6.3.4 Power control

6.3.4.1 General

The requirements on power control accuracy apply under normal conditions.

6.3.4.2 Absolute power tolerance

6.3.4.2.1 Test purpose

To verify the ability of the UE transmitter to set its initial output power to a specific value at the start of a contiguous transmission or non-contiguous transmission with a long transmission gap, i.e. transmission gap is larger than 20ms.

6.3.4.2.2 Test applicability

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

6.3.4.2.3 Minimum conformance requirements

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame(1ms) at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. The tolerance includes the channel estimation error.

The minimum requirement specified in Table 6.3.4.2.3-1 apply in the power range bounded by the minimum output power as specified in sub-clause 6.3.1 and the maximum output power as specified in sub-clause 6.2.1.

Table 6.3.4.2.3-1: Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3.4.2

6.3.4.2.4 Test description

6.3.4.2.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in clause 6.2D.3.4.1 for NS_03, NS_03U, NS_04 and NS_35. 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 6.3.4.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 2)		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest		
Test SCS as specified in Table 5.3.5-1		Lowest, Highest		
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation (NOTE 1)**
1	N/A for Absolute power tolerance test case		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. NOTE 2: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3.4.2.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.3.4.2.4.3. Note that PDCCH DCI format 0_1 sent after resetting uplink power with RRC Connection Reconfiguration, should have TPC command 0dB.

6.3.4.2.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 with TPC command 0dB for C_RNTI to schedule the UL RMC according to Table 6.3.4.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Measure the initial output power of the first sub-frame (1ms) of UE PUSCH first transmission.
3. Repeat for the two test points as indicated in section 6.3.4.2.4.3. The timing of the execution between the two test points shall be larger than 20ms.

6.3.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.3.4.2.4.3-1: UplinkPowerControlCommon: Test point 1

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-114	Test point 1 to verify a UE relative low initial power transmission	
}			

Table 6.3.4.2.4.3-2: UplinkPowerControlCommon: Test point 2

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-100	Test point 2 to verify a UE relative high initial power transmission	
}			

Table 6.3.4.2.4.3-3: *Void*

Table 6.3.4.2.4.3-4: ServingCellConfigCommon

Derivation Path: 38.508-1[5], Table 4.6.3-168			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfigCommon ::= SEQUENCE {			
ss-PBCH-BlockPower	18		SCS_15kHz
	21		SCS_30kHz
}			

Condition	Explanation
SCS_15kHz	SCS=15kHz for SS/PBCH block
SCS_30kHz	SCS=30kHz for SS/PBCH block

6.3.4.2.5 Test requirement

The requirement for the power measured in step (2) of the test procedure is not to exceed the values specified in Table 6.3.4.2.5-1 and 6.3.4.2.5-2.

Table 6.3.4.2.5-1: Absolute power tolerance: test point 1

		Channel bandwidth / expected output power (dBm)													
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Expected Measured power	SCS15	-17.6	-14.4	-12.6	-11.3	-10.4	-9.6	-8.3	-7.8	-7.3	N/A	N/A	N/A	N/A	N/A
	SCS30	-18.2	-14.8	-12.8	-11.5	-10.5	-9.7	-8.3	-7.9	-7.4	-6.5	-5.8	-5.2	-4.7	-4.2
	SCS60		-15.2	-13	-11.8	-10.7	-9.8	-8.5	-8	-7.5	-6.6	-5.9	-5.3	-4.8	-4.3
Power tolerance		± (9+TT)dB													
Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3.															

Table 6.3.4.2.5-2: Absolute power tolerance: test point 2

		Channel bandwidth / expected output power (dBm)													
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Expected Measured power	SCS15	-3.6	0.4	1.4	2.7	3.6	4.4	5.7	6.2	6.7	N/A	N/A	N/A	N/A	N/A
	SCS30	-4.2	-0.8	1.2	2.5	3.5	4.3	5.7	6.2	6.6	7.5	8.2	8.8	9.3	9.8
	SCS60	N/A	-1.2	1	2.2	3.3	4.2	5.5	6	6.5	7.4	8.1	8.7	9.2	9.7
Power tolerance		± (9+TT)dB													
Note 1: The higher power limit shall not exceed the maximum output power requirements defined in sub-clause 6.2.1.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3.															

