
	PCC				CP-OFDM QPSK	Outer_Full
	SCCs				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.						

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5A.2.1.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.2.1.1.4.3

6.5A.2.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2, and C.3 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.2.1.1.4.3.
3. Apply the test step based on the 5G NR UE Release:

   3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition ‘NR FR2 2CA’. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

   3b. For Release 15 5G NR UEs: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.2.1.1.4.1-1 on both PCC and SCC(s). Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.
7. Apply the test step based on the 5G NR UE Release:

   7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.

   7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. Measure the TRP of the transmitted signal with a measurement filter of bandwidths according to Table 6.5A.2.1.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. TRP shall be recorded for each step. The measurement period shall capture the active time slots. Total radiated power is measured according to TRP measurement procedure defined in Annex K. The measurement grid used for TRP measurement defined in Annex M. TRP is calculated considering both polarizations, theta and phi.

9. Apply the test step based on the 5G NR UE Release:

   9a. For Release 16 and forward 5G NR UEs SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

   9b. For Release 15 5G NR UEs: No action.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.5A.2.1.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5A.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

6.5A.2.1.1.4.3-1: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.2.1.1.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.1.5-1.

Table 6.5A.2.1.1.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	**Any carrier aggregation bandwidth class**	**Measurement bandwidth**
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.1.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth.		

Table 6.5A.2.1.1.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	**FR2a**	**FR2b**
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.2 Spectrum Emission Mask for CA (3UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4

6.5A.2.1.2.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.2.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.2.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.2.5-1.

6.5A.2.1.2.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.2.5-1.

Table 6.5A.2.1.2.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.2.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.2.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.3 Spectrum Emission Mask for CA (4UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.1.3.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.2.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.3.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.3.5-1.

6.5A.2.1.3.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.3.5-1.

Table 6.5A.2.1.3.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.3.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.3.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.4 Spectrum Emission Mask for CA (5UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4

6.5A.2.1.4.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.2.1.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.4.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.4.5-1.

6.5A.2.1.4.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.4.5-1.

Table 6.5A.2.1.4.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.4.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.4.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.5 Spectrum Emission Mask for CA (6UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.1.5.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.2.1.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.5.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.5.5-1.

6.5A.2.1.5.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.5.5-1.

Table 6.5A.2.1.5.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.5.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.5.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.6 Spectrum Emission Mask for CA (7UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4

6.5A.2.1.6.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.2.1.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.6.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.6.5-1.

6.5A.2.1.6.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.6.5-1.

Table 6.5A.2.1.6.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.6.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.6.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.1.7 Spectrum Emission Mask for CA (8UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.1.7.1 Test purpose

To verify that the power of any UE emission shall not exceed specified levels for the specified channel bandwidth for CA.

6.5A.2.1.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.2.1.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.1.0.

6.5A.2.1.7.4 Test description

Same as in clause 6.5A.2.1.1.4 with following exceptions:

- Instead of Table 6.5A.2.1.1.5-1→ use Table 6.5A.2.1.7.5-1.

6.5A.2.1.7.5 Test Requirements

The measured TRP of any UE emission derived in step 7, shall fulfil requirements in Table.6.5A.2.1.7.5-1.

Table 6.5A.2.1.7.5-1: General NR spectrum emission mask for intra-band contiguous CA in frequency range 2

Δf_{OOB} (MHz)	Any carrier aggregation bandwidth class	Measurement bandwidth
$\pm$ 0-0.1*$BW_{Channel\_CA}$	-5 + TT	1 MHz
$\pm$ 0.1*$BW_{Channel\_CA}$ - 2*$BW_{Channel\_CA}$	-13 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.1.7.5-1a NOTE 2: If carrier leakage or I/Q image lands inside the spectrum occupied by the configured UL and DL CCs, exception to the general spectrum emission mask limit applies. For carrier leakage the requirements specified in section 6.4A.2.2.0 shall apply. For I/Q image the requirements specified in section 6.4A.2.3.0 shall apply. NOTE 3: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0.5MHz and -0.5MHz, respectively. NOTE 4: The measurements are to be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth		

Table 6.5A.2.1.7.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	3.21 dB	3.46 dB

6.5A.2.2 Adjacent channel leakage ratio for CA

6.5A.2.2.0 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5A.2.3.

6.5A.2.2.0.1 Adjacent channel leakage ratio for intra-band contiguous UL CA

In case the CA configuration consists of a single UL CC, the adjacent channel leakage ratio defined in subclause 6.5.2.3 applies. For intra-band contiguous UL carrier aggregation, the carrier aggregation NR adjacent channel leakage power ratio (CA NR_{ACLR}) is the ratio of the filtered mean power centred on the UL aggregated channel bandwidth to the filtered mean power centred on an adjacent UL aggregated channel bandwidth at spacing equal to the UL aggregated channel bandwidth. The assigned UL aggregated channel bandwidth power and adjacent UL aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.2.0.1-1. If the measured adjacent channel power is greater than -35 dBm then the CA NR_{ACLR} shall be higher than the value specified in Table 6.5A.2.2.0.1-1.

Table 6.5A.2.2.0.1-1: General requirements for contiguous UL CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 dB
CA NR_{ACLR} for band n260	16 dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA} - 2*BW_{GB}$
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2.	

6.5A.2.2.0.2 Adjacent channel leakage ratio for intra-band non-contiguous UL CA

TBD

6.5A.2.2.1 Adjacent channel leakage ratio for CA (2UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances and Test limit analysis for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
- Measurement Uncertainties and Test Tolerances and Test limit analysis are FFS for power class 1, 2 and 4.
- -For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.
- Test for DL intra-band non-contiguous configurations with UL intra-band contiguous configuration is FFS.

6.5A.2.2.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.2.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.1.4 Test description

6.5A.2.2.1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA combination and subcarrier spacing, are shown in Table 6.5A.2.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.2.2.1.4.1-1: Test Configuration Table

Default Conditions	
Test Environment as specified in TS 38.508-1 [10] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes.	For intra-band contiguous CA: Low and High range. For intra-band non-contiguous CA: FFS.
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE.	Highest aggregated BW of the CA configuration
Test SCS as specified in Table 5.3.5-1.	Lowest, Highest

Test Parameters						
Test ID	**CC**	**ChBw(MHz)**	**Test frequency**	**DL RB allocation**	**UL Modulation**	**UL RB allocation (Note 1)**
1	PCC	Default	Low	-	DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
	SCCs		Low		DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
2	PCC		High		DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
	SCCs		High		DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
3	PCC		Default		DFT-s-OFDM PI/2 BPSK	Outer_Full
	SCCs		Default		DFT-s-OFDM PI/2 BPSK	Outer_Full
4	PCC		Low		DFT-s-OFDM QPSK	Outer_1RB_Left
	SCCs		Low		DFT-s-OFDM QPSK	Outer_1RB_Left
5	PCC		High		DFT-s-OFDM QPSK	Outer_1RB_Right
	SCCs		High		DFT-s-OFDM QPSK	Outer_1RB_Right
6	PCC		Default		DFT-s-OFDM QPSK	Outer_Full
	SCCs		Default		DFT-s-OFDM QPSK	Outer_Full
7	PCC		Low		DFT-s-OFDM 16QAM	Outer_1RB_Left
	SCCs		Low		DFT-s-OFDM 16QAM	Outer_1RB_Left
8	PCC		High		DFT-s-OFDM 16QAM	Outer_1RB_Right
	SCCs		High		DFT-s-OFDM 16QAM	Outer_1RB_Right
9	PCC		Default		DFT-s-OFDM 16QAM	Outer_Full
	SCCs		Default		DFT-s-OFDM 16QAM	Outer_Full
10	PCC		Default		DFT-s-OFDM 64QAM	Outer_Full
	SCCs		Default		DFT-s-OFDM 64QAM	Outer_Full
11	PCC		Low		CP-OFDM QPSK	Outer_1RB_Left
	SCCs		Low		CP-OFDM QPSK	Outer_1RB_Left
12	PCC		High		CP-OFDM QPSK	Outer_1RB_Right
	SCCs		High		CP-OFDM QPSK	Outer_1RB_Right
13	PCC		Default		CP-OFDM QPSK	Outer_Full
	SCCs		Default		CP-OFDM QPSK	Outer_Full

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.

NOTE 2: Following Test IDs shall be skipped for FR2b
- All Test IDs for 100 MHz < $BW_{Channel\_CA}$ ≤ 400 MHz
- Test ID 1-2, 4-5, 7-12 for 50 MHz < $BW_{Channel\_CA}$ ≤ 100 MHz

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5A.2.2.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.2.2.1.4.3

6.5A.2.2.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2, and C.3 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.2.2.1.4.3.
3. Apply the test step based on the 5G NR UE Release:

   3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition ‘NR FR2 2CA’. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

   3b. For Release 15 5G NR UEs: No action.
4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.2.2.1.4.1-1 on both PCC and SCC(s). Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.
7. Apply the test step based on the 5G NR UE Release:

   7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 2) for the UE Tx beam selection to complete.

   7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.
8. Measure EIRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5A.2.2.1.5-1. EIRP measurement procedure defined in Annex K. EIRP is calculated considering both polarizations, theta and phi.
9. Measure EIRP of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively using a rectangular measurement filter with bandwidths according to Table 6.5A.2.2.1.5-1. EIRP measurement procedure defined in Annex K. EIRP is calculated considering both polarizations, theta and phi.
10. Calculate the ratios of the power between the values measured in step 7 over step 8 for lower and upper NR_{ACLR}, respectively.
11. Apply the test step based on the 5G NR UE Release:

11a. For Release 16 and forward 5G NR UEs: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

11b. For Release 15 5G NR UEs: No action.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.5A.2.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5A.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.5A.2.2.1.4.3-1: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.2.2.1.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR_{ACLR}, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.1.5-1.

Table 6.5A.2.2.1.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 - TT- R dB
CA NR_{ACLR} for band n260	16 - TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA} - 2*BW_{GB}$
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.1.5-1a NOTE 3: R for each frequency, channel bandwidth and test point is specified in Table 6.5A.2.2.1.5-1b		

Table 6.5A.2.2.1.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	**Any CA bandwidth class**	**23.45GHz ≤ f ≤ 30.3GHz**	**30.3GHz < f ≤ 40.8GHz**
IFF (Max device size ≤ 30 cm)	$BW_{Channel\_CA}$ ≤ 100 MHz	4.96 dB	4.96 dB
	100 MHz < $BW_{Channel\_CA}$ ≤ 200 MHz	4.96 dB	4.96 dB
	200 MHz < $BW_{Channel\_CA}$ ≤ 400 MHz	4.96 dB	4.96 dB

Table 6.5A.2.2.1.5-1b: Relaxation due to testability limit (Aggregated BW ≤ 400MHz)

		Channel bandwidth / NR_{ACLR} / Measurement bandwidth		
	Test ID	$BW_{Channel\_CA}$ ≤ 100 MHz	100 MHz < $BW_{Channel\_CA}$ ≤ 200 MHz	200 MHz < $BW_{Channel\_CA}$ ≤ 400 MHz
NR_{ACLR} for band n257, n258, n261	1	0	3	6
	2	0	3	6
	3	0	0	3
	4	0	3	6
	5	0	3	6
	6	0	0	3
	7	0	3	6
	8	0	3	6
	9	0	2.5	5.5
	10	2	5	8
	11	0	3	6
	12	0	3	6
	13	0	0	3
NOTE 1: Relaxation value is 0 for FR2b.				

6.5A.2.2.2 Adjacent channel leakage ratio for CA (3UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.2.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.2.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.2.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.2.5-1.

6.5A.2.2.2.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.2.5-1.

Table 6.5A.2.2.2.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 - TT - R dB
CA NR_{ACLR} for band n260	16 - TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA} - 2*BW_{GB}$
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.2.5-1a NOTE 3: R for each frequency, channel bandwidth and test point is specified in Table 6.5A.2.2.1.5-1b	

Table 6.5A.2.2.2.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	Any CA bandwidth class	23.45GHz ≤ f ≤ 30.3GHz	30.3GHz < f ≤ 40.8GHz
IFF (Max device size ≤ 30 cm)	$BW_{Channel\_CA}$ ≤ 100 MHz	4.96 dB	4.96 dB
	100 MHz < $BW_{Channel\_CA}$ ≤ 200 MHz	4.96 dB	4.96 dB
	200 MHz < $BW_{Channel\_CA}$ ≤ 400 MHz	4.96 dB	4.96 dB

6.5A.2.2.3 Adjacent channel leakage ratio for CA (4UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.2.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.2.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.3.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.3.5-1.

6.5A.2.2.3.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.3.5-1.

Table 6.5A.2.2.3.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 - TT - R dB
CA NR_{ACLR} for band n260	16 - TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA} - 2*BW_{GB}$
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.3.5-1a NOTE 3: R for each frequency, channel bandwidth and test point is specified in Table 6.5A.2.2.1.5-1b	

Table 6.5A.2.2.3.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	Any CA bandwidth class	23.45GHz ≤ f ≤ 30.3GHz	30.3GHz < f ≤ 40.8GHz
IFF (Max device size ≤ 30 cm)	$BW_{Channel\_CA}$ ≤ 100 MHz	4.96 dB	4.96 dB
	100 MHz < $BW_{Channel\_CA}$ ≤ 200 MHz	4.96 dB	4.96 dB
	200 MHz < $BW_{Channel\_CA}$ ≤ 400 MHz	4.96 dB	4.96 dB

6.5A.2.2.4 Adjacent channel leakage ratio for CA (5UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.2.4.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.2.2.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.4.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.4.5-1.

6.5A.2.2.4.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.4.5-1.

Table 6.5A.2.2.4.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 – TT dB
CA NR_{ACLR} for band n260	16 – TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA}$ – 2*BW_{GB}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.4.5-1a	

Table 6.5A.2.2.4.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	[4.6] dB	[5.0] dB

6.5A.2.2.5 Adjacent channel leakage ratio for CA (6UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4

6.5A.2.2.5.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.2.2.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.5.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.5.5-1.

6.5A.2.2.5.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.5.5-1.

Table 6.5A.2.2.5.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 – TT dB
CA NR_{ACLR} for band n260	16 – TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA}$ – 2*BW_{GB}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.5.5-1a	

Table 6.5A.2.2.5.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	[4.6] dB	[5.0] dB

6.5A.2.2.6 Adjacent channel leakage ratio for CA (7UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4
- This test case is incomplete until a suitable solution for preventing SCell drop is implemented in the test procedure.

6.5A.2.2.6.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.2.2.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.6.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.6.5-1.

6.5A.2.2.6.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.6.5-1.

Table 6.5A.2.2.6.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 – TT dB
CA NR_{ACLR} for band n260	16 – TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA}$ – 2*BW_{GB}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.6.5-1a	

Table 6.5A.2.2.6.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	[4.6] dB	[5.0] dB

6.5A.2.2.7 Adjacent channel leakage ratio for CA (8UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4

6.5A.2.2.7.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR) for CA.

6.5A.2.2.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.2.2.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.2.2.0.

6.5A.2.2.7.4 Test description

Same as in clause 6.5A.2.2.1.4 with following exceptions:

- Instead of Table 6.5A.2.2.1.5-1→ use Table 6.5A.2.2.7.5-1.

6.5A.2.2.7.5 Test Requirements

If the measured adjacent channel power, derived in step 8, is greater than -35 dBm then the measured NR ACLR, derived in step 9, shall be higher than the limits in Table 6.5A.2.2.7.5-1.

Table 6.5A.2.2.7.5-1: General requirements for CA NR_{ACLR}

	CA bandwidth class / CA NR_{ACLR} / Measurement bandwidth
	Any CA bandwidth class
CA NR_{ACLR} for band n257, n258, n261	17 – TT dB
CA NR_{ACLR} for band n260	16 – TT dB
NR channel measurement bandwidth[1]	$BW_{Channel\_CA}$ – 2*BW_{GB}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
NOTE 1: BW_{GB} is defined in clause 5.3A.2. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5A.2.2.7.5-1a	

Table 6.5A.2.2.7.5-1a: Test Tolerance (Aggregated BW ≤ 400MHz)

Test Metric	FR2a	FR2b
IFF (Max device size ≤ 30 cm)	[4.6] dB	[5.0] dB

6.5A.3 Spurious emissions for CA

6.5A.3.1 General spurious emissions for CA

6.5A.3.1.0 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5A.3.

6.5A.3.1.0.0 General

This clause specifies the spurious emission requirements for carrier aggregation. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid). The TX beam peak direction used for CA testing is the [same as that found for single carrier scenario in clause 6.5.3].

In case the CA configuration consists of a single UL CC, spurious emissions requirements defined in subclause 6.5.3 apply. Spurious emissions requirements do not apply at any frequency where IBE requirements of clause 6.4A.2.3 apply.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.5A.3.1.0.1 Spurious emissions for intra-band contiguous UL CA

For intra-band contiguous UL carrier aggregation, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) from the edge of the UL aggregated channel bandwidth, where F_{OOB} is defined as the twice the UL aggregated channel bandwidth. For frequencies Δf_{OOB} greater than F_{OOB}, the spurious emission requirements in Table 6.5.3.1.3-2 are applicable.

6.5A.3.1.0.2 Spurious emissions for intra-band non-contiguous UL CA

TBD

6.5A.3.1.1 General spurious emissions for CA (2UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.
- For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

6.5A.3.1.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.3.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.1.4 Test description

6.5A.3.1.1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5A.3.1.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.3.1.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes		Low range, High range (NOTE 2)		
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.		Highest aggregated BW of the CA configuration		
Test SCS as specified in Table 5.3.5-1		120kHz		
Test Parameters				
Test ID	**CC**	**Downlink Configuration**	**UL Modulation**	**UL RB allocation (NOTE 1)**
1	PCC	-	DFT-s-OFDM QPSK	Outer_Full
	SCCs		DFT-s-OFDM QPSK	Outer_Full
2	PCC		DFT-s-OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)
	SCCs		DFT-s-OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.
NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} - \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$).
NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC2, PC3 and PC4 or Inner_Partial_Left_Region1 for PC1 and when testing High range configure uplink RB to Inner_1RB_Right for PC2, PC3 and PC4 or Inner_Partial_Right_Region1 for PC1.
NOTE 4: The number of DL CCs shall be configured the same as the number of UL CCs. The requirements are appliable as per 5.3A.4 "The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier".

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5A.3.1.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.3.1.1.4.3

6.5A.3.1.1.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.
2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.
3. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

4. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.3.1.1.4.3.

5. Apply the test step based on the 5G NR UE Release:

   5a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition 'NR FR2 2CA'. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 6.

   5b. For Release 15 5G NR UEs: No action.

6. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

7. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.3.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

8. Set the UE in the Inband Tx beam peak direction [(same as that found for single carrier in clause 6.5.3)] found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

9. Apply the test step based on the 5G NR UE Release:

   9a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

9b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.10. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

11. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4):

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex L, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5A.3.1.1.5-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5A.3.1.1.5-1 may be applied as long as the SNR (ratio of test limit to floor noise of test equipment) ≥ 10dB is guaranteed. The measurement period shall capture the [active time slots]. For each spurious emission frequency with coarse TRP identified to be less than an offset dB (NOTE 2) from the TRP limit according to Table 6.5A.3.1.1.5-1, continue with fine TRP procedures according to step (b).

   The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

   (b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5A.3.1.1.5-1.

12. Apply the test step based on the 5G NR UE Release:

   12a. For Release 16 and forward 5G NR UEs SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

   12b. For Release 15 5G NR UEs: No action.

13. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5A.3.1.1.5-1 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: The coarse TRP measurement grid and corresponding offset dB value referred in step 10(a) above, for some valid grids can be found in TR 38.903 section B.18.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

6.5A.3.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config with the following exceptions for Release 15 5G NR UE.

Table 6.5A.3.1.1.4.3-1: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.3.1.1.5 Test Requirements

This clause specifies the requirements for the specified *NR* band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5A.3.1.1.5-1.

The maximum TRP power of spurious emission, measured using RMS detector, shall not exceed the described value in Table 6.5A.3.1.1.5-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.5.3.1.3-1 starting from the edge of the assigned *NR* channel bandwidth. The spurious emission limits in Table 6.5A.3.1.1.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5A.3.1.1.5-1: Spurious emissions for CA test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
6 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band in GHz	-13 dBm	1 MHz	
NOTE 1: Applies for Band n257, n258, n260			

6.5A.3.1.2 General spurious emissions for CA (3UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.3.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.2.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.2.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5.

6.5A.3.1.3 General spurious emissions for CA (4UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.3.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.3.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.3.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5.

6.5A.3.1.4 General spurious emissions for CA (5UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.4.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.3.1.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.4.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.4.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5

6.5A.3.1.5 General spurious emissions for CA (6UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.5.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.3.1.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.5.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.5.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5

6.5A.3.1.6 General spurious emissions for CA (7UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.6.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.3.1.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.6.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.6.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5

6.5A.3.1.7 General spurious emissions for CA (8UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.1.7.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5A.3.1.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.3.1.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.1.0.

6.5A.3.1.7.4 Test description

Same test description as in clause 6.5A.3.1.1.4.

6.5A.3.1.7.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.1.1.5

6.5A.3.2 Spurious emission band UE co-existence for UL CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid). The TX beam peak direction used for CA testing is the [same as that found for single carrier scenario in clause 6.5.3].

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.5A.3.2.0 Minimum conformance requirements

For intra-band contiguous carrier aggregation, the requirements in Table 6.5A.3.2.0-1 apply.

Table 6.5A.3.2.0-1: Spurious emissions UE co-existence CA limits

CA band	Spurious emission						
	Protected band / frequency range	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n257	NR Band n260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	23600	-	24000	1	200	2
	Frequency range	57000	-	66000	2	100	
CA_n258							
	Frequency range	57000	-	66000	2	100	
CA n259	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	

	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	36000	-	37000	7	1000	
	Frequency range	57000	-	66000	2	100	
CA_n260	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	57000	-	66000	2	100	
CA_n261	NR Band 260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	57000	-	66000	2	100	
NOTE 1: F_{DL_low} and F_{DL_high} refer to each NR frequency band specified in Table 5.2-1 NOTE 2: The protection of frequency range 23600-24000MHz is meant for protection of satellite passive services.							

6.5A.3.2.1 Spurious emission band UE co-existence for CA (2UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.
- For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

6.5A.3.2.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.3.2.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.2.0.

6.5A.3.2.1.4 Test description

6.5A.3.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5A.3.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.3.2.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes	Low range, High range (NOTE 2)			
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.	Maximum aggregated BW (contiguous CA)			
Test SCS as specified in Table 5.3.5-1	120kHz			
Test Parameters				
Test ID	**CC**	**Downlink Configuration**	**UL Modulation**	**UL RB allocation (NOTE 1)**
1	PCC	-	DFT-s-OFDM QPSK	Outer_Full
	SCCs		DFT-s-OFDM QPSK	Outer_Full
2	PCC		DFT-s-OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1 (NOTE 3)
	SCCs		DFT-s-OFDM QPSK	Inner_1RB for PC2, PC3 and PC4 Inner_Partial for PC1

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.

NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} - \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$).

NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC2, PC3 and PC4 or Inner_Partial_Left_Region1 for PC1 and when testing High range configure uplink RB to Inner_1RB_Right for PC2, PC3 and PC4 or Inner_Partial_Right_Region1 for PC1.

NOTE 4: For a FR2 band under test, if the protected band frequency range in Table 6.5A.3.2.0-1 is only on lower or only higher frequency region with respect to the FR2 band under test then it is sufficient to test only Low range or High range frequencies, otherwise test at both Low range and High range.

NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4**:** "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*.

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5A.3.2.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.3.2.1.4.3.

6.5A.3.2.1.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.
2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

4. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.3.2.1.4.3.

5. Apply the test step based on the 5G NR UE Release:

   5a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition 'NR FR2 2CA'. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 6.

   5b. For Release 15 5G NR UEs: No action.

6. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

7. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.3.2.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

8. Set the UE in the Inband Tx beam peak direction [(same as that found for single carrier in clause 6.5.3)] found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

9. Apply the test step based on the 5G NR UE Release:

   9a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

   9b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

10. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

11. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4):

    (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex L, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5A.3.2.1.5-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5A.3.2.1.5-1 may be applied as long as the SNR (ratio of test limit to floor noise of test equipment) ≥ 10dB is guaranteed. The measurement period shall capture the [active time slots]. For each spurious emission frequency with coarse TRP identified to be less than an offset dB (NOTE 2) from the TRP limit according to Table 6.5A.3.2.1.5-1, continue with fine TRP procedures according to step (b).

    The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

    (b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5A.3.2.1.5-1.

12. Apply the test step based on the 5G NR UE Release:

12a. For Release 16 and forward 5G NR UEs: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

12b. For Release 15 5G NR UEs: No action.

13. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5A.3.2.1.5-1 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: The coarse TRP measurement grid and corresponding offset dB value referred in step 10(a) above, for some valid grids can be found in TR 38.903 section B.18.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

6.5A.3.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.1 with the following exceptions for Release 15 5G NR UE.

Table 6.5A.3.2.1.4.3-1: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.3.2.1.5 Test requirement

This clause specifies the requirements for the specified *NR* band for Transmitter Spurious emissions for UE co-existence requirement with frequency range as indicated in Table 6.5A.3.2.1.5-1.

The maximum TRP power of spurious emission for UE co-existence, measured using RMS detector, shall not exceed the described value in Table 6.5A.3.2.1.5-1.

The spurious emission UE co-existence limits in Table 6.5A.3.2.1.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5A.3.2.1.5-1: Spurious emissions UE co-existence CA test requirements

UL CA for any CA bandwidth class	Spurious emission						
	Protected band / frequency range	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n257	NR Band n260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	23600	-	24000	1	200	2
	Frequency range	57000	-	66000	2	100	
CA_n258							
	Frequency range	57000	-	66000	2	100	
CA_n259	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	36000	-	37000	7	1000	
	Frequency range	57000	-	66000	2	100	
CA_n260	NR Band 257	F_{DL_low}	-	F_{DL_high}	-5	100	
	NR Band 261	F_{DL_low}	-	F_{DL_high}	-5	100	
	Frequency range	57000	-	66000	2	100	
CA_n261	NR Band 260	F_{DL_low}	-	F_{DL_high}	-2	100	
	Frequency range	57000	-	66000	2	100	
NOTE 1: F_{DL_low} and F_{DL_high} refer to each NR frequency band specified in Table 5.2-1 NOTE 2: The protection of frequency range 23600-2400MHz is meant for protection of satellite passive services.							

6.5A.3.2.2 Spurious emission band UE co-existence for CA (3UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.3.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.2.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.2.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.2.3 Spurious emission band UE co-existence for CA (4UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.3.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.3.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.3.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.2.4 Spurious emission band UE co-existence for CA (5UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.4.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.3.2.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.4.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.4.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.2.5 Spurious emission band UE co-existence for CA (6UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.5.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.3.2.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.5.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.5.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.2.6 Spurious emission band UE co-existence for CA (7UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.6.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.3.2.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.6.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.6.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.2.7 Spurious emission band UE co-existence for CA (8UL CA)

Editor's note: The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.2.7.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5A.3.2.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.3.2.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.5A.3.2.0.

6.5A.3.2.7.4 Test description

Same test description as in clause 6.5A.3.2.1.4.

6.5A.3.2.7.5 Test Requirements

The test requirement is the same as in clause 6.5A.3.2.1.5.

6.5A.3.3 Additional spurious emissions for CA

6.5A.3.3.0 Minimum conformance requirements

The additional spurious emission for CA limits in Table 6.5A.3.3.0-2 and Table 6.5A.3.3.0-3 apply for all transmitter band configurations (RB) and channel bandwidths. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5A.3.3.0-1: Void

When " CA_NS_202" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5A.3.3.0-2.

Table 6.5A.3.3.0-2: Additional spurious emissions for (CA_NS_202) test limits

Frequency Range	Maximum Level	Measurement bandwidth
7.25 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band	-10 dBm	100 MHz
23.6 GHz ≤ f ≤ 24.0 GHz	+1 dBm	200 MHz

When "CA_NS_203" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5A.3.3.0-3. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5A.3.2.0-1 from the edge of the channel bandwidth.

Table 6.5A.3.3.0-3: Additional spurious emissions (CA_NS_203) test limits

Frequency band (GHz)	Spectrum emission limit (dBm)	Measurement bandwidth
23.6 ≤ f ≤ 24.0	+1	200 MHz

The normative reference for this requirement is TS 38.101-2 subclause 6.5A.3.2.

6.5A.3.3.1 Additional spurious emissions for CA (2UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.
- For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

6.5A.3.3.1.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.5A.3.3.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.1.4 Test description

6.5A.3.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.5A.3.3.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5A.3.3.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes		Low range, High range (NOTE 2)	
Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE.		Highest	
Test SCS as specified in Table 5.3.5-1		120kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	-	**Modulation**	**RB allocation (NOTE 1)**
1		FFS	FFS
2		FFS	FFS
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: When testing Low range test only in Frequency Range lower than ($F_{UL\_low} - \Delta f_{OOB}$) and when testing High range test only in Frequency Range higher than ($F_{UL\_high} + \Delta f_{OOB}$). NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4**:** "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure [TBD] for TE diagram and Figure [TBD] for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5A.3.3.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5A.3.3.1.4.3.

6.5A.3.3.1.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.
2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.
3. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
4. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.5A.3.3.1.4.3.

5. Apply the test step based on the 5G NR UE Release:

   5a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell power by activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using condition 'NR FR2 2CA'. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 6.

   5b. For Release 15 5G NR UEs: No action.

6. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

7. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5A.3.3.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

8. Set the UE in the Inband Tx beam peak direction [(same as that found for single carrier in clause 6.5.3)] found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

9. Apply the test step based on the 5G NR UE Release:

   9a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.

   9b For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

10. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

11. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4):

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex L, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 6.5A.3.3.1.5-2. Optionally, a larger and non-constant measurement bandwidth than that of Table 6.5A.3.3.1.5-2 may be applied as long as the SNR (ratio of test limit to floor noise of test equipment) ≥ 10dB is guaranteed. The measurement period shall capture the [active time slots]. For each spurious emission frequency with coarse TRP identified to be less than an offset dB (NOTE 2) from the TRP limit according to Table 6.5A.3.3.1.5-2, continue with fine TRP procedures according to step (b).

   The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

   (b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 6.5A.3.3.1.5-2.

12. Apply the test step based on the 5G NR UE Release:

   12a. For Release 16 and forward 5G NR UEs: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

   12b. For Release 15 5G NR UEs: No action.

13. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5A.3.3.1.5-2 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: The coarse TRP measurement grid and corresponding offset dB value referred in step 10(a) above, for some valid grids can be found in TR 38.903 section B.18.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

6.5A.3.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.1 with the following exceptions for Release 15 5G NR UE.

Table 6.5A.3.3.1.4.3-1: PUSCH-PowerControl

Derivation Path: TS 38.508-1 [10], Table 4.6.3-120			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-PowerControl ::= SEQUENCE {			
tpc-Accumulation	disabled		
p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE {	1 entry		
P0-PUSCH-AlphaSet[1] SEQUENCE {			
alpha	alpha0		
}			
}			
}			

6.5A.3.3.1.5 Test requirement

This clause specifies the requirements for the specified *NR* band for Transmitter Spurious emissions for UE co-existence requirement with frequency range as indicated in Table 6.5A.3.3.1.5-2.

The maximum TRP power of spurious emission for UE co-existence, measured using RMS detector, shall not exceed the described value in Table 6.5A.3.3.1.5-2.

The additional spurious emission for CA limits in Table 6.5A.3.3.1.5-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.5A.3.3.1.5-1: Void

Table 6.5A.3.3.1.5-2: Additional spurious emissions for CA (CA_NS_202) test requirements

Frequency Range	Maximum Level	Measurement bandwidth
7.25 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band	-10 dBm	100 MHz
23.6 GHz ≤ f ≤ 24.0 GHz	+1 dBm	200 MHz
23.6 GHz ≤ f ≤ 24.0 GHz	+1 dBm	200 MHz

Table 6.5A.3.3.1.5-3: Additional spurious emissions for CA (CA_NS_203) test limits

Frequency band (GHz)	Spectrum emission limit (dBm)	Measurement bandwidth
23.6 ≤ f ≤ 24.0	+1	200 MHz

6.5A.3.3.2 Additional spurious emissions for CA (3UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.2.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.5A.3.3.2.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.2.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.2.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5

6.5A.3.3.3 Additional spurious emissions for CA (4UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.3.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.5A.3.3.3.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.3.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.3.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5.

6.5A.3.3.4 Additional spurious emissions for CA (5UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.4.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.5A.3.3.4.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.4.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.4.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5.

6.5A.3.3.5 Additional spurious emissions for CA (6UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.5.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.5A.3.3.5.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.5.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.5.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5.

6.5A.3.3.6 Additional spurious emissions for CA (7UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.6.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.5A.3.3.6.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.6.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.6.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5.

6.5A.3.3.7 Additional spurious emissions for CA (8UL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.
- TP analysis for CA is FFS (identify lowest MPR w/form, RB allocation for multiple carrier or PCC only, 1RB location if RB allocated for multiple carrier).
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5A.3.3.7.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5A.3.3.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.5A.3.3.7.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5A.3.3.0.

6.5A.3.3.7.4 Test description

Same test description as in clause 6.5A.3.3.1.4.

6.5A.3.3.7.5 Test requirement

The test requirement is the same as in clause 6.5A.3.3.1.5

6.5D Output RF spectrum emissions for UL MIMO

6.5D.1 Occupied bandwidth for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- Measurement Uncertainty is FFS

6.5D.1.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE supporting UL MIMO are less than their specific limits when UE is configured using UL MIMO transmission.

6.5D.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supporting UL MIMO.

6.5D.1.3 Minimum conformance requirements

For UE configured with UL MIMO, the minimum conformance requirements are defined in clause 6.5.1.3. The requirements shall be met with the UL MIMO configurations specified in Table 6.5D.1.3-1.

Table 6.5D.1.3-1: UL MIMO configuration

Transmission scheme	DCI format	TPMI Index
Codebook based uplink	DCI format 0_1	0

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.1.

6.5D.1.4 Test description

6.5D.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and subcarrier spacing, are shown in Table 6.5D.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5D.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] clause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] clause 4.3.1		All	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	-	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.			

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and clause A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.5D.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.5D.1.4.3

6.5D.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5D.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [10] subclause 4.3.6.1.1.2
2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.
3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.
4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.
5. Measure the EIRP spectrum distribution within two times or more frequency range over the requirement for Occupied Bandwidth specification centring on the current carrier frequency. The characteristics of the filter shall be approximately Gaussian (typical spectrum analyser filter). The measuring duration is one active uplink subframe. EIRP is captured from both polarizations, theta and phi.
6. Calculate the total EIRP from both polarizations, theta and phi, within the range of all frequencies measured in step 5 and save this value as "Total EIRP". EIRP measurement procedure is defined in Annex K.
7. Identify the measurement window whose centre is aligned on the centre of the channel for which the sum of the power measured in theta and phi polarization is 99% of the “Total EIRP”.
8. The “Occupied Bandwidth” is the width of the measurement window obtained in step 7.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

6.5D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.1.5 Test requirement

The measured Occupied Bandwidth shall not exceed values in Table 6.5D.1.5-1.

Table 6D.5.1.5-1: Occupied channel bandwidth

	Occupied channel bandwidth / Channel bandwidth			
	50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
Channel bandwidth (MHz)	50	100	200	400

6.5D.2 Out of band emission for UL MIMO

6.5D.2.1 Spectrum Emission Mask for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- TRP Measurement Uncertainty is FFS.

6.5D.2.1.1 Test purpose

To verify that the power of any UE emission shall not exceed specified lever for the specified channel bandwidth.

6.5D.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.5D.2.1.3 Minimum conformance requirements

For UE(s) supporting UL MIMO, the Spectrum Emission Mask requirements in clause 6.5.2.1.3 apply. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.0-1.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.2.

6.5D.2.1.4 Test description

6.5D.2.1.4.1 Initial condition

Same initial condition in clause 6.5.2.1.4.1 with following exceptions:

- Instead of Table 6.5.2.1.4.1-1→ use Table 6.5D.2.1.4.1-1.
- Instead of Table 6.5.2.1.4.1-2 → use Table 6.5D.2.1.4.1-2

Table 6.5D.2.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [10] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	-	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_Full
2		CP-OFDM 16 QAM	Outer_Full
3		CP-OFDM 64 QAM	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: All test points in this table must also exist in Table 6.2D.2.4.1-1, Table 6.2D.2.4.1-2, Table 6.2D.2.4.1-3 (MPR) for PC1 or Table 6.2D.2.4.1-4, Table 6.2D.2.4.1-5, Table 6.2D.2.4.1-6 (MPR) for PC2, PC3 and PC4.			