Table 6.3.4.2.5-3: Test Tolerance

	f ≤ 3.0GHz	**3.0GHz < f ≤ 4.2GHz**	**4.2GHz < f ≤ 6.0GHz**
BW ≤ 40MHz	1.0 dB	1.4 dB	1.4 dB
40MHz < BW ≤ 100MHz	1.4 dB	1.4 dB	1.4 dB

6.3.4.3 Relative power tolerance

6.3.4.3.1 Test purpose

To verify the ability of the UE transmitter to set its output power in a target sub-frame(1ms) relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is less than or equal to 20ms.

6.3.4.3.2 Test applicability

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

6.3.4.3.3 Minimum conformance requirement

The UE shall meet the requirements specified in Table 6.3.4.3.3-1.

The minimum requirements specified in Table 6.3.4.3.3-1 apply when the power of the target and reference sub-frames are within the power range bounded by the minimum output power as defined in sub-clause 6.3.1 and the measured P_{UMAX} as defined in sub-clause 6.2.1.

To account for RF Power amplifier mode changes, 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.1 and 6.2.1, respectively. For those exceptions, the power tolerance limit is a maximum of ± 6.0 dB in Table 6.3.4.3.3-1.

Table 6.3.4.3.3-1: Relative Power Tolerance

Power step ΔP (Up or down) (dB)	All combinations of PUSCH and PUCCH transitions (dB)	All combinations of PUSCH/PUCCH and SRS transitions between sub-frames (dB)	PRACH (dB)
ΔP < 2	± 2.0 (NOTE)	± 2.5	± 2.0
2 ≤ ΔP < 3	± 2.5	± 3.5	± 2.5
3 ≤ ΔP < 4	± 3.0	± 4.5	± 3.0
4 ≤ ΔP ≤ 10	± 3.5	± 5.5	± 3.5
10 ≤ ΔP < 15	± 4.0	± 7.0	± 4.0
15 ≤ ΔP	± 5.0	± 8.0	± 5.0
NOTE: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods: for a power step ΔP ≤ 1 dB, the relative power tolerance for transmission is ± 0.7 dB.			

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3.4.3.

6.3.4.3.4 Test description

6.3.4.3.4.1 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, 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3.4.3.4.1-1. 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 6.3.4.3.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.3.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test Parameters				
Ch BW	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB Allocation**	**Modulation**	**RB allocation (NOTE 1)**
5MHz	N/A for Relative power tolerance test case		DFT-s-OFDM QPSK	See Table 6.3.4.3.5-1 See Table 6.3.4.3.5-2 See Table 6.3.4.3.5-7
10MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
15MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
20MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
25MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
30MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
40MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
45MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
50MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-3 See Table 6.3.4.3.5-4 See Table 6.3.4.3.5-7
60MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
70MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
80MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
90MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
100MHz			DFT-s-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
Note 1: The starting resource block shall be RB# 0				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3.4.3.4.1-1.
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 [5] clause 4.5 Message contents are defined in clause 6.3.4.3.4.3.

6.3.4.3.4.2 Test procedure

The procedure is separated in various subtests to verify different aspects of relative power control. The power patterns of the subtests are described in figure 6.3.4.3.4.2-1 thru figure 6.3.4.3.4.2-5.