Table 6.5D.2.1.4.1-2: Void

6.5D.2.1.4.2 Test procedure

Same test procedure as in clause 6.5.2.1.4.2.

6.5D.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.2.1.5 Test requirements

The test requirement is the same as in clause 6.5.2.1.5.

6.5D.2.2 Adjacent channel leakage ratio for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- TRP Measurement Uncertainty is FFS.
- Testability for PC1, 2 and 4 is FFS.

6.5D.2.2.1 Test purpose

To verify that the power of any UE emission shall not exceed specified lever for the specified channel bandwidth.

6.5.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.5D.2.2.3 Minimum conformance requirements

For UE(s) supporting UL MIMO, the Adjacent channel leakage ratio requirements in clause 6.5.2.3.3 apply. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.0-1.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.2.

6.5D.2.2.4 Test description

6.5D.2.2.4.1 Initial condition

Same initial condition in clause 6.5.2.3.4.1 with following exceptions:

- Instead of Table 6.5.2.3.4.1-1→ use Table 6.5D.2.2.4.1-1.
- Instead of Table 6.5.2.3.4.1-2 → use Table 6.5D.2.2.4.1-2.

Table 6.5D.2.2.4.1-1: Test Configuration Table (Power Class 1)

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1					Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1					Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 5.3.5-1					Lowest, Highest	
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	-	**Modulation**	**RB allocation (NOTE 1)**
1	Low				CP-OFDM QPSK	8@0
2	High				CP-OFDM QPSK	8@N_{RB}-8
3	Mid				CP-OFDM QPSK	Outer_Full
4	Low				CP-OFDM 16 QAM	8@0
5	High				CP-OFDM 16 QAM	8@N_{RB}-8
6	Mid				CP-OFDM 16 QAM	Outer_Full
7	Low				CP-OFDM 64 QAM	8@0
8	High				CP-OFDM 64 QAM	8@N_{RB}-8
9	Mid				CP-OFDM 64 QAM	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Applicability of test IDs for for CHBWs and frequency ranges is FFS.NOTE 3: All test points in this table must also exist in Table 6.2.2.4.1-1, Table 6.2.2.4.1-2, Table 6.2.2.4.1-3 (MPR).						

Table 6.5D.2.2.4.1-2: Test Configuration Table (Power Class 2, 3 and 4)

Default Conditions						
Test Environment as specified in TS 38.508-1 [10] subclause 4.1					Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1					Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 5.3.5-1					Lowest, Highest	
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	-	**Modulation**	**RB allocation (NOTE 1)**
1	Low				CP-OFDM QPSK	Outer_1RB_Left
2	High				CP-OFDM QPSK	Outer_1RB_Right
3	Default				CP-OFDM QPSK	Outer Full
4	Low				CP-OFDM 16 QAM	Outer_1RB_Left
5	High				CP-OFDM 16 QAM	Outer_1RB_Right
6	Default				CP-OFDM 16 QAM	Outer Full
7	Low				CP-OFDM 64 QAM	Outer_1RB_Left
8	High				CP-OFDM 64 QAM	Outer_1RB_Right
9	Default				CP-OFDM 64 QAM	Outer Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. NOTE 2: Following Test IDs shall be skipped for FR2b - All Test IDs for 400MHz Channel Bandwidth - All Test IDs for 200MHz Channel Bandwidth - Test ID 7-9 for 100MHz Channel Bandwidth NOTE 3: All test points in this table must also exist in Table 6.2D.2.4.1-4, Table 6.2D.2.4.1-5, Table 6.2D.2.4.1-6 (MPR).						

6.5D.2.2.4.2 Test procedure

Same test procedure as in clause 6.5.2.3.4.2.

6.5D.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.2.2.5 Test requirements

The test requirement is the same as in clause 6.5.2.3.5 with the following exceptions:

- Instead of Table 6.5.2.3.5-1b→ use Table 6.5D.2.2.5-1 for Power class 1.
- Instead of Table 6.5.2.3.5-1b→ use Table 6.5D.2.2.5-2 for Power class 2.
- Instead of Table 6.5.2.3.5-1b→ use Table 6.5D.2.2.5-3 for Power class 3.
- Instead of Table 6.5.2.3.5-1b→ use Table 6.5D.2.2.5-4 for Power class 4.

Table 6.5D.2.2.5-1: Relaxation due to testability limit (Adjacent channel leakage ratio) for (Power Class 1)

FFS

Table 6.5D.2.2.5-2: Relaxation due to testability limit (Adjacent channel leakage ratio) for (Power Class 2)

FFS

Table 6.5D.2.2.5-3: Relaxation due to testability limit (Adjacent channel leakage ratio) for (Power Class 3)

		Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	Test ID	50 MHz	100 MHz	200 MHz	400 MHz
NR_{ACLR} for band n257, n258, n261	1	0	0	0	3
	2	0	0	0	3
	3	0	0	0	3
	4	0	0	0	5.5
	5	0	0	0	5.5
	6	0	0	0	5.5
	7	0	0.5	3.5	8
	8	0	0.5	3.5	8
	9	0	0.5	3.5	8
NOTE 1: Relaxation value is derived by Table 6.5.2.3.5-1c for FR2a.					

Table 6.5D.2.2.5-4: Relaxation due to testability limit (Adjacent channel leakage ratio) for (Power Class 4)

FFS

6.5D.3 Spurious emissions for UL MIMO

6.5D.3.1 Transmitter Spurious emissions for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- TRP Measurement Uncertainty is FFS.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5D.3.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5D.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.5D.3.1.3 Minimum conformance requirements

For UE configured with UL MIMO, the minimum conformance requirements are defined in clause 6.5.3.1.3. The requirements shall be met with the UL MIMO configurations specified in Table 6.5D.3.1.3-1.

Table 6.5D.3.1.3-1: UL MIMO configuration

Transmission scheme	DCI format	TPMI Index
Codebook based uplink	DCI format 0_1	0

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.3.

6.5D.3.1.4 Test description

6.5D.3.1.4.1 Initial condition

Same initial condition in clause 6.5.3.1.4.1 with following exceptions:

- Instead of DFT-s -OFDM → use CP-OFDM.

6.5D.3.1.4.2 Test procedure

Same test procedure as in clause 6.5.3.1.4.2 with the following added to step 3 for UL MIMO configuration:

3.1 The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in 38.508-1 [10] subclause 4.3.6.1.1.2.

6.5D.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.3.1.5 Test requirements

The test requirement is the same as in clause 6.5.3.1.5.

6.5D.3.2 Spurious emission band UE co-existence for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- TRP Measurement Uncertainty is FFS.
- Applicability of Beam peak of single UL is FFS.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5D.3.2.1 Test purpose

To verify that UL MIMO configured UE's transmitter does not cause unacceptable interference when in co-existence with protected bands in terms of transmitter spurious emissions.

6.5D.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.5D.3.2.3 Minimum conformance requirements

For UE configured with UL MIMO, the minimum conformance requirements are defined in clause 6.5.3.2.3. The requirements shall be met with the UL MIMO configurations specified in Table 6.5D.3.1.3-1.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.3.

6.5D.3.2.4 Test description

6.5D.3.2.4.1 Initial condition

Same initial condition in clause 6.5.3.2.4.1 with following exceptions:

- Instead of DFT-s -OFDM → use CP-OFDM.

6.5D.3.2.4.2 Test procedure

Same test procedure as in clause 6.5.3.2.4.2 with the following added to step 3 for UL MIMO configuration:

3.1 The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in 38.508-1 [10] subclause 4.3.6.1.1.2.

6.5D.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.3.2.5 Test requirements

The test requirement is the same as in clause 6.5.3.2.5.

6.5D.3.3 Additional spurious emissions for UL MIMO

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- OTA test procedure for UL MIMO is still under investigation
- TRP Measurement Uncertainty is FFS.
- Applicability of Beam peak of single UL is FFS.
- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.
- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

6.5D.3.3.1 Test purpose

Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

6.5D.3.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.5D.3.3.3 Minimum conformance requirements

For UE configured with UL MIMO, the minimum conformance requirements are defined in clause 6.5.3.3.3. The requirements shall be met with the UL MIMO configurations specified in Table 6.5D.3.1.3-1.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.5D.3.

6.5D.3.3.4 Test description

6.5D.3.3.4.1 Initial condition

Same initial condition in clause 6.5.3.3.4.1 with following exceptions:

- Instead of DFT-s -OFDM → use CP-OFDM.

6.5D.3.3.4.2 Test procedure

Same test procedure as in clause 6.5.3.3.4.2 with the following added to step 3 for UL MIMO configuration:

3.1 The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in 38.508-1 [10] subclause 4.3.6.1.1.2.

6.5D.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.3.3.5 Test requirements

The test requirement is the same as in clause 6.5.3.3.5.

6.6 Beam correspondence

6.6.0 General

Beam correspondence is the ability of the UE to select a suitable beam for UL transmission based on DL measurements with or without relying on UL beam sweeping. The beam correspondence requirement is satisfied assuming the presence of both SSB and CSI-RS signal and Type D QCL is maintained between SSB and CSI-RS.

Enhanced Beam correspondence is the ability of the UE to select a suitable beam for UL transmission based on DL measurements with or without relying on UL beam sweeping. The beam correspondence requirement is satisfied assuming the presence of either SSB and CSI-RS signal.

6.6.1 Beam correspondence - EIRP

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class1, 2 and 4.

- The test case is incomplete for band n259.

6.6.1.1 Test purpose

To verify the UE's ability to select a suitable beam for UL transmission based on DL measurements with or without relying on UL beam sweeping within the range prescribed by the specified nominal maximum output power and beam correspondence tolerance.

6.6.1.2 Test applicability

This test case applies to all types of NR UE release 15 that do not support beam correspondence without UL beam sweeping.

This test case applies to all types of NR UE release 16 and forward that do not support SSB-based or CSI-RS based enhanced beam correspondence and do not support enhanced beam correspondence without UL beam sweeping.

6.6.1.3 Minimum conformance requirements

6.6.1.3.1 (Void)

6.6.1.3.2 (Void)

6.6.1.3.3 Beam correspondence for PC3

6.6.1.3.3.1 General

The beam correspondence requirement for PC3 UEs consists of three components: UE minimum peak EIRP (as defined in clause 6.2.1.1.3.3), UE spherical coverage (as defined in clause 6.2.1.1.3.3), and beam correspondence tolerance (as defined in clause 6.6.1.3.3.2). The beam correspondence requirement is fulfilled if the UE satisfies one of the following conditions, depending on the UE's beam correspondence capability IE *beamCorrespondenceWithoutUL-BeamSweeping*, as defined in TS 38.306 [26]:

- If *beamCorrespondenceWithoutUL-BeamSweeping* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 with its autonomously chosen UL beams and without uplink beam sweeping. Such a UE is considered to have met the beam correspondence tolerance requirement.

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 with uplink beam sweeping. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.1.3.3.2 and shall support uplink beam management, as defined in TS 38.306 [26].

6.6.1.3.3.1.1 Side condition for SSB and CSI-RS

The beam correspondence requirements are only applied under the following conditions:

- The downlink reference signals including both SSB and CSI-RS are provided and Type D QCL shall be maintained between SSB and CSI-RS.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- The beam correspondence conditions for L1-RSRP measurements are fulfilled according to Table 6.6.1.3.3.1.1-1 and Table 6.6.1.3.3.1.1-2.

Table 6.6.1.3.3.1.1-1: Conditions for SSB based L1-RSRP measurements for beam correspondence

Angle of arrival	NR operating bands	Minimum SSB_RP Note 2	SSB Ês/Iot
		dBm / SCS_{SSB}	dB
		SCS_{SSB} = 120 kHz	
All angles Note 1	n257	-92.2	≥6
	n258	-96.2	
	n259	-90.7	
	n260	-91.9	
	n261	-96.2	
NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB_RP values for all angles are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1.			
NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise.			

Table 6.6.1.3.3.1.1-2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence

Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2	CSI-RS Ês/Iot
		dBm / SCS_{CSI-RS}	dB
		SCS_{CSI-RS} = 120 kHz	
All angles Note 1	n257	-96.2	≥6
	n258	-96.2	
	n259	-90.7	
	n260	-91.9	
	n261	-96.2	
NOTE 1: For UEs that support multiple FR2 bands, the Minimum CSI-RS_RP values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1. NOTE 2: Values specified at the radiated requirements reference point to give minimum CSI-RS Ês/Iot, with no applied noise.			

6.6.1.3.3.2 Beam correspondence tolerance for PC3

The beam correspondence tolerance requirement $\Delta EIRP_{BC}$ for power class 3 UEs is defined based on a percentile of the distribution of $\Delta EIRP_{BC}$, defined as $\Delta EIRP_{BC} = EIRP_2 - EIRP_1$ over the link angles spanning a subset of the spherical coverage grid points, such that

- $EIRP_1$ is the total EIRP in dBm calculated based on the beam the UE chooses autonomously (corresponding beam) to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping.
- $EIRP_2$ is the best total EIRP (beam yielding highest EIRP in a given direction) in dBm which is based on beam correspondence with relying on UL beam sweeping.
- The link angles are the ones corresponding to the top N^{th} percentile of the $EIRP_2$ measurement over the whole sphere, where the value of N is according to the test point of EIRP spherical coverage requirement for power class 3, i.e. N = 50.

For power class 3 UEs, the requirement is fulfilled if the UE's corresponding UL beams satisfy the maximum limit in Table 6.6.1.3.3.2-1.

Table 6.6.1.3.3.2-1: UE beam correspondence tolerance for power class 3

Operating band	Max $\Delta EIRP_{BC}$ at 85 %-tile $\Delta EIRP_{BC}$ CDF (dB)
n257	3.0
n258	3.0
n260	3.2
n261	3.0
NOTE: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1	

6.6.1.3.4 Normative reference

The normative reference for this requirement is TS 38.101-2 [3] clause 6.6.4.

6.6.1.4 Test description

6.6.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.6.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. The downlink reference measurement channels (RMCs) are specified in Annex A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.6.1.4.1-1: Test Configuration Table for PC3

Default Conditions					
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1			Low range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1			Lowest, Highest		
Test SCS as specified in Table 5.3.5-1			120 kHz		
Test Parameters					
Test ID	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	-	**Modulation**	**RB allocation (NOTE 1)**
1	50			DFT-s-OFDM QPSK	Inner_Full
2	100				
3	200				
4	400				
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.					

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 6.6.1.4.1-1.
5. Propagation conditions are set according to Annex B.0
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.6.1.4.3.

6.6.1.4.2 Test procedure

Test procedure without uplink beam sweeping:

1.1 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.6.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.6.1.4.3.

1.2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1 without uplink beam sweeping (i.e., not executing steps 5.1) to step 5.5) in Annex K.1.1). Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

1.3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec to ensure that the UE transmits at its maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

1.4. Measure UE $EIRP_1$ in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. Repeat $EIRP_1$ measurement for all directions in the sphere according to EIRP measurement procedure defined in Annex K.1.9 without beam sweeping for all the points in the grid. After a rotation, allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for UE to find the best beam to use.

The measuring duration is one active uplink subframe. $EIRP_1$ is calculated considering both polarizations, theta and phi.

1.5 Record all the measured $EIRP_1$values.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

Test procedure with uplink beam sweeping:

2.1 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.6.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.6.1.4.3.

2.3. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec to ensure that the UE transmits at its maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.4. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. Repeat EIRP measurements for all directions in the sphere according to EIRP measurement procedure defined in Annex K.1.9 with beam sweeping. After a rotation, allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for UE to find the best beam to use. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

2.5. Record all the measured $EIRP_2$ values.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

2.6. Calculate the $\Delta EIRP_{BC} = EIRP_2 - EIRP_1$.

2.7. Calculate a cumulative distribution function for the $\Delta EIRP_{BC}$ values.

NOTE 2: The $\Delta EIRP_{target\text{-}CDF}$ is then obtained from the Cumulative Distribution Function (CDF) computed using $\Delta EIRP_{BC}$ for each of all top N^{th} percentile of the $EIRP_2$ measurement points in the grid. When using constant step size measurement grids, a theta-dependent correction shall be applied, i.e., the PDF probability contribution for each measurement point is scaled by $\sin(\theta)$ or the normalized Clenshaw-Curtis weights $W(\theta)/W(90^o)$, introduced in Section M.4.2.1.

6.6.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with following exceptions:

Table 6.6.1.4.3-1: *SRS-Config: SpatialRelationInfo test requirement for with beam sweeping*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-182			
Information Element	**Value/remark**	**Comment**	**Condition**
spatialRelationInfo	Not present	The UE can consider the UL beam sweeping.	

Table 6.6.1.4.3-2: *SRS-Config: SpatialRelationInfo test requirement for without beam sweeping*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-182			
Information Element	**Value/remark**	**Comment**	**Condition**
spatialRelationInfo	SRS-SpatialRelationInfo	The UE consider autonomous beam selection	

Table 6.6.1.4.3-3: *SRS-Config: ssb-Index test requirement for without beam sweeping*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-182			
Information Element	**Value/remark**	**Comment**	**Condition**
ssb-Index	SSB-Index		

Table 6.6.1.4.3-4: *SRS-Config: SRS resources test requirement for with beam sweeping*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-182			
Information Element	**Value/remark**	**Comment**	**Condition**
srs-ResourceSetToReleaseList	Not present		
srs-ResourceSetToAddModList SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SEQUENCE {	2 entries	1 set with 8 SRS resources using 'beamManagement' plus 1 set with 1 semi-persistent SRS resource using 'codebook'	
SRS-ResourceSet[1] SEQUENCE{		For the 'beamManagement' resource set	
usage	beamManagement		
resourceType CHOICE {	aperiodic		
}			
SRS-ResourceSet[2] SEQUENCE{		For the semi-persistent SRS resource set	
usage	codebook		
resourceType CHOICE {	semi-persistent		
}			
srs-ResourceToReleaseList	Not present		
srs_ResourceToAddModList	9	The default beam correspondence SRS resource upper limit (M) = 8 in Rel-15 for the 'beamManagement' SRS Resource set plus 1 resource for the semi-persistent SRS 'codebook' resource set.	

Table 6.6.1.4.3-5: *CSI-RS-ResourceMapping: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-45			
Information Element	**Value/remark**	**Comment**	**Condition**
CSI-RS-ResourceMapping ::= SEQUENCE {			
frequencyDomainAllocation CHOICE {			
row1	0001	k0 = 0, row1, 1Tx test cases	
}			
nrofPorts	p1	1Tx test cases	
firstOFDMSymbolInTimeDomain	6 for resource #0		
	7 for resource #1		
	8 for resource #2		
	9 for resource #3		
	10 for resource #4		
	11 for resource #5		
	12 for resource #6		
	13 for resource #7		
cdm-Type	noCDM		
density CHOICE {			
three	NULL		
}			
freqBand	CSI-FrequencyOccupation		
}			

Table 6.6.1.4.3-6: *NZP-CSI-RS-Resource: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-85			
Information Element	**Value/remark**	**Comment**	**Condition**
NZP-CSI-RS-Resource ::= SEQUENCE {			
nzp-CSI-RS-ResourceId	NZP-CSI-RS-ResourceId		
resourceMapping	CSI-RS-ResourceMapping		
powerControlOffset	0		
powerControlOffsetSS	db0		
scramblingID	ScramblingId		
periodicityAndOffset	CSI-ResourcePeriodicityAndOffset		
qcl-InfoPeriodicCSI-RS	TCI-StateId		
}			

Table 6.6.1.4.3-7: *NZP-CSI-RS-ResourceSet: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-87			
Information Element	**Value/remark**	**Comment**	**Condition**
NZP-CSI-RS-ResourceSet ::= SEQUENCE {			
nzp-CSI-ResourceSetId	NZP-CSI-RS-ResourceSetId		
nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF {	[1 entry]		
NZP-CSI-RS-ResourceId[1]	NZP-CSI-RS-ResourceId		
}			
repetition	on		
aperiodicTriggeringOffset	0	Depending on UE capability	
trs-Info	Not present		
}			

Table 6.6.1.4.3-8: *NZP-CSI-RS-ResourceId: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-86			
Information Element	**Value/remark**	**Comment**	**Condition**
NZP-CSI-RS-ResourceId	30 for resource #0		
	31 for resource #1		
	32 for resource #2		
	33 for resource #3		
	34 for resource #4		
	35 for resource #5		
	36 for resource #6		
	37 for resource #7		

Table 6.6.1.4.3-9: *CSI-ResourceConfig: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-39			
Information Element	**Value/remark**	**Comment**	**Condition**
CSI-ResourceConfig ::= SEQUENCE {			
csi-ResourceConfigId	CSI-ResourceConfigId		
csi-RS-ResourceSetList CHOICE {			
nzp-CSI-RS-SSB SEQUENCE {			
nzp-CSI-RS-ResourceSetList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig)) OF {	2 entries		
NZP-CSI-RS-ResourceSetId[0]	0		
NZP-CSI-RS-ResourceSetId[1]	1		
}			
csi-SSB-ResourceSetList	Not present		
}			
}			
bwp-Id	BWP-Id		
resourceType	aperiodic		
}			

Table 6.6.1.4.3-10: *CSI-FrequencyOccupation: CSI-RS test requirements*

Derivation Path: TS 38.508-1 [10], clause 4.6.3, Table 4.6.3-33			
Information Element	**Value/remark**	**Comment**	**Condition**
CSI-FrequencyOccupation ::= SEQUENCE {			
startingRB	0		
nrofRBs	48		FR2_≥100MHz
	32		FR2_50MHz
}			

6.6.1.5 Test requirements

The defined %-tile EIRP in measurement distribution derived in step 2.6 shall exceed the values specified in Table 6.2.1.2.5-3 in clause 6.2.1.2.5. The defined %-tile $\Delta EIRP_{BC}$ in measurement distribution derived in step 2.7 shall not exceed the values specified in Table 6.6.1.5-1 and Table 6.6.1.5-2.

Table 6.6.1.5-1: UE beam correspondence tolerance for power class 3

Operating band	**Max $\Delta EIRP_{BC}$ at 85th %-tile $\Delta EIRP_{BC}$ CDF (dB)**
n257	3.0 +TT
n258	3.0 +TT
n260	3.2 +TT
n261	3.0 +TT
NOTE: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1	

Table 6.6.1.5-2: Test Tolerance (TT) for UE beam correspondence tolerance for power class 3

Operating band	Test Tolerance (dB)
n257, n258, n260, n261	1.26
n259	FFS

6.6.2 Enhanced Beam correspondence – EIRP

6.6.2.1 Test purpose

To verify the UE's ability to select a suitable beam for UL transmission based on DL measurements with or without relying on UL beam sweeping within the range prescribed by the specified nominal maximum output power and beam correspondence tolerance.

6.6.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support either CSI-RS or SSB based beam correspondence and do not support beam correspondence without UL beam sweeping.

6.6.2.3 Minimum conformance requirements

6.6.2.3.1 Enhanced Beam correspondence for PC3

6.6.2.3.1.1 General Test Coverage Rules

The beam correspondence requirement for PC3 UEs consists of three components: UE minimum peak EIRP (as defined in clause 6.2.1.1.3.3), UE spherical coverage (as defined in clause 6.2.1.1.3.3), and beam correspondence tolerance (as defined in clause 6.6.1.3.3.2). The beam correspondence requirement is fulfilled if the UE satisfies one of the following conditions, depending on the UE's beam correspondence capability IE *beamCorrespondenceWithoutUL-BeamSweeping*, as defined in TS 38.306 [26]:

If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.2.3.2.

- If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceCSI-RS-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.2.3.3.

If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceSSB-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 with uplink beam sweeping using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.2.3.2. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.1.3.3.2 and shall support uplink beam management, as defined in TS 38.306 [14].

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceCSI-RS-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.1.3.3-1 and spherical coverage requirement according to Table 6.2.1.1.3.3-3 with uplink beam sweeping using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.2.3.3. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.1.3.3.2 and shall support uplink beam management, as defined in TS 38.306 [14].

6.6.2.3.1.2 Applicability rules based on support for type of enhanced beam correspondence

For UEs supporting more than one type of beam correspondence, the following applicability rules apply:

- If a UE meets enhanced beam correspondence requirements either based on SSB or based on CSI-RS, it is considered to have met the beam correspondence requirements based on SSB and CSI-RS.

- For a UE supporting either SSB based or CSI-RS based enhanced beam correspondence, UE shall meet the supported enhanced beam correspondence requirements.

- For a UE supporting both SSB based and CSI-RS based enhanced beam correspondence, the UE shall meet both SSB based and CSI-RS based enhanced beam correspondence requirements and the following applicability rules for verifying the requirements apply:

    - The enhanced beam correspondence requirements shall be verified with the SSB based enhanced beam correspondence side conditions in clause 6.6.2.3.2

    - If the UE meets the SSB based enhanced beam correspondence requirements using the side conditions in clause 6.6.2.3.2 and meets the minimum peak EIRP requirement as defined in clause 6.2.1.1 using the CSI-RS based side conditions in clause 6.6.2.3.3, where the link direction is determined in the SSB based enhanced beam correspondence test, the UE is considered to have met both the SSB based and CSI-RS based enhanced beam correspondence requirements.

- Otherwise, if UE does not meet the minimum peak EIRP requirement as defined in clause 6.2.1.3 using the CSI-RS based side conditions in clause 6.6.4.3.3, the enhanced beam correspondence requirements shall be further verified for the UE with the CSI-RS based enhanced beam correspondence side conditions in clause 6.6.2.3.3.

6.6.2.3.2 Side Condition for SSB based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on SSB are only applied under the following side conditions:

- The downlink reference signal SSB is provided and CSI-RS is not provided.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.1.3.3.1.1-1.

6.6.2.3.3 Side Condition for CSI-RS based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on CSI-RS are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.1.3.3.1.1-2 and SSB signal is provided according to Table 6.6.2.3.3-1.

Table 6.6.2.3.3-1: SSB signal conditions for CSI-RS based beam correspondence requirements

Angle of arrival	NR operating bands	Minimum SSB_RP Note 2	SSB Ês/Iot
		dBm / SCS_{SSB}	dB
		SCS_{SSB} = 120 kHz	
All angles Note 1	n257	-101,4	≥1
	n258	-101,4	
	n259	-97,1	
	n260	-97,1	
	n261	-101,4	
NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB_RP values for all angles are increased by ΣMB_S, the UE multi-band relaxation factor in dB specified in clause 6.2.1.			
NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise.			

6.6.2.3.4 Normative reference

The normative reference for this requirement is TS 38.101-2 [3] clause 6.6.4

6.6.2.4 Test description

6.6.2.4.1 Initial conditions

Same as 6.6.1.4.1.

6.6.2.4.2 Test procedure

The following cases are tested depending on UE capability:

1. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, uplink beam management and *beamCorrespondenceSSB-based-r16* are supported:

   1.1 Same as 6.6.1.4.2 with the exception that measurements shall be carried out using only side conditions defined in Table 6.6.1.3.3.1.1-1.

   1.2 End test procedure.

2. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, uplink beam management and *beamCorrespondenceCSI-RS-based-r16* is supported

   2.1 Same as 6.6.1.4.2 with the exception that measurements shall be carried out using only side conditions defined in Table 6.6.2.3.3-1.

   2.2 End test procedure.

3. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, uplink beam management, *beamCorrespondenceCSI-RS-based-r16* and *beamCorrespondenceSSB-based-r16* are supported

   3.1 Same as 6.6.1.4.2 with the exception that measurements shall be carried out using only side conditions defined in Table 6.6.1.3.3.1.1-1.

   3.2 If measurement performed in 6.2.1.1_1.4.2 Step 3.2 was fail, repeat test same as 6.6.1.4.2 with the exception that measurements shall be carried out using only side conditions defined in Table 6.6.2.3.3-1.

   3.3 End test procedure.

6.6.2.4.3 Message contents

Same as the message contents in 6.6.1.4.3

6.6.2.5 Test requirements

The defined %-tile EIRP in measurement distribution derived within 6.6.2.4.2 (as per step 2.6 of clause 6.6.1.4.2) shall exceed the values specified in Table 6.2.1.2.5-3 in clause 6.2.1.2.5. The defined %-tile $\Delta EIRP_{BC}$ in measurement distribution derived in step 2.7 shall not exceed the values specified in Table 6.6.1.5-1.

Table 6.6.1.5-1: UE beam correspondence tolerance for power class 3

Operating band	Max $\Delta EIRP_{BC}$ at 85th %-tile $\Delta EIRP_{BC}$ CDF (dB)
n257	3.0 +TT
n258	3.0 +TT
n260	3.2 +TT
n261	3.0 +TT
NOTE: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1.	

6.6A Beam correspondence for CA

6.6A.1 Test purpose

Same test purpose as in clause 6.6

6.6A.2 Test applicability

The requirements in this test covered by section 6.6 dealing with non-CA Beam Correspondence.

No test case details are specified.

6.6A.3 Minimum Conformance Requirements

For intra-band CA in FR2, the same beam correspondence relationship for beam management is supported across CCs in Rel-15 and no requirement is specified. Beam correspondence performance for intra-band CA is fulfilled if the beam correspondence requirements defined in section 6.6 is met for non-CA case.

7 Receiver characteristics

7.1 General

Editor's Note: Test configurations/environments that require new spherical scan shall be included in test procedure section and identifying such scenarios is currently FFS and owned by RAN5.

Unless otherwise stated, the receiver characteristics are specified over the air (OTA). The reference receive sensitivity (REFSENS) is defined assuming a 0 dBi reference antenna located at the centre of the quiet zone.

For Rx test cases the identified beam peak direction can be stored and reused for a device under test in various configurations/environments for the full duration of device testing as long as beam peak direction is the same.

Unless otherwise stated, Channel Bandwidth shall be prioritized in the selecting of test points. Subcarrier spacing shall be selected after Test Channel Bandwidth is selected.

The UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

7.2 Diversity characteristics

FFS

7.3 Reference sensitivity

7.3.1 General

The reference sensitivity power level REFSENS is the EIS level (total component) at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3.2 Reference sensitivity power level

Editor's note: The following aspects of the clause are for future consideration:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- The test case is incomplete for band n259.

The following aspects of the clause are for future consideration:

- The 3D EIS scan test time optimization in RAN 4/ RAN 5 is FFS (existing EIS based test time needs to be re-evaluated for 200/266 grid points).
- Statistical model in Annex H.2 (currently based on LTE model) needs to be validated to confirm that it is also applicable for FR2

7.3.2.1 Test purpose

To verify the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an g-NodeB.

7.3.2.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

7.3.2.3 Minimum conformance requirements

The reference sensitivity power level REFSENS is defined as the EIS level at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3.2.3.1 Reference sensitivity power level for power class 1

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annex A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.3.1-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.3.1-1: Reference sensitivity for power class 1

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97.5	-94.5	-91.5	-88.5
n258	-97.5	-94.5	-91.5	-88.5
n260	-94.5	-91.5	-88.5	-85.5
n261	-97.5	-94.5	-91.5	-88.5
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4				

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3.1-2.

Table 7.3.2.3.1-2: Uplink configuration for reference sensitivity

Operating band	NR Band / Channel bandwidth / NRB / SCS / Duplex mode					
	50 MHz	100 MHz	200 MHz	400 MHz	SCS	Duplex Mode
n257	32	64	128	256	120 kHz	TDD
n258	32	64	128	256	120 kHz	TDD
n260	32	64	128	256	120 kHz	TDD
n261	32	64	128	256	120 kHz	TDD

Unless given by Table 7.3.2.3.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1) configured.

Table 7.3.2.3.1-3: Reserved

Operating band	Network Signalling value

7.3.2.3.2 Reference sensitivity power level for power class 2

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.3.2-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.3.2-1: Reference sensitivity for power class 2

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-92	-89	-86	-83
n258	-92	-89	-86	-83
n261	-92	-89	-86	-83
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4				

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3.1-2.

Unless given by Table 7.3.2.3.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1) configured.

7.3.2.3.3 Reference sensitivity power level for power class 3

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.3.3-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

For the power class 3 UEs that support multiple FR2 bands, the minimum requirement for Reference sensitivity in Table 7.3.2.3.3-1 shall be increased per band, respectively, by the reference sensitivity relaxation parameter $\sum MB_P$ and $\Delta MB_{P,n}$ as specified in Table 7.3.2.3.3-1a and 7.3.2.3.3-1b.

Table 7.3.2.3.3-1: Reference sensitivity for power class 3

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.3	-85.3	-82.3	-79.3
n258	-88.3	-85.3	-82.3	-79.3
n259	-84.7	-81.7	-78.7	-75.7
n260	-85.7	-82.7	-79.7	-76.7
n261	-88.3	-85.3	-82.3	-79.3
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4				

Table 7.3.2.3.3-1a: UE multi-band relaxation factors for power class 3 (Rel-15)

Supported bands	$\sum MB_P$ (dB)	$\sum MB_S$ (dB)
n257, n258	≤ 1.3	≤ 1.25
n257, n260	≤ 1.0	≤ 0.75[3]
n258, n260	≤ 1.0	≤ 0.75[3]
n258, n261	≤ 1.0	≤ 1.25
n260, n261	0.0	≤ 0.75[2]
n257, n258, n260	≤ 1.7	≤ 1.75[3]
n257, n258, n261	≤ 1.7	≤ 1.75
n257, n260, n261	≤ 0.5	≤ 1.25[3]
n258, n260, n261	≤ 1.5	≤ 1.25[3]
n257, n258, n260, n261	≤ 1.7	≤ 1.75[3]
NOTE 1: The requirements in this table are applicable to UEs which support only the indicated bands NOTE 2: For supported bands n260 + n261, $\Delta MB_{S,n}$ is not applied for band n260 NOTE 3: For n260, maximum applicable $\Delta MB_{S,n}$ is 0.4 dB and $\Delta MB_{P,n}$ is 0.75 dB NOTE 4: For all bands except n260, the maximum applicable $\Delta MB_{P,n}$ and $\Delta MB_{S,n}$ is 0.75 dB		

Table 7.3.2.3.3-1b: UE multi-band relaxation factors for power class 3 (Rel-16 and forward)

Band	$\Delta MB_{P,n}$ (dB)	$\Delta MB_{S,n}$ (dB)
n257	0.7[3]	0.7[3]
n258	0.6	0.7
n259	0.5	0.4
n260	0.5[1]	0.4[1]
n261	0.5[2,4]	0.7[4]
NOTE 1: n260 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n260 NOTE 2: n261 peak relaxation is 0 dB for UE that exclusively supports n261+n260 NOTE 3: n257 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257 NOTE 4: n261 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257		

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3.1-2.

Unless given by Table 7.3.2.3.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1) configured.

7.3.2.3.4 Reference sensitivity power level for power class 4

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.3.4-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.3.4-1: Reference sensitivity for power class 4

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97.0	-94.0	-91.0	-88.0
n258	-97.0	-94.0	-91.0	-88.0
n260	-95.0	-92.0	-89.0	-86.0
n261	-97.0	-94.0	-91.0	-88.0
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4				

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3.1-2.

Unless given by Table 7.3.2.3.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1) configured.

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3.2.

7.3.2.4 Test description

7.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and subcarrier spacing are shown in Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3 The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1			Lowest, 100MHz, Highest	
Test SCS as specified in Table 5.3.5-1			120kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.				

Table 7.3.2.4.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	**SCS kHz**	**LCRBmax**	**RB allocation (LCRB@RBstart)**
50MHz	120	32	32@0
100MHz	120	66	66@0
200MHz	120	132	132@0
400MHz	120	264	264@0
NOTE 1: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 5.3.5-1.			

Table 7.3.2.4.1-3: Uplink configuration for reference sensitivity, LCRB@RBstart format

Operating Band	SCS kHz	50 MHz	100 MHz	200 MHz	400 MHz	Duplex Mode
n257	120	32@0	64@0	128@0	256@0	TDD
n258	120	32@0	64@0	128@0	256@0	TDD
n260	120	32@0	64@0	128@0	256@0	TDD
n261	120	32@0	64@0	128@0	256@0	TDD

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 7.3.2.4.3.

7.3.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}.
4. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
5. Perform EIS procedure as stated in Annex K.1.4 to calculate “averaged EIS”. At each power level, by changing the power level of the wanted signal with a step size of 0.2dB (coarse and fine searches are not precluded as long as the fine search is using the 0.2dB step size near the sensitivity level). For each power step measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2. The downlink power step size shall be no more than 0.2 dB when the RF power level is near the sensitivity level.
6. Compare the dB value of the “averaged EIS” value corresponding to the Rx beam peak direction identified in step 5 to the test requirement in Table 7.3.2.5-1 to Table 7.3.2.5-4. If the EIS value is lower or equal to the value in Table 7.3.2.5-1 to Table 7.3.2.5-4, pass the UE. Otherwise fail the UE.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.3.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Tables 7.3.2.5-1 to 7.3.2.5-4. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.5-1: Reference sensitivity for power class 1

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97.5+TT	-94.5+TT	-91.5+TT	-88.5+TT
n258	-97.5+TT	-94.5+TT	-91.5+TT	-88.5+TT
n260	-94.5+TT	-91.5+TT	-88.5+TT	-85.5+TT
n261	-97.5+TT	-94.5+TT	-91.5+TT	-88.5+TT

Table 7.3.2.5-1a: Test Tolerance (Reference sensitivity for power class 1)

Test Metric	FR2a
IFF (Max device size ≤ 30 cm)	[2.51] dB , NTC TBD dB , ETC

Table 7.3.2.5-2: Reference sensitivity for power class 2

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-92+TT	-89+TT	-86+TT	-83+TT
n258	-92+TT	-89+TT	-86+TT	-83+TT
n261	-92+TT	-89+TT	-86+TT	-83+TT

Table 7.3.2.5-3: Reference sensitivity for power class 3 for single band UE or multi-band UE declaring MB_p = 0 in all FR2 bands

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.3+TT	-85.3+TT	-82.3+TT	-79.3+TT
n258	-88.3+TT	-85.3+TT	-82.3+TT	-79.3+TT
n259	-84.7+TT	-81.7+TT	-78.7+TT	-75.7+TT
n260	-85.7+TT	-82.7+TT	-79.7+TT	-76.7+TT
n261	-88.3+TT	-85.3+TT	-82.3+TT	-79.3+TT

Table 7.3.2.5-3a: Reference sensitivity for power class 3 for multi-band UE declaring MB_p > 0 in any FR2 band (Rel-15)

Operating band	REFSENS (dBm) / Channel bandwidth (NOTE 1)			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.3+TT+MB_p	-85.3+TT+MB_p	-82.3+TT+MB_p	-79.3+TT+MB_p
n258	-88.3+TT+MB_p	-85.3+TT+MB_p	-82.3+TT+MB_p	-79.3+TT+MB_p
n260	-85.7+TT+MB_p	-82.7+TT+MB_p	-79.7+TT+MB_p	-76.7+TT+MB_p
n261	-88.3+TT+MB_p	-85.3+TT+MB_p	-82.3+TT+MB_p	-79.3+TT+MB_p

NOTE 1: Refer Table 7.3.2.5-3b for details for MB_p allowance corresponding to supported FR2 bands set

NOTE 2: For a Rel-15 UE supporting FR2 bands set not defined in Table 7.3.2.3.3-1a, Table 7.3.2.5-3c applies.

Table 7.3.2.5-3b: Reference sensitivity multi-band relaxation factors for power class 3 (Rel-15)

ID	Supported FR2 bands set	Maximum sum of MB_P, $\sum MB_P$ (dB) (Note 3)	Comments
1	n257, n258	1.3	Maximum 0.75 dB relaxation allowed for each band
2	n257, n260	1.0	Maximum 0.75 dB relaxation allowed for each band
3	n258, n260	1.0	Maximum 0.75 dB relaxation allowed for each band
4	n258, n261	1.0	Maximum 0.75 dB relaxation allowed for each band
5	n260, n261	0.0	No relaxation factor allowed
6	n257, n258, n260	1.7	Maximum 0.75 dB relaxation allowed for each band
7	n257, n258, n261	1.7	Maximum 0.75 dB relaxation allowed for each band
8	n257, n260, n261	0.5	Maximum 0.75 dB relaxation allowed for each band
9	n258, n260, n261	1.5	Maximum 0.75 dB relaxation allowed for each band
10	n257, n258, n260, n261	1.7	Maximum 0.75 dB relaxation allowed for each band
NOTE 1: MB_p is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in Table 7.3.2.3.3-1a. NOTE 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant NOTE 3: Max allowed sum of MB_p over all supported FR2 bands as defined in clause 7.3.2.3.3.			

Table 7.3.2.5-3c: Reference sensitivity for power class 3 (Rel-16 and forward)

Operating band	REFSENS (dBm) / Channel bandwidth (NOTE 1)			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	$-88.3+TT+\Delta MB_{P,n}$	$-85.3+TT+\Delta MB_{P,n}$	$-82.3+TT+\Delta MB_{P,n}$	$-79.3+TT+\Delta MB_{P,n}$
n258	$-88.3+TT+\Delta MB_{P,n}$	$-85.3+TT+\Delta MB_{P,n}$	$-82.3+TT+\Delta MB_{P,n}$	$-79.3+TT+\Delta MB_{P,n}$
n259	$-84.7+TT+\Delta MB_{P,n}$	$-81.7+TT+\Delta MB_{P,n}$	$-78.7+TT+\Delta MB_{P,n}$	$-75.7+TT+\Delta MB_{P,n}$
n260	$-85.7+TT+\Delta MB_{P,n}$	$-82.7+TT+\Delta MB_{P,n}$	$-79.7+TT+\Delta MB_{P,n}$	$-76.7+TT+\Delta MB_{P,n}$
n261	$-88.3+TT+\Delta MB_{P,n}$	$-85.3+TT+\Delta MB_{P,n}$	$-82.3+TT+\Delta MB_{P,n}$	$-79.3+TT+\Delta MB_{P,n}$
NOTE 1: Refer Table 7.3.2.5-3d for details for $\Delta MB_{P,n}$ allowance corresponding to supported FR2 bands set				

Table 7.3.2.5-3d: Reference sensitivity multi-band relaxation factors for power class 3 (Rel-16 and forward)

ID	FR2 bands/set	$\Delta MB_{P,n}$ (dB)	Comments
1	n257	0.7	
2	n258	0.6	
3	n259	0.5	
4	n260	0.5	
5	n261	0.5	
6	n257, n261	0	$\Delta MB_{P,n}$ relaxation is 0 dB
7	n260, n261	0	$\Delta MB_{P,n}$ relaxation is 0 dB
NOTE 1: $\Delta MB_{P,n}$ is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 7.3.2.3.3-1b.			

Table 7.3.2.5-3e: Test Tolerance (Reference sensitivity for power class 3)

Test Metric	f ≤ 40.8 GHz
IFF (Max device size ≤ 30 cm)	2.34 dB, NTC 2.45 dB, ETC

Table 7.3.2.5-4: Reference sensitivity for power class 4

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97+TT	-94+TT	-91+TT	-88+TT
n258	-97+TT	-94+TT	-91+TT	-88+TT
n260	-95+TT	-92+TT	-89+TT	-86+TT
n261	-97+TT	-94+TT	-91+TT	-88+TT

7.3.4 EIS spherical coverage

Editor's Note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- The test case is incomplete for band n259.

7.3.4.1 Test purpose

To verify that the EIS spherical coverage of the UE receiver is acceptable under conditions of low signal level, ideal propagation and no added noise.

7.3.4.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

7.3.4.3 Minimum conformance requirements

The reference sensitivity power level REFSENS at a single grid point of the spherical grid is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

The reference measurement channels and throughput criterion shall be as specified in section 7.3.2.3.

For power class 1, the maximum EIS at the 85th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.3-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.3-1: EIS spherical coverage for power class 1

Operating band	EIS at 85th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-89.5	-86.5	-83.5	-80.5
n258	-89.5	-86.5	-83.5	-80.5
n260	-86.5	-83.5	-80.5	-77.5
n261	-89.5	-86.5	-83.5	-80.5
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

For power class 2, the maximum EIS at the 60th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.3-2 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.3-2: EIS spherical coverage for power class 2

Operating band	EIS at 60th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-81	-78	-75	-72
n258	-81	-78	-75	-72
n261	-81	-78	-75	-72
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

For power class 3, the maximum EIS at the 50th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.3-3 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

For power class 3, the UEs that support operation in multiple FR2 bands, the minimum requirement for EIS spherical coverage in Table 7.3.4.3-3 shall be increased per band, respectively, by the reference sensitivity relaxation parameter $\sum MB_S$ and $\Delta MB_{S,n}$ as specified in Table 7.3.2.3.3-1a and 7.3.2.3.3-1b..

Table 7.3.4.3-3: EIS spherical coverage for power class 3

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4	-74.4	-71.4	-68.4
n258	-77.4	-74.4	-71.4	-68.4
n259	-71.9	-68.9	-65.9	-62.9
n260	-73.1	-70.1	-67.1	-64.1
n261	-77.4	-74.4	-71.4	-68.4
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4 NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

For power class 4, the maximum EIS at the 20th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.3-4 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.3-4: EIS spherical coverage for power class 4

Operating band	EIS at 20th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.0	-85.0	-82.0	-79.0
n258	-88.0	-85.0	-82.0	-79.0
n260	-83.0	-80.0	-77.0	-74.0
n261	-88.0	-85.0	-82.0	-79.0
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4 NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.4.3-5.

Table 7.3.4.3-5: Uplink configuration for reference sensitivity

NR Band / Channel bandwidth / N_{RB} / SCS / Duplex mode						
NR Band	50 MHz	100 MHz	200 MHz	400 MHz	SCS	Duplex Mode
n257	32	64	128	256	120 kHz	TDD
n258	32	64	128	256	120 kHz	TDD
n260	32	64	128	256	120 kHz	TDD
n261	32	64	128	256	120 kHz	TDD

Unless given by Table 7.3.4.3-6, the minimum requirements specified in Table 7.3.4.3-1, Table 7.3.4.3-2, Table 7.3.4.3-3 and Table 7.3.4.3-4 shall be verified with the network signalling value NS_200 configured.

Table 7.3.4.3-6: Network Signalling value for reference sensitivity

NR Band	Network Signalling value
n258	NS_201

For the UE which supports inter-band carrier aggregation, the minimum requirement for reference sensitivity in Table 7.3.4.3-1, Table 7.3.4.3-2, Table 7.3.4.3-3 and Table 7.3.4.3-4 shall be increased by the amount given in $\Delta R_{IB,P,n}$ defined in subclause 7.3A.2.0.3 for the applicable operating bands.

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3.4.

7.3.4.4 Test description

7.3.4.4.1 Initial conditions

Same initial conditions as in clause 7.3.2.4.1 except that only normal condition is tested.

7.3.4.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}.
4. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
5. Measure UE EIS value for each grid point according to EIS spherical coverage procedure defined in Annex K.1.6.0, and obtain a Complimentary Cumulative Distribution Function (CCDF) of all EIS dBm values. Alternatively, UE EIS measurement for each grid point could be done according to Rx Fast spherical coverage procedure defined in Annex K.1.6.1. After a rotation, allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for UE to find the best beam to use. EIS is calculated considering both polarizations, theta and phi.
6. Identify the EIS dBm value corresponding to %-tile (UE power class dependent) value in the applicable test requirement table in section 7.3.4.5.
7. Compare the EIS dBm value identified in step 6, to the limit value in the applicable test requirement table in section 7.3.4.5. If the EIS dBm value is lower or equal to the limit value, pass the UE. Otherwise fail the UE.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.3.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.3.4.5 Test requirement

The reference measurement channels and throughput criterion shall be as specified in section 7.3.2.5.

Table 7.3.4.5-1: EIS spherical coverage for power class 1

Operating band	EIS at 85th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-89.5 +TT	-86.5 +TT	-83.5 +TT	-80.5 +TT
n258	-89.5 +TT	-86.5 +TT	-83.5 +TT	-80.5 +TT
n260	-86.5 +TT	-83.5 +TT	-80.5 +TT	-77.5 +TT
n261	-89.5 +TT	-86.5 +TT	-83.5 +TT	-80.5 +TT
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

Table 7.3.4.5-2: EIS spherical coverage for power class 2

Operating band	EIS at 60th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-81 +TT	-78 +TT	-75 +TT	-72 +TT
n258	-81 +TT	-78 +TT	-75 +TT	-72+TT
n261	-81 +TT	-78 +TT	-75 +TT	-72 +TT
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

Table 7.3.4.5-3: EIS spherical coverage for power class 3 for single band UE or multi-band UE declaring MB_s = 0 in all FR2 bands

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4 +TT	-74.4 +TT	-71.4 +TT	-68.4 +TT
n259	-71.9 +TT	-68.9 +TT	-65.9 +TT	-62.9 +TT
n258	-77.4 +TT	-74.4 +TT	-71.4 +TT	-68.4 +TT
n260	-73.1 +TT	-70.1 +TT	-67.1 +TT	-64.1 +TT
n261	-77.4 +TT	-74.4 +TT	-71.4 +TT	-68.4 +TT
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

Table 7.3.4.5-3a: EIS spherical coverage for power class 3 for multi-band UE declaring MB_s > 0 in any FR2 band (Rel-15)

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth (NOTE 3)			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4 +TT+MB_s	-74.4 +TT+MB_s	-71.4 +TT+MB_s	-68.4 +TT+MB_s
n258	-77.4 +TT+MB_s	-74.4 +TT+MB_s	-71.4 +TT+MB_s	-68.4 +TT+MB_s
n260	-73.1 +TT+MB_s	-70.1 +TT+MB_s	-67.1 +TT+MB_s	-64.1 +TT+MB_s
n261	-77.4 +TT+MB_s	-74.4 +TT+MB_s	-71.4 +TT+MB_s	-68.4 +TT+MB_s
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1. NOTE 3: Refer Table 7.3.4.5-3b for details for MB_s allowance corresponding to supported FR2 band set combination NOTE 4: For a Rel-15 UE supporting FR2 bands set not defined in Table 7.3.2.3.3-1a, Table 7.3.4.5-3c applies.				

Table 7.3.4.5-3b: EIS spherical coverage multiband relaxation factors for power class 3 (Rel-15)

ID	Supported FR2 bands set	Maximum sum of MB_s, $\sum MB_s$ (dB) (Note 3)	Comments
1	n257, n258	1.25	Maximum 0.75 dB relaxation allowed for each band
2	n257, n260	0.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
3	n258, n260	0.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
4	n258, n261	1.25	Maximum 0.75 dB relaxation allowed for each band
5	n260, n261	0.75	No relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
6	n257, n258, n260	1.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
7	n257, n258, n261	1.75	Maximum 0.75 dB relaxation allowed for each band
8	n257, n260, n261	1.25	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
9	n258, n260, n261	1.25	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
10	n257, n258, n260, n261	1.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
NOTE 1: MB_s is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in Table 7.3.2.3.3-1a. NOTE 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant NOTE 3: Max allowed sum of MB_s over all supported FR2 bands as defined in clause 7.3.2.3.3.			

Table 7.3.4.5-3c: EIS spherical coverage for power class 3 (Rel-16 and forward)

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth (NOTE 3)			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4 +TT+$\Delta MB_{s,n}$	-74.4 +TT+$\Delta MB_{s,n}$	-71.4 +TT+$\Delta MB_{s,n}$	-68.4 +TT+$\Delta MB_{s,n}$
n258	-77.4 +TT+$\Delta MB_{s,n}$	-74.4 +TT+$\Delta MB_{s,n}$	-71.4 +TT+$\Delta MB_{s,n}$	-68.4 +TT+$\Delta MB_{s,n}$
n259	-71.9 +TT+$\Delta MB_{s,n}$	-68.9 +TT+$\Delta MB_{s,n}$	-65.9 +TT+$\Delta MB_{s,n}$	-62.9 +TT+$\Delta MB_{s,n}$
n260	-73.1 +TT+$\Delta MB_{s,n}$	-70.1 +TT+$\Delta MB_{s,n}$	-67.1 +TT+$\Delta MB_{s,n}$	-64.1 +TT+$\Delta MB_{s,n}$
n261	-77.4 +TT+$\Delta MB_{s,n}$	-74.4 +TT+$\Delta MB_{s,n}$	-71.4 +TT+$\Delta MB_{s,n}$	-68.4 +TT+$\Delta MB_{s,n}$
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1. NOTE 3: Refer Table 7.3.4.5-3d for details for MB_s allowance corresponding to supported FR2 band set combination				

Table 7.3.4.5-3d: EIS spherical coverage multi-band relaxation factors for power class 3 (Rel-16 and forward)

ID	FR2 bands/set	Comments
1	n257	
2	n258	
3	n259	
4	n260	
5	n261	
6	n257, n261	$\Delta MB_{s,n}$ relaxation is 0 dB
7	n260, n261	$\Delta MB_{s,n}$ relaxation is 0 dB
NOTE 1: $MB_{s,n}$ is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 7.3.2.3.3-1b.		

Table 7.3.4.5-3e: Test Tolerance (Reference sensitivity for power class 3)

Test Metric	f ≤ 40.8 GHz
IFF (Max device size ≤ 30 cm)	2.21 dB

Table 7.3.4.5-4: EIS spherical coverage for power class 4

Operating band	EIS at 20th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.0 +TT	-85.0 +TT	-82.0 +TT	-79.0 +TT
n258	-88.0 +TT	-85.0 +TT	-82.0 +TT	-79.0 +TT
n260	-83.0 +TT	-80.0 +TT	-77.0 +TT	-74.0 +TT
n261	-88.0 +TT	-85.0 +TT	-82.0 +TT	-79.0 +TT
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4 NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

7.3A Reference sensitivity for CA

7.3A.1 General

The reference sensitivity power level REFSENS for both Intra-band non-contiguous CA and Intra-band contiguous CA is defined as the EIS level at the centre of the quiet zone in the RX beam peak direction[(same as that found for single carrier scenario in clause 7.3.2)], at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3A.2 Reference sensitivity power level for CA

7.3A.2.0 Minimum Conformance Requirements

7.3A.2.0.1 Intra-band contiguous CA

For each component carrier in the intra-band contiguous carrier aggregation, the throughput in QPSK R = 1/3 shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annex A (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal) with peak reference sensitivity values determined from section 7.3.2.3, and relaxation applied to peak reference sensitivity requirement as specified in Table 7.3A.2.0.1-1.

Table 7.3A.2.0.1-1: ΔR_{IB} EIS Relaxation for CA operation by aggregated channel bandwidth

Aggregated Channel BW '$BW_{Channel\_CA}$' (MHz)	ΔR_{IB} (dB)
$BW_{Channel\_CA} \leq 800$	0.0
$800 < BW_{Channel\_CA} \leq 1200$	0.5

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3A.2.1.

7.3A.2.0.2 Intra-band non-contiguous CA

For each component carrier in the intra-band non-contiguous carrier aggregation, the throughput in QPSK R=1/3 shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annex A (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal) with peak reference sensitivity values determined from section 7.3.2.3, and relaxation applied to peak reference sensitivity requirement as specified in Table 7.3A.2.0.2-1. The configured downlink spectrum is defined as the frequency band from the lowest edge of the lowest CC to the upper edge of the highest CC of all DL configured CCs.

Table 7.3A.2.0.2-1: ΔR_{IB} EIS Relaxation for CA operation by cumulative aggregated channel bandwidth

Cumulative Aggregated Channel BW (MHz)	ΔR_{IB} (dB)
≤ 800	0.0
> 800 and ≤ 1400	0.5
> 1400 and ≤ 2400	1.5

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3A.2.2.

7.3A.2.0.3 Inter-band CA

The inter-band requirement applies for all active component carriers. The throughput for each component carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity for each carrier specified in section 7.3.2, and relaxation $\Delta R_{IB,P,n}$ applied to peak reference sensitivity requirement. $\Delta R_{IB,P,n}$ is specified in Table 7.3A.2.0.3-1. The requirement on each component carrier shall be met when the power in the component carrier in the other band is set to its EIS spherical coverage requirement for inter-band CA specified in sub-clause 7.3A.3.3.

For the combination of intra-band and inter-band carrier aggregation, the intra-band CA relaxation, ΔR_{IB}, is also applied according to the clause 7.3A.2.1 and 7.3A.2.2.

Table 7.3A.2.0.3-1: $\Delta R_{IB,P,n}$ reference sensitivity relaxation for inter-band CA for power class 3

NR CA bands	NR band	$\Delta R_{IB,P,n}$ (dB)
CA_n260-n261	n260	3.5
	n261	3.5

7.3A.2.1 Reference sensitivity power level for CA (2DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc
- Some references are in square brackets for inter-band DL CA

7.3A.2.1.1 Test purpose

Same test purpose as in clause 7.3.2.1.

7.3A.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2DL CA.

7.3A.2.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.1.4 Test description

7.3A.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and subcarrier spacing are shown in Table 7.3A.2.1.4.1-1, Table 7.3A.2.1.4.1-2 and Table 7.3A.2.1.4.1-3. The details of the uplink and downlink reference

measurement channels (RMCs) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3A.2.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal, TL, TH	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes			Low range, High range	
Test CA Bandwidth combination as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE			Maximum aggregated BW (contiguous CA) or Maximum cumulative aggregated BW (non-contiguous CA)	
Test SCS as specified in Table 5.3.5-1			120kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2, NOTE 3)
NOTE 1: Full RB allocation shall be used per each SCS and component carrier as specified in Table 7.3A.2.1.4.1-2. NOTE 2: REFSENS refers to Table 7.3A.2.1.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW. NOTE 3: Use single carrier UL when testing reference sensitivity power level for CA. The PCC is located on the CC with the lowest carrier frequency.				

Table 7.3A.2.1.4.1-2: Downlink Configuration of each RB allocation

Component Carrier Bandwidth	SCS kHz	LCRBmax	RB allocation (LCRB@RBstart)
50MHz	120	32	32@0
100MHz	120	66	66@0
200MHz	120	132	132@0
400MHz	120	264	264@0
NOTE 1: CA Bandwidths are checked separately for each NR band, the applicable CA bandwidths are specified in Table 5.3A.4-1.			

Table 7.3A.2.1.4.1-3: Uplink configuration for reference sensitivity, LCRB@RBstart format

Operating Band	SCS kHz	50 MHz	100 MHz	200 MHz	400 MHz	Duplex Mode
n257	120	32@0	64@0	128@0	256@0	TDD
n258	120	32@0	64@0	128@0	256@0	TDD
n260	120	32@0	64@0	128@0	256@0	TDD
n261	120	32@0	64@0	128@0	256@0	TDD

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The UL Reference Measurement channels are set according to Table 7.3A.2.1.4.1-1, Table 7.3A.2.1.4.1-2 and Table 7.3A.2.1.4.1-3.
5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 7.3A.2.1.4.3.

7.3A.2.1.4.2 Test Procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 7.3A.2.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321[28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.2).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3A.2.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
5. SS sends uplink scheduling information on PCC for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 7.3A.2.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
6. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}.
7. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2.. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
8. For each component carrier, perform EIS procedure as stated in Annex K.1.4 to calculate “averaged EIS” by changing the power level of the wanted signal with a step size of 0.2dB, while increasing the power level of each component carrier other than the one being tested by a fixed offset of 5 dB compared to the current power level of the component carrier under test. Coarse and fine searches are not precluded as long as the fine search is using the 0.2dB step size near the sensitivity level. For each power step measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.
9. For each component carrier, compare the dB value of the “averaged EIS” value corresponding to the Rx beam peak direction (same as that found for single carrier in clause 7.3.2) identified in step 8 to the test requirement in Tables 7.3A.2.1.5-4 to Table 7.3A.2.1.5-7. If the EIS value is lower or equal to the value in Tables 7.3A.2.1.5-4 to Table 7.3A.2.1.5-7, pass the UE. Otherwise fail the UE.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.3A.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.3A.2.1.5 Test requirement

For each component carrier, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2 and A.3 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5) with peak reference sensitivity specified in Tables 7.3A.2.1.5-4 to 7.3A.2.1.5-7. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3A.2.1.5-1: ΔR_{IB} EIS Relaxation per component carrier for intra-band contiguous CA

Aggregated Channel BW '$BW_{Channel\_CA}$' (MHz)	ΔR_{IB} (dB) / CC
$BW_{Channel\_CA} \leq 800$	0.0
$800 < BW_{Channel\_CA} \leq 1200$	0.5

Table 7.3A.2.1.5-2: ΔR_{IB} EIS Relaxation per component carrier for intra-band non-contiguous CA

Cumulative Aggregated Channel BW (MHz)	ΔR_{IB} (dB) / CC
≤ 800	0.0
> 800 and ≤ 1400	0.5
> 1400 and ≤ 2400	1.5

Table 7.3A.2.1.5-3: ΔR_{IB} reference sensitivity relaxation for inter-band CA for power class 3

NR CA bands	NR band	$\Delta R_{IB,P,n}$ (dB)
CA_n260-n261	n260	3.5
	n261	3.5

Table 7.3A.2.1.5-4: Reference sensitivity per component carrier for power class 1

Operating band	REFSENS (dBm) / CC			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97.5+TT+ΔR_{IB}	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}
n258	-97.5+TT+ΔR_{IB}	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}
n260	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}	-85.5+TT+ΔR_{IB}
n261	-97.5+TT+ΔR_{IB}	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}

Table 7.3A.2.1.5-5: Reference sensitivity per component carrier for power class 2

Operating band	REFSENS (dBm) / CC			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}	-85.5+TT+ΔR_{IB}
n258	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}	-85.5+TT+ΔR_{IB}
n260				
n261	-94.5+TT+ΔR_{IB}	-91.5+TT+ΔR_{IB}	-88.5+TT+ΔR_{IB}	-85.5+TT+ΔR_{IB}

Table 7.3A.2.1.5-6: Reference sensitivity per component carrier for power class 3

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-88.3+TT+ΔR_{IB}	-85.3+TT+ΔR_{IB}	-82.3+TT+ΔR_{IB}	-79.3+TT+ΔR_{IB}
n258	-88.3+TT+ΔR_{IB}	-85.3+TT+ΔR_{IB}	-82.3+TT+ΔR_{IB}	-79.3+TT+ΔR_{IB}
n260	-85.7+TT+ΔR_{IB}	-82.7+TT+ΔR_{IB}	-79.7+TT+ΔR_{IB}	-76.7+TT+ΔR_{IB}
n261	-88.3+TT+ΔR_{IB}	-85.3+TT+ΔR_{IB}	-82.3+TT+ΔR_{IB}	-79.3+TT+ΔR_{IB}

Table 7.3A.2.1.5-6a: Test Tolerance per component carrier (Reference sensitivity for power class 3)

Test Metric	f ≤ 40.8 GHz
IFF (Max device size ≤ 30 cm)	3.37 dB

Table 7.3A.2.1.5-7: Reference sensitivity per component carrier for power class 4

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-97+TT+ΔR_{IB}	-94+TT+ΔR_{IB}	-91+TT+ΔR_{IB}	-88+TT+ΔR_{IB}
n258	-97+TT+ΔR_{IB}	-94+TT+ΔR_{IB}	-91+TT+ΔR_{IB}	-88+TT+ΔR_{IB}
n260	-95+TT+ΔR_{IB}	-92+TT+ΔR_{IB}	-89+TT+ΔR_{IB}	-86+TT+ΔR_{IB}
n261	-97+TT+ΔR_{IB}	-94+TT+ΔR_{IB}	-91+TT+ΔR_{IB}	-88+TT+ΔR_{IB}

7.3A.2.2 Reference sensitivity power level for CA (3DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc
- Testing of extreme conditions for FR2 is FFS.

7.3A.2.2.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3DL CA.

7.3A.2.2.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.2.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.2.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.2.3 Reference sensitivity power level for CA (4DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and for intra-band non-contiguous CA are TBD.
- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc
- Testing of extreme conditions for FR2 is FFS.

7.3A.2.3.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4DL CA.

7.3A.2.3.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.3.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.3.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.2.4 Reference sensitivity power level for CA (5DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc
- Testing of extreme conditions for FR2 is FFS.

7.3A.2.4.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5DL CA.

7.3A.2.4.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.4.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.4.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.2.5 Reference sensitivity power level for CA (6DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc
- Testing of extreme conditions for FR2 is FFS.

7.3A.2.5.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6DL CA.

7.3A.2.5.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.5.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.5.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.2.6 Reference sensitivity power level for CA (7DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc.
- Testing of extreme conditions for FR2 is FFS.

7.3A.2.6.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7DL CA.

7.3A.2.6.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.6.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.6.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.2.7 Reference sensitivity power level for CA (8DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS.

- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc

- Testing of extreme conditions for FR2 is FFS.

7.3A.2.7.1 Test purpose

Same test purpose as in clause 7.3A.2.1.1.

7.3A.2.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3DL CA.

7.3A.2.7.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.2.0.

7.3A.2.7.4 Test description

Same test description as in clause 7.3A.2.1.4.

7.3A.2.7.5 Test requirement

For each component carrier, the test requirement is the same as in clause 7.3A.2.1.5.

7.3A.3 EIS spherical coverage for DL CA

7.3A.3.0 Minimum Conformance Requirements

7.3A.3.0.1 Void

7.3A.3.0.2 Void

7.3A.3.0.3 EIS spherical coverage for inter-band CA

The inter-band CA requirement applies per operating band, for all active component carriers with UL assigned to one band and one DL component carrier per band. The requirement on each component carrier shall be met when the power in the component carrier in the other band is set to its EIS spherical coverage requirement for inter-band CA specified in this sub-clause.

The inter-band CA spherical coverage requirement for each power class will be satisfied if the intersection set of spherical coverage areas exceeds the common coverage requirement. Intersection set of spherical coverage areas is defined as a fraction of area of full sphere measured around the UE where both bands meet their defined individual EIS spherical coverage requirements for inter-band CA operation. The common coverage requirement is determined as <100-percentile rank> %, where ‘percentile rank’ is the percentile value in the specification of spherical coverage for that power class from clause 7.3.4.The requirement is verified with the test metric of EIS (Link=Beam peak search grids, Meas=Link angle).

The reference measurement channels and throughput criterion shall be as specified in clause 7.3A.2.0.3. The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in clause 7.3.2.

Unless otherwise specified, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1) configured.

The required spherical coverage EIS for each band in inter-band CA operation is given in clause 7.3.4 and modified by $\Delta R_{IB,S,n}$. The value of $\Delta R_{IB,S,n}$ is defined in Table 7.3A.3.0.3-1.

Table 7.3A.3.0.3-1: $\Delta R_{IB,S,n}$ EIS spherical coverage requirement relaxation for inter-band CA for power class 3

NR CA band combination	NR band	$\Delta R_{IB,S,n}$ (dB)
CA_n260-n261	n260	3.5
	n261	3.5

7.3A.3.1 EIS Spherical Coverage for Inter-band CA (2DL CA)

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS
- Test Config is FFS.
- In case of frequency separation larger than 800 MHz and in case the device manufacturer does not explicitly declare that the beam peak for a reference (frequency band, CBW) or (frequency band combination, CA BW class) is applicable for a group of other intra-band contiguous combinations and CA BW classes, according to Table A.4.3.9-6 in 38.508-2, following aspect of beam peak search procedures for CA is FFS: RB allocation, power level, channel bandwidth configuration, per CC approach or all CC combined approach, etc

7.3A.3.1.1 Test purpose

Same test purpose as in 7.3.4.1

7.3A.3.1.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward that supports FR2 2DL inter-band CA.

7.3A.3.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.3A.3.0.

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3A.3.

7.3A.3.1.4 Test description

7.3A.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and subcarrier spacing are shown in Table [TBD], Table [TBD] and Table [TBD]. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3A.3.1.4.1-1: Test Configuration Table

FFS

7.3A.3.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 7.3A.3.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321[28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.2).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3A.3.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.3A.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200msec for the UE to reach P_{UMAX}.

4. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.

5. For each component carrier, measure UE EIS value for each grid point according to EIS spherical coverage procedure defined in Annex K.1.6.0, and obtain a Complimentary Cumulative Distribution Function (CCDF) of all EIS dBm values. Alternatively, UE EIS measurement for each grid point could be done according to Rx Fast spherical coverage procedure defined in Annex K.1.6.1. After a rotation, allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for UE to find the best beam to use. EIS is calculated considering both polarizations, theta and phi.

6. Identify the EIS dBm value corresponding to %-tile (UE power class dependent) value in the applicable test requirement tables in section 7.3A.3.1.5.

7. Compare the EIS dBm value identified in step 6, to the limit value in the applicable test requirement tables in section 7.3A.3.1.5. If the EIS dBm value is lower or equal to the limit value, pass the UE. Otherwise fail the UE.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.3A.3.1.4.3 Message contents

Same as 7.3.4.4.3

7.3A.3.1.5 Test requirement

The reference measurement channels and throughput criterion shall be as specified in section 7.3.2.5.

Table 7.3A.3.1.5-1: $\Delta R_{IB,S,n}$ EIS spherical coverage requirement relaxation per component carrier for inter-band CA for power class 3

NR CA band combination	NR band	$\Delta R_{IB,S,n}$ (dB)
CA_n260-n261	n260	3.5
	n261	3.5

Table 7.3A.3.1.5-2: EIS spherical coverage per component carrier for power class 3 for single band UE or multi-band UE declaring MB_s = 0 in all FR2 bands

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4 +TT+ $\Delta R_{IB,S,n}$	-74.4 +TT+ $\Delta R_{IB,S,n}$	-71.4 +TT+ $\Delta R_{IB,S,n}$	-68.4 +TT+ $\Delta R_{IB,S,n}$
n259	-71.9 +TT+ $\Delta R_{IB,S,n}$	-68.9 +TT+ $\Delta R_{IB,S,n}$	-65.9 +TT+ $\Delta R_{IB,S,n}$	-62.9 +TT+ $\Delta R_{IB,S,n}$
n258	-77.4 +TT+ $\Delta R_{IB,S,n}$	-74.4 +TT+ $\Delta R_{IB,S,n}$	-71.4 +TT+ $\Delta R_{IB,S,n}$	-68.4 +TT+ $\Delta R_{IB,S,n}$
n260	-73.1 +TT+ $\Delta R_{IB,S,n}$	-70.1 +TT+ $\Delta R_{IB,S,n}$	-67.1 +TT+ $\Delta R_{IB,S,n}$	-64.1 +TT+ $\Delta R_{IB,S,n}$
n261	-77.4 +TT+ $\Delta R_{IB,S,n}$	-74.4 +TT+ $\Delta R_{IB,S,n}$	-71.4 +TT+ $\Delta R_{IB,S,n}$	-68.4 +TT+ $\Delta R_{IB,S,n}$
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1.				

Table 7.3A.3.1.5-2a: EIS spherical coverage per component carrier for power class 3 for multi-band UE declaring MB_s > 0 in any FR2 band (Rel-15)

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth (NOTE 3)			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-77.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-74.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-71.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-68.4 +TT+MB_s+ $\Delta R_{IB,S,n}$
n258	-77.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-74.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-71.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-68.4 +TT+MB_s+ $\Delta R_{IB,S,n}$
n260	-73.1 +TT+MB_s+ $\Delta R_{IB,S,n}$	-70.1 +TT+MB_s+ $\Delta R_{IB,S,n}$	-67.1 +TT+MB_s+ $\Delta R_{IB,S,n}$	-64.1 +TT+MB_s+ $\Delta R_{IB,S,n}$
n261	-77.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-74.4 +TT+MB_s+ $\Delta R_{IB,S,n}$	-71.4 +TT+MB+ $\Delta R_{IB,S,n\ s}$	-68.4 +TT+MB_s+ $\Delta R_{IB,S,n}$
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1. NOTE 3: Refer Table 7.3A.3.1.5-2b for details for MB_s allowance corresponding to supported FR2 band set combination NOTE 4: For a Rel-15 UE supporting FR2 bands set not defined in Table 7.3.2.3.3-1a, Table 7.3A.3.1.5-2c applies.				

Table 7.3A.3.1.5-2b: EIS spherical coverage multiband relaxation factors per component carrier for power class 3 (Rel-15)

ID	Supported FR2 bands set	Maximum sum of MB_s, $\sum MB_s$ (dB) (Note 3)	Comments
1	n257, n258	1.25	Maximum 0.75 dB relaxation allowed for each band
2	n257, n260	0.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
3	n258, n260	0.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
4	n258, n261	1.25	Maximum 0.75 dB relaxation allowed for each band
5	n260, n261	0.75	No relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
6	n257, n258, n260	1.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
7	n257, n258, n261	1.75	Maximum 0.75 dB relaxation allowed for each band
8	n257, n260, n261	1.25	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
9	n258, n260, n261	1.25	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
10	n257, n258, n260, n261	1.75	Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands
NOTE 1: MB_s is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in Table 7.3.2.3.3-1a. NOTE 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant NOTE 3: Max allowed sum of MB_s over all supported FR2 bands as defined in clause 7.3.2.3.3.			

Table 7.3A.3.1.5-2c: EIS spherical coverage per component carrier for power class 3 (Rel-16 and forward)

Operating band	EIS at 50th%ile CCDF (dBm) / Channel bandwidth (NOTE 3)			
	50 MHz	100 MHz	200 MHz	400 MHz

n257	-77.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-74.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-71.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-68.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$
n258	-77.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-74.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-71.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-68.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$
n259	-71.9 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-68.9 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-65.9 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-62.9 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$
n260	-73.1 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-70.1 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-67.1 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-64.1 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$
n261	-77.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-74.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-71.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$	-68.4 +TT+$\Delta MB_{s,n}$+ $\Delta R_{IB,S,n}$
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4. NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in TS 38.508-1 [10] subclause 4.1.1. NOTE 3: Refer Table 7.3A.3.1.5-2d for details for MB_s allowance corresponding to supported FR2 band set combination				

Table 7.3A.3.1.5-2d: EIS spherical coverage multi-band relaxation factors per component carrier for power class 3 (Rel-16 and forward)

ID	FR2 bands/set	Comments
1	n257	
2	n258	
3	n259	
4	n260	
5	n261	
6	n257, n261	$\Delta MB_{s,n}$ relaxation is 0 dB
7	n260, n261	$\Delta MB_{s,n}$ relaxation is 0 dB
NOTE 1: $MB_{s,n}$ is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 7.3.2.3.3-1b.		

Table 7.3A.3.1.5-3: Test Tolerance per component carrier (EIS spherical coverage for power class 3)

Test Metric	f ≤ 40.8 GHz
IFF (Max device size ≤ 30 cm)	FFS

7.3A.3.2 EIS Spherical Coverage for Inter-band CA (3DL CA)

7.3A.3.3 EIS Spherical Coverage for Inter-band CA (4DL CA)

7.3D Reference sensitivity for UL MIMO

The normative reference for this requirement is TS 38.101-2 [3] clause 7.3D.

No test case details are specified. Given UE's Rx performance would not be impacted by the Tx configuration on TDD bands, the requirements in this test case can be well covered in 7.3 and don't need to be tested again.

7.4 Maximum input level

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty is FFS.
- UL power level configuration is TBD.
- Relaxation of DL power for 256 QAM is FFS

7.4.1 Test purpose

Maximum input level tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of high signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area near to a g-NodeB.

7.4.2 Test applicability

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward.

7.4.3 Minimum conformance requirements

The maximum input level is defined as the maximum mean power, for which the throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

The maximum input level is defined as a directional requirement. The requirement is verified in beam locked mode in the direction where peak gain is achieved.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with parameters specified in Table 7.4.3-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.4.3-1: Maximum input level

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in transmission bandwidth configuration	dBm	-25 (NOTE 2) -27 (NOTE 3)			
NOTE 1: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in subclause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2. NOTE 2: Reference measurement channel is specified in Annex A.3.3.2: QPSK, R=1/3 variant with one sided dynamic OCNG Pattern as described in Annex A. NOTE 3: Reference measurement channel is specified in Annex A.3.3.5: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern as described in Annex A.					

The normative reference for this requirement is TS 38.101-2 [3] clause 7.4.

7.4.4 Test description

7.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1			Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1			120kHz	
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	NOTE1	DFT-s-OFDM QPSK	NOTE2
2	CP-OFDM 256QAM	NOTE1	DFT-s-OFDM QPSK	NOTE2
NOTE 1: The specific configuration of downlink RB allocation is defined in Table 7.3.2.4.1-2. NOTE 2: The specific configuration of uplink RB allocation is defined in Table 7.3.2.4.1-3.				

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.4.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 7.4.4.3.

7.4.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.4.4.1-1. Since the UL has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
3. Set the Downlink signal level for θ-polarization to the value as defined in Table 7.4.5-1.
4. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE) for the UE Rx beam selection to complete.
5. Send Uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power is within [TBD] dB of the target power level in Table 7.4.5-1, for at least the duration of the throughput measurement.
6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Rx Only.
7. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.
8. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.
9. Repeat steps from 3 to 8, for the downlink signal from φ-polarization.
10. Compare the results for both the θ-polarization and φ-polarization against the requirement. If either result meets the requirements, pass the UE.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.4.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A with parameters specified in Tables 7.4.5-1.

Table 7.4.5-1: Maximum input level

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration	dBm	-51 (NOTE 2,3) for band n257, n258 and n261 -59 (NOTE 2,3) for band n260 -53 (NOTE 3,4) for band n257, n258 and n261 -61 (NOTE 3,4) for band n260			
NOTE 1: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in subclause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2. NOTE 2: Reference measurement channel is specified in Annex A.3.3.2: QPSK, R=1/3 variant with one sided dynamic OCNG Pattern as described in Annex A. NOTE 3: The test requirements deviate from minimum requirements by 26dB relaxation for 24.25 ~ 29.5 GHz and 34 dB relaxation for 37 ~ 40 GHz. NOTE 4: Reference measurement channel is specified in Annex A.3.3.5: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern as described in Annex A.					

7.4A Maximum input level for CA

7.4A.0 Minimum Conformance Requirements

7.4A.0.1 Maximum input level for Intra-band contiguous CA

For intra-band contiguous carrier aggregation the input level is defined as the cumulative received power, summed over the transmission bandwidth configurations of each active DL CC. All DL CCs shall be active throughout the test. The input power shall be distributed among the active DL CCs so their PSDs are aligned with each other. At the maximum input level, the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier. The minimum requirement is specified in Table 7.4A.0.1-1.

The maximum input level is defined as a directional requirement. The requirement is verified in beam locked mode in the direction where peak gain is achieved. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.4A.0.1-1: Maximum input level for Intra-band contiguous CA

Rx Parameter	Units	Level
Power summed over transmission bandwidth configurations of all active DL CCs	dBm	-25 (NOTE 2) -27 (NOTE 3)
NOTE 1: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2. NOTE 2: Reference measurement channel in each CC is specified in Annex A.3.3.2: QPSK, R=1/3 variant with one sided dynamic OCNG Pattern as described in Annex A. NOTE 3: Reference measurement channel is specified in Annex A.3.3.5: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern as described in Annex A.		

7.4A.0.2 Maximum input level for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation the requirement of clause 7.4A.0.1 applies.

7.4A.0.3 Maximum input level for inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the maximum input level is defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in clause 7.4 for each component carrier while all downlink carriers are active.

7.4A.1 Maximum input level for CA (2DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.
- Relaxation of DL power for 256 QAM is FFS.
- Test for DL intra-band non-contiguous configurations with UL intra-band contiguous configuration is FFS.
- Test Config and Test requirements for Inter-band CA tests is FFS

7.4A.1.1 Test purpose

Same test purpose as in clause 7.4.1.

7.4A.1.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 2DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 2DL CA.

7.4A.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.1.4 Test description

7.4A.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.4A.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4A.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes			For intra-band contiguous CA: Mid range For intra-band non-contiguous CA: FFS. For inter-band CA: FFS	
Test CA Bandwidth combination as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE			Maximum aggregated BW (contiguous CA) or Maximum cumulative aggregated BW (non-contiguous CA)	
Test SCS as specified in Table 5.3.5-1			120kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2, NOTE 3)
2	CP-OFDM 256QAM	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2, NOTE 3)
NOTE 1: Full RB allocation shall be used per each SCS and component carrier as specified in Table 7.3A.2.1.4.1-2. NOTE 2: REFSENS refers to Table 7.3A.2.1.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW. NOTE 3: Use single carrier UL when testing Maximum input level for CA. The PCC is located on the CC with the lowest carrier frequency.				

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.4A.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 7.4A.1.4.3.

7.4A.1.4.2 Test Procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 7.4A.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321[28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.2).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4A.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.4A.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
6. Set the Downlink signal level for θ-polarization to the value as defined in Table 7.4A.1.5-1.
7. Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE) for the UE Rx beam selection to complete.

8. Send Uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power is within [TBD] dB of the target power level in Table 7.4A.1.5-1, for at least the duration of the throughput measurement.

9. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Rx Only.

10. For each component carrier, ensure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

12. Repeat steps from 3 to 8, for the downlink signal from φ-polarization.

13. Compare the results for both the θ-polarization and φ-polarization against the requirement. If either result meets the requirements, pass the UE.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.4A.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.4A.1.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A with parameters specified in Tables 7.4A.1.5-1.

Table 7.4A.1.5-1: Maximum input level for Intra-band contiguous and Intra-band non-contiguous CA

Rx Parameter	Units	Level
Power summed over transmission bandwidth configurations of all active DL CCs	dBm	[-51 (NOTE 2,3) for band n257, n258 and n261 -59 (NOTE 2,3) for band n260] [-53 (NOTE 3,4) for band n257, n258 and n261 -61 (NOTE 3,4) for band n260]
NOTE 1: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in subclause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2. NOTE 2: Reference measurement channel in each CC is specified in Annex A.3.3.2: QPSK, R=1/3 variant with one sided dynamic OCNG Pattern as described in Annex A. [NOTE 3: The test requirements deviate from minimum requirements by 26dB relaxation for 24.25 ~ 29.5 GHz and 34 dB relaxation for 37 ~ 40 GHz.] NOTE 4: Reference measurement channel is specified in Annex A.3.3.5: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern as described in Annex A.		

7.4A.2 Maximum input level for CA (3DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.2.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.2.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 3DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 3DL CA.

7.4A.2.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.2.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.2.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4A.3 Maximum input level for CA (4DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.3.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.3.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 4DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 4DL CA.

7.4A.3.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.3.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.3.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4A.4 Maximum input level for CA (5DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.4.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.4.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 5DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 5DL CA.

7.4A.4.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.4.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.4.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4A.5 Maximum input level for CA (6DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.5.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.5.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 6DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 6DL CA.

7.4A.5.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.5.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.5.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4A.6 Maximum input level for CA (7DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.6.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.6.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 7DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 7DL CA.

7.4A.6.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.6.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.6.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4A.7 Maximum input level for CA (8DL CA)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Measurement uncertainty and test requirement are FFS.
- UL power level configuration is TBD.

7.4A.7.1 Test purpose

Same test purpose as in clause 7.4A.1.1.

7.4A.7.2 Test applicability

This test case applies to all types of NR UEs release 15 and forward that support FR2 8DL CA.

The minimum conformance requirements in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed. Thus the test case will not be tested as part of UE conformance testing.

NOTE: This does not preclude the test from being used for R&D or other purposes if deemed useful to all types of NR UEs release 15 and forward that support FR2 8DL CA.

7.4A.7.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 7.4A.0.

7.4A.7.4 Test description

Same test description as in clause 7.4A.1.4.

7.4A.7.5 Test requirement

The test requirement is the same as in clause 7.4A.1.5.

7.4D Maximum input level for UL MIMO

The normative reference for this requirement is TS 38.101-2 [3] clause 7.4D.

No test case details are specified. Given UE's Rx performance would not be impacted by the Tx configuration on TDD bands, the requirements in this test case can be well covered in 7.4 and don't need to be tested again.

7.5 Adjacent channel selectivity

Editor's note: The following aspects are either missing or not yet determined:

- Measurement Uncertainty is FFS for power class 1,2 and 4.
- The minimum conformance requirements for Case 2 in this test case are not testable due to maximum input level unachievable in IFF OTA test setup. Other test setups have not been analysed.

7.5.1 Test purpose

Adjacent channel selectivity tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel, under conditions of ideal propagation and no added noise.

7.5.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.5.3 Minimum conformance requirements

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

The requirement applies at the Radiated Interface Boundary (RIB) when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

The UE shall fulfil the minimum requirement specified in Table 7.5.3-1 for all values of an adjacent channel interferer up to –25 dBm. However, it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.3-2 and Table 7.5.3-3 where the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2, with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.5.3-1: Adjacent channel selectivity

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
ACS for band n257, n258, n261	dB	23	23	23	23
ACS for band n259, n260	dB	22	22	22	22

Table 7.5.3-2: Test parameters for adjacent channel selectivity, Case 1

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB			
$P_{Interferer}$ for band n257, n258, n261	dBm	REFSENS + 35.5 dB	REFSENS +35.5dB	REFSENS +35.5dB	REFSENS +35.5dB
$P_{Interferer}$ for band n259, n260	dBm	REFSENS + 34.5 dB	REFSENS +34.5dB	REFSENS +34.5dB	REFSENS +34.5dB
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 NOTE 3	100 / -100 NOTE 3	200 / -200 NOTE 3	400 / -400 NOTE 3

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3 with one sided dynamic OCNG Pattern as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The REFSENS power level is specified in subclause 7.3.2.3, which are applicable to different UE power classes.
NOTE 3: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to (CEIL($|F_{Interferer}|$/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 4: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

Table 7.5.3-3: Test parameters for adjacent channel selectivity, Case 2

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz

Power in Transmission Bandwidth Configuration for band n257, n258, n261	dBm	-46.5	-46.5	-46.5	-46.5
Power in Transmission Bandwidth Configuration for band n259, n260	dBm	-45.5	-45.5	-45.5	-45.5
$P_{Interferer}$	dBm	-25			
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 NOTE 2	100 / -100 NOTE 2	200 / -200 NOTE 2	400 / -400 NOTE 2

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3 with one sided dynamic OCNG Pattern TDD as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 3: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

The normative reference for this requirement is TS 38.101-2 [3] clause 7.5.

7.5.4 Test description

7.5.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and subcarrier spacing, are shown in Table 7.5.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.5.4.1-1: Test Configuration

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1	50 MHz, 100 MHz			
Test SCS as specified in Table 5.3.5-1	120 kHz			
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of each RB allocation is defined in Table 7.3.2.4.1-1.				

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.2 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.5.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 7.5.4.3.

7.5.4.2 Test procedure

1. Set the UE in the Rx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
2. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
3. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5.4.1-1. Since the UL has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
4. Send Uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5.5-2 (Case 1) or Table 7.5.5-3 (Case 2), for at least the duration of the throughput measurement, where:
    - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW.
    - Uplink power control window size = 1dB (UE power step size) + 1dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-2 [3], Table 6.3.4.3-2 and is 1dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.3-1.
5. Perform Blocking measurement procedure as stated in Annex K.1.8 using Downlink signal level and Interferer signal level as defined in Table 7.5.5-2 (Case 1). Modulated interferer signal characteristics as defined in Annex D with frequency below the wanted signal. Measure throughput for a duration sufficient to achieve statistical significance according to Annex H.2.
6. Repeat step 5 using an interfering signal frequency above the wanted signal in Case 1.
7. Perform Blocking measurement procedure as stated in Annex K.1.8 using Downlink signal level and Interferer signal level as defined in Table 7.5.5-3 (Case 2). Modulated interferer signal characteristics as defined in Annex D with frequency below the wanted signal. Measure throughput for a duration sufficient to achieve statistical significance according to Annex H.2.
8. Repeat step 7 using an interfering signal frequency above the wanted signal in Case 2.
9. Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

7.5.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.5.5 Test requirements

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A, under the conditions specified in Table 7.5.5-2 and also under the conditions specified in Table 7.5.5-3.

Table 7.5.5-1: Adjacent channel selectivity

		Channel bandwidth			
Rx Parameter	**Units**	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**
ACS for band n257, n258, n261	dB	23	23	23	23
ACS for band n260	dB	22	22	22	22

Table 7.5.5-2: Test parameters for adjacent channel selectivity, Case 1

Rx Parameter	**Units**	**Channel bandwidth**			
		50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
Power in Transmission Bandwidth Configuration for band n257, n258, n261	dBm	REFSENS + 14 dB			
Power in Transmission Bandwidth Configuration for band n260	dBm	REFSENS + 14 - 1.8 dB NOTE 4	REFSEN + 14 - 4.8 dB NOTE 4	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$ for band n257, n258, n261	dBm	REFSENS + 35.5 dB	REFSENS +35.5dB	REFSENS +35.5dB NOTE 5	REFSENS +35.5dB NOTE 5
$P_{Interferer}$ for band n260	dBm	REFSENS + 34.5 - 1.8 dB NOTE 4	REFSENS +34.5 - 4.8 dB NOTE 4	REFSENS +34.5dB NOTE 5	REFSENS +34.5dB NOTE 5
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 NOTE 3	100 / -100 NOTE 3	200 / -200 NOTE 3	400 / -400 NOTE 3

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3 with one sided dynamic OCNG Pattern as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The REFSENS power level is specified in subclause 7.3.2.5.
NOTE 3: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to $(\lceil |F_{Interferer}|/SCS \rceil + 0.5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 4: Core requirement cannot be tested due to testability issue and test requirement for wanted signal and interferer includes relaxation to achieve feasible interferer power level.
NOTE 5: Core requirement cannot be tested due to testability issue.
NOTE 6: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

Table 7.5.5-3: Test parameters for adjacent channel selectivity, Case 2

Rx Parameter	**Units**	**Channel bandwidth**			
		50 MHz	**100 MHz**	**200 MHz**	**400 MHz**

Power in Transmission Bandwidth Configuration for band n257, n258, n261	dBm	-46.5	-46.5	-46.5	-46.5
Power in Transmission Bandwidth Configuration for band n260	dBm	-45.5	-45.5	-45.5	-45.5
$P_{Interferer}$	dBm	-25			
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 NOTE 2	100 / -100 NOTE 2	200 / -200 NOTE 2	400 / -400 NOTE 2

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3 with one sided dynamic OCNG Pattern TDD as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to $(\lceil |F_{Interferer}|/SCS \rceil + 0.5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 3: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

7.5A Adjacent channel selectivity for CA

7.5A.0 Minimum Conformance Requirements

7.5A.0.1 Adjacent channel selectivity for Intra-band contiguous CA

For intra-band contiguous carrier aggregation, the SCC(s) shall be configured at nominal channel spacing to the PCC. The input power shall be distributed among the active DL CCs so their PSDs are aligned with each other. The UE shall fulfil the minimum requirement specified in Table 7.5A.0.1-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.5A.0.1-1: Adjacent channel selectivity for intra-band contiguous CA

Operating band	Units	Adjacent channel selectivity / CA bandwidth class
		All CA bandwidth class
n257, n258, n261	dB	23
n259, n260	dB	22

Table 7.5A.0.1-2: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 1

Rx Parameter	Units	All CA bandwidth Classes
Pw in Transmission Bandwidth Configuration, per CC		REFSENS + 14 dB
$P_{Interferer}$ for band n257, n258, n261	dBm	Aggregated power + 21.5
$P_{Interferer}$ for band n259, n260	dBm	Aggregated power + 20.5
$BW_{Interferer}$	MHz	$BW_{Channel\_CA}$
$F_{Interferer}$ (offset)	MHz	+ $BW_{channel\ CA}$

		/ - $BW_{channel\ CA}$ NOTE 3

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.3.2 with one sided dynamic OCNG Pattern as described in Annex A and set-up according to Annex C.
NOTE 2: The $F_{interferer}$ (offset) is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal
NOTE 3: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.
NOTE 4: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

Table 7.5A.0.1-3: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 2

Rx Parameter	Units	All CA bandwidth classes
Pw in Transmission Bandwidth Configuration, aggregated power for band n257, n258, n261	dBm	- 46.5
Pw in Transmission Bandwidth Configuration, aggregated power for band n259, n260	dBm	- 45.5
$P_{interferer}$	dBm	- 25
$BW_{Interferer}$	MHz	$BW_{Channel\_CA}$
$F_{Interferer}$ (offset)	MHz	+ $BW_{channel\ CA}$ / - $BW_{channel\ CA}$ NOTE 3

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The $F_{interferer}$ (offset) is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal
NOTE 3: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.
NOTE 4: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

7.5A.0.2 Adjacent channel selectivity for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with two component carriers, two different requirements apply for out-of-gap and in-gap. For out-of-gap, the UE shall meet the requirements for each component carrier as specified in clauses 7.5. For in-gap, the requirement applies if the following minimum gap condition is met:

$$\Delta f_{ACS} \geq BW_1/2 + BW_2/2 + \max(BW_1, BW_2),$$

where Δf_{ACS} is the frequency separation between the centre frequencies of the component carriers and BW_k are the channel bandwidths of carrier k, k = 1,2.

If the minimum gap condition is met, the UE shall meet the requirements specified in clauses 7.5 for each component carrier considered. The respective channel bandwidth of the component carrier under test will be used in the parameter calculations of the requirement. In case of more than two component carriers, the minimum gap condition is computed for any pair of adjacent component carriers following the same approach as the two component carriers. The in-gap requirement for the corresponding pairs shall apply if the minimum gap condition is met.

For every component carrier to which the requirements apply, the UE shall meet the requirement with one active interferer signal (in-gap or out-of-gap) while all downlink carriers are active and the input power shall be distributed among the active DL CCs so their PSDs are aligned with each other.

7.5A.0.3 Adjacent channel selectivity for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the adjacent channel requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in clause 7.5 for each component carrier while all downlink carriers are active.

7.5A.1 Adjacent channel selectivity for CA (2DL CA)

FFS

7.5A.2 Adjacent channel selectivity for CA (3DL CA)

FFS

7.5A.3 Adjacent channel selectivity for CA (4DL CA)

FFS

7.5A.4 Adjacent channel selectivity for CA (5DL CA)

FFS

7.5A.5 Adjacent channel selectivity for CA (6DL CA)

FFS

7.5A.6 Adjacent channel selectivity for CA (7DL CA)

FFS

7.5A.7 Adjacent channel selectivity for CA (8DL CA)

FFS

7.5D Adjacent channel selectivity for UL MIMO

The normative reference for this requirement is TS 38.101-2 [3] clause 7.5D.

No test case details are specified. Given UE's Rx performance would not be impacted by the Tx configuration on TDD bands, the requirements in this test case can be well covered in 7.5 and don't need to be tested again.

7.6 Blocking characteristics

7.6.1 General

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occurs.

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

7.6.2 In-band blocking

In-band blocking is a measure of a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an interferer at a given frequency offset from the centre frequency of the assigned channel.

Editor's note: The following aspects are either missing or not yet determined:

- Measurement uncertainty is FFS for power class 1, 2 and 4.

7.6.2.1 Test purpose

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the spectrum equivalent to twice the channel bandwidth below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

7.6.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.6.2.3 Minimum conformance requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.6.2.3-1: In-band blocking requirements

Rx parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14dB			
$BW_{Interferer}$	MHz	50	100	200	400
$P_{Interferer}$ for bands n257, n258, n261	dBm	REFSENS + 35.5 dB	REFSENS + 35.5 dB	REFSENS + 35.5 dB	REFSENS + 35.5 dB
$P_{Interferer}$ for band n260	dBm	REFSENS + 34.5 dB	REFSENS + 34.5 dB	REFSENS + 34.5 dB	REFSENS + 34.5 dB
$F_{Ioffset}$	MHz	≤ -100 & ≥ 100 NOTE 5	≤ -200 & ≥ 200 NOTE 5	≤ -400 & ≥ 400 NOTE 5	≤ -800 & ≥ 800 NOTE 5
$F_{Interferer}$	MHz	F_{DL_low} + 25 to F_{DL_high} - 25	F_{DL_low} + 50 to F_{DL_high} - 50	F_{DL_low} + 100 to F_{DL_high} - 100	F_{DL_low} + 200 to F_{DL_high} - 200

NOTE 1: The interferer consists of the Reference measurement channel specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) and set-up according to Annex C.
NOTE2: The REFSENS power level is specified in Section 7.3.2.3, which are applicable according to different UE power classes.
NOTE 3: The wanted signal consists of the reference measurement channel specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) and set-up according to Annex C.
NOTE 4: $F_{Ioffset}$ is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal.
NOTE 5: The absolute value of the interferer offset $F_{Ioffset}$ shall be further adjusted (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 6: $F_{Interferer}$ range values for unwanted modulated interfering signals are interferer centre frequencies.
NOTE 7: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

The normative reference for this requirement is TS 38.101-2 [10] clause 7.6.2.

7.6.2.4 Test description

7.6.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.6.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2. The details of the OCNG patterns used are specified in Annex A.5.

Table 7.6.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1	50 MHz, 100 MHz			
Test SCS as specified in Table 5.3.5-1	120 kHz			
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of each RB allocation is defined in Table 7.3.2.4.1-1.				

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.2 for TE diagram and Figure A.3.4.1.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C, and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.6.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38-508-1 [10] clause 4.5. Message content are defined in clause 7.6.2.4.3.

7.6.2.4.2 Test procedure

1. Set the UE in the Rx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.2. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Rx beam selection to complete.
2. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
3. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
4. Send Uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6.2.5-1, for at least the duration of the throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW.

- Uplink power control window size = 1dB (UE power step size) + 1dB (UE power step tolerance)) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-2 [3], Table 6.3.4.3-2 and is 1dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.3-1.

5. Perform Blocking measurement procedure as stated in Annex K.1.8 using Downlink signal level and Interferer signal level as defined in Table 7.6.2.5-1. Modulated interferer signal characteristics as defined in Annex D. Measure throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

6. Repeat step 5 using interfering signals specified in 7.6.2.5-1. The ranges are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the centre frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to $F_{Interferer}$ range limit defined at the corresponding band edge.

NOTE 1: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.2.

Table 7.6.2.4.2-1: Example for interferer frequencies

	Lower frequency	Upper frequency
Band n257	26500.00 MHz	29500.00 MHz
Band n257 Midrange	27999.96 MHz	
SCS	120 kHz	
CHBW	100 MHz	
Interferer (1st :most inner)	FFS	FFS
Interferer (2nd)	FFS	FFS
:	:	:
Interferer (13th)	FFS	FFS
Interferer (last step) NOTE 1	FFS	FFS
Outer limit for in band blocking	FFS	FFS
Number of test frequencies	14	14
NOTE 1: Adjusted interferer frequency in the last step will be out of outer limit but should be tested.		

7.6.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.6.2.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A with parameters specified in Table 7.6.2.5-1.

Table 7.6.2.5-1: In-band blocking test requirement

Rx parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration for bands n257, n258, n261	dBm	REFSENS + 14dB			
Power in Transmission Bandwidth Configuration for band n260	dBm	REFSENS + 14 - 1.8 dB NOTE 7	REFSENS + 14 - 4.8 dB NOTE 7	REFSENS + 14 dB	REFSENS + 14 dB
$BW_{Interferer}$	MHz	50	100	200	400
$P_{Interferer}$ for bands n257, n258, n261	dBm	REFSENS + 35.5 dB	REFSENS + 35.5 dB	REFSENS + 35.5 dB NOTE 8	REFSENS + 35.5 dB NOTE 8
$P_{Interferer}$ for band n260	dBm	REFSENS + 34.5 - 1.8 dB NOTE 7	REFSENS + 34.5 - 4.8 dB NOTE 7	REFSENS + 34.5 dB NOTE 8	REFSENS + 34.5 dB NOTE 8
$F_{loffset}$	MHz	≤ -100 & ≥ 100 NOTE 5	≤ -200 & ≥ 200 NOTE 5	≤ -400 & ≥ 400 NOTE 5	≤ -800 & ≥ 800 NOTE 5
$F_{Interferer}$	MHz	F_{DL_low} + 25 to F_{DL_high} - 25	F_{DL_low} + 50 to F_{DL_high} - 50	F_{DL_low} + 100 to F_{DL_high} - 100	F_{DL_low} + 200 to F_{DL_high} - 200

NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1.TDD as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 2: The REFSENS power level is specified in Section 7.3.2.5, which are applicable according to different UE power classes.
NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG pattern OP.1.TDD as described in Annex A.5.2.1 and set-up according to Annex C.
NOTE 4: $F_{loffset}$ is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal.

NOTE 5: The absolute value of the interferer offset $F_{loffset}$ shall be further adjusted (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.
NOTE 6: $F_{Interferer}$ range values for unwanted modulated interfering signals are interferer centre frequencies.
NOTE 7: Core requirement cannot be tested due to testability issue and test requirement for wanted signal and interferer includes relaxation to achieve feasible interferer power level.
NOTE 8: Core requirement cannot be tested due to testability issue.
NOTE 9: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.

7.6.3 Void

7.6A Blocking characteristics for CA

7.6A.1 General

FFS

7.6A.2 In-band blocking for CA

7.6A.2.0 Minimum Conformance Requirements

7.6A.2.0.1 In-band blocking for Intra-band contiguous CA

In-band blocking for Intra-band contiguous CAFor intra-band contiguous carrier aggregation, the SCC(s) shall be configured at nominal channel spacing to the PCC. The input power shall be distributed among the active DL CCs so their PSDs are aligned with each other. The UE shall fulfil the minimum requirement specified in Table 7.6A.2.0.1-1 for in the presence of an interferer at a given frequency offset from the centre frequency of the assigned channel and an interferer power shall not exceed -25 dBm. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.6A.2.0.1-1: In band blocking minimum requirements for intra-band contiguous CA

Rx Parameter	Units	All CA bandwidth classes
Power in Transmission Bandwidth Configuration, per CC		REFSENS + 14 dB
Pinterferer for band n257, n258, n261	dBm	Aggregated power + 21.5
Pinterferer for band n260	dBm	Aggregated power + 20.5
$BW_{Interferer}$	MHz	$BW_{Channel\_CA}$
$F_{Ioffset}$	MHz	+2*$BW_{Channel\_CA}$ / -2*$BW_{Channel\_CA}$ NOTE 5
$F_{Interferer}$	MHz	F_{DL_low} + 0.5*$BW_{Channel\_CA}$ To F_{DL_high} - 0.5*$BW_{Channel\_CA}$
NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. and set-up according to Annex C. NOTE 2: The REFSENS power level is specified in clause 7.3.2. NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 QPSK, R=1/3 with one sided dynamic OCNG pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C. NOTE 4: The $F_{Interferer}$ (offset) is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal. NOTE 5: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to (CEIL(|$F_{Interferer}$|/SCS) + 0.5)*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier. NOTE 6: $F_{Interferer}$ range values for unwanted modulated interfering signals are interferer centre frequencies. NOTE 7: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.3.1-2.		

7.6A.2.0.2 In-band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with two component carriers, the requirement applies to out-of-gap and in-gap. For out-of-gap, the UE shall meet the requirements for each component carrier with parameters as specified in Table 7.6.2.3-1. The requirement associated to the maximum channel between across the component carriers is selected. For in-gap, the requirement shall apply if the following minimum gap condition is met:

$$\Delta f_{IBB} \geq 0.5(BW_1 + BW_2) + 2\max(BW_1, BW_2),$$

where Δf_{IBB} is the frequency separation between the centre frequencies of the component carriers and BW_k are the channel bandwidths of carrier k, k = 1,2.

If the minimum gap condition is met, the UE shall meet the requirement specified in Table 7.6.2.3-1 for each component carrier. The respective channel bandwidth of the component carrier under test will be used in the parameter calculations of the requirement. In case of more than two component carriers, the minimum gap condition is computed for any pair of adjacent component carriers following the same approach as the two component carriers. The in-gap requirement for the corresponding pairs shall apply if the minimum gap condition is met. For every component carrier to which the requirements apply, the UE shall meet the requirement with one active interferer signal (in-gap or out-of-gap) while all downlink carriers are active and the input power shall be distributed among the active DL CCs so their PSDs are aligned with each other.

7.6A.2.0.3 In-band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the in-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in clause 7.6.2 for each component carrier while all downlink carriers are active.

7.6A.2.1 In-band blocking for CA (2DL CA)

FFS

7.6A.2.2 In-band blocking for CA (3DL CA)

FFS

7.6A.2.3 In-band blocking for CA (4DL CA)

FFS

7.6A.2.4 In-band blocking for CA (5DL CA)

FFS

7.6A.2.5 In-band blocking for CA (6DL CA)

FFS

7.6A.2.6 In-band blocking for CA (7DL CA)

FFS

7.6A.2.7 In-band blocking for CA (8DL CA)

FFS

7.6D Blocking characteristics for UL MIMO

The normative reference for this requirement is TS 38.101-2 [3] clause 7.6D.

No test case details are specified. Given UE's Rx performance would not be impacted by the Tx configuration on TDD bands, the requirements in this test case can be well covered in 7.6 and don't need to be tested again.

7.7 Void

7.8 Void

7.9 Spurious emissions

Editor's note: Following aspects are either missing or not yet determined:

- The testability of this test case is pending further analysis on relaxation of the requirement for band other than n257, n258, n260 and n261.

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, and 4.

- Connection diagram between SS and UE in TS 38.508-1 [10] Annex A is FFS.

- Test procedure only includes the testing of smartphone and is FFS for laptop and FWA.

7.9.1 Test purpose

Test verifies the UE's spurious emissions meet the requirements described in clause 7.9.3.

Excess spurious emissions increase the interference to other systems.

7.9.2 Test applicability

This test case applies to all types of *NR* UE release 15 and forward.

7.9.3 Minimum conformance requirements

The spurious emissions power is the power of emissions generated or amplified in a receiver. The spurious emissions power level is measured as TRP.

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.3-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 7.9.3-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	NOTE
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	1
1GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1.			

The normative reference for this requirement is TS 38.101-2 [3] clause 7.9.

7.9.4 Test description

7.9.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table

7.9.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.9.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [10] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1	Low range, Mid range, High range			
Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1	Highest			
Test SCS as specified in Table 5.3.5-1	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	-	-	-	-
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1.				

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, [Figure TBD] for TE diagram and [Figure TBD] for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C , and uplink signals according to Annex G.
4. The DL and UL Reference Measurement channels are set according to Table 7.9.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message content are defined in clause 7.9.4.3.

7.9.4.2 Test procedure

1. Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 to mount the DUT inside the QZ.
2. If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.
3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1 using the uplink configuration in section 6.2.1.1. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 3) for the UE Tx beam selection to complete.
4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.
5. Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K if the re-positioning concept is applied (NOTE 4). Step (a) is optional and applicable only if SNR (test requirement level in Table 7.9.5-1 minus offset value minus noise floor of the test system) ≥ 0 dB is guaranteed.

   (a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K, using coarse TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 7.9.5-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 7.9.5-1 may be applied. The measurement period shall capture the active time slots. For each spurious emission frequency with coarse TRP identified to be less than an offset dB from the TRP limit according to Table 7.9.5-1, continue with fine TRP procedures according to step (b).

The offset value shall be the TRP measurement uncertainty at 95% confidence level including the effect of coarse grid measurement uncertainty element, excluding the influence of noise. Different coarse TRP grids and corresponding offset values may be used for different frequencies. The coarse TRP grid and offset values used shall be recorded in the test report.

Table 7.9.4.2-1: Typical offset values for coarse TRP measurement step 7(a)

Grid	Frequency Range	Offset Value
Constant Density	6 GHz ≤ f < 12.75 GHz	5.25
	12.75 GHz ≤ f < 23.45GHz	5.21
	23.45 GHz ≤ f < 40.8GHz	5.49
	40.8 GHz ≤ f < 66GHz	7.31
	66 GHz ≤ f ≤ 80GHz	7.61
Constant-Step Size	6 GHz ≤ f < 12.75 GHz	5.38
	12.75 GHz ≤ f < 23.45GHz	5.34
	23.45 GHz ≤ f < 40.8GHz	5.62
	40.8 GHz ≤ f < 66GHz	7.43
	66 GHz ≤ f ≤ 80GHz	7.73
NOTE 1: These offset values are the upper limit values when fine TRP measurement uncertainty of the test system is same as maximum test system uncertainty in Annex F and when using the coarse measurement grid with minimum number of points as specified in Table M.4.5-3. NOTE 2: It is allowed to use the offset values derived based on test system's actual measurement uncertainty budget and denser measurement grid as specified in Table M.4.5-3.		

(b) Measure fine TRP measurements according to procedures in Annex K, using fine TRP measurement grid selection criteria as per Table M.4.5-3 in Annex M, for each of the spurious emission frequency identified in step (a). Apply a measurement bandwidth according to Table 7.9.5-1.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The frequency range defined in Table 7.9.5-1 may be split into ranges. For each range a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges must pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in Annex K.1.1.

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

NOTE 5: The coarse TRP measurement grid and corresponding offset dB value referred in step 5(a) above, for some valid grids can be found in TR 38.903[20] section B.18.

7.9.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

7.9.5 Test requirement

The measured spurious emissions derived in step 5, shall not exceed the maximum level specified in Table 7.9.5-1.

Table 7.9.5-1: General receiver spurious emission requirements (Band n257, n258, n260, n261)

Frequency range	Measurement bandwidth	Maximum level	NOTE
6GHz ≤ f < 20GHz	1 MHz	-47 + 10.2 dBm	1
20GHz ≤ f < 40GHz	1 MHz	-47 + 17.2 dBm	1
40GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 + 33.1 dBm	1
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1.			

Table 7.9.5-2: Void

7.10 Void