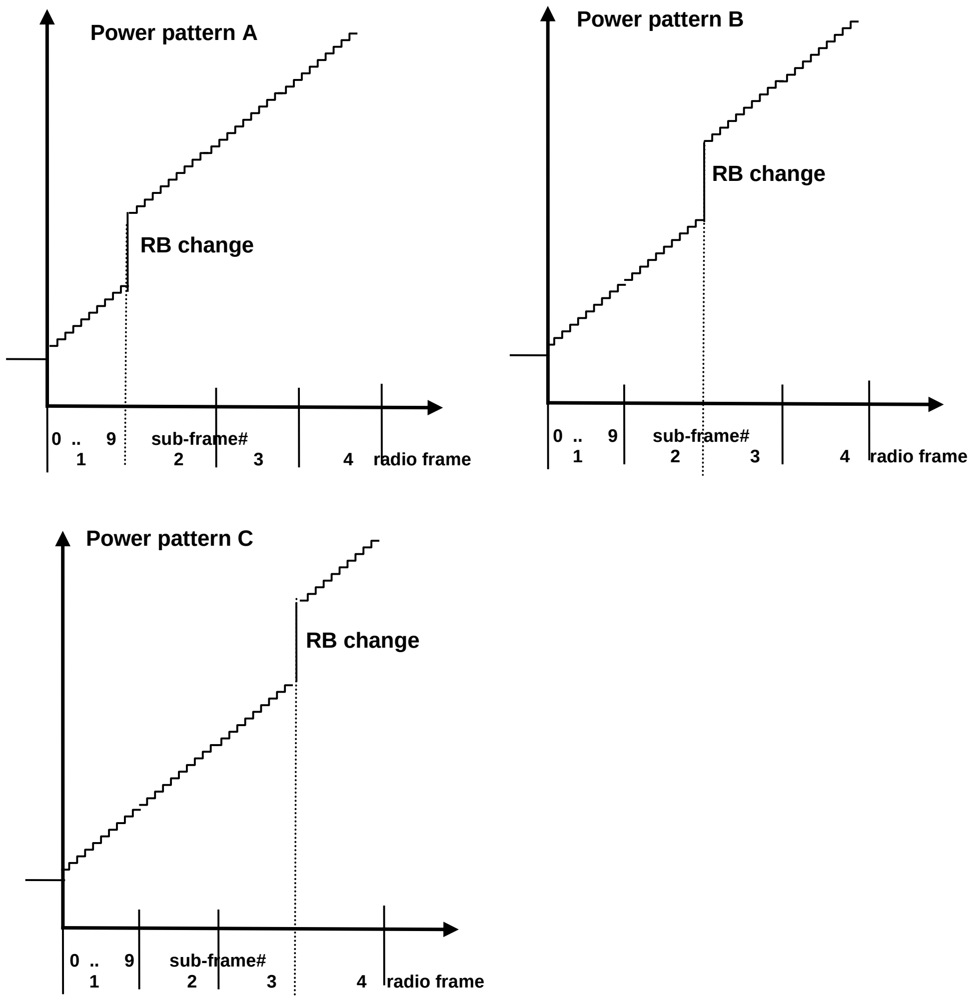

Figure 6.3.4.3.4.2-1: FDD ramping up test power patterns

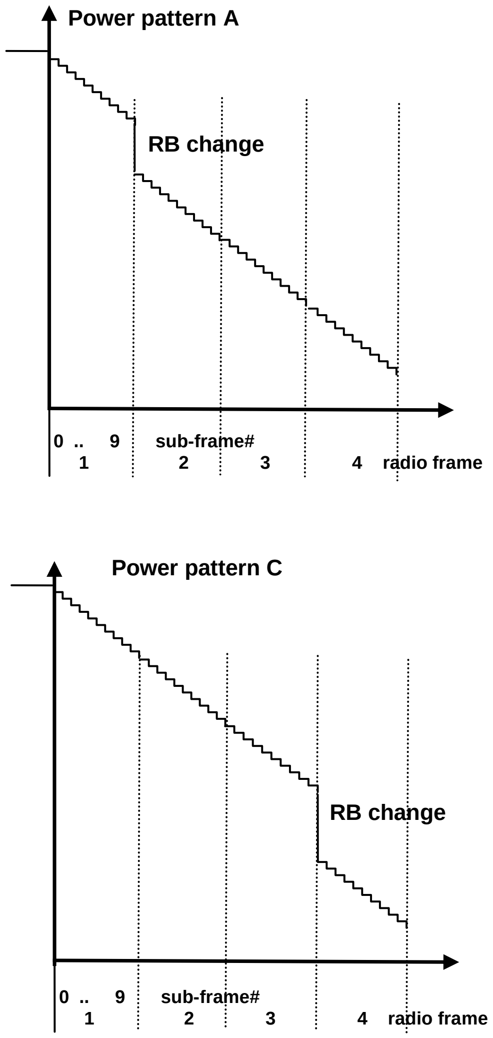

Figure 6.3.4.3.4.2-2: FDD ramping down test power patterns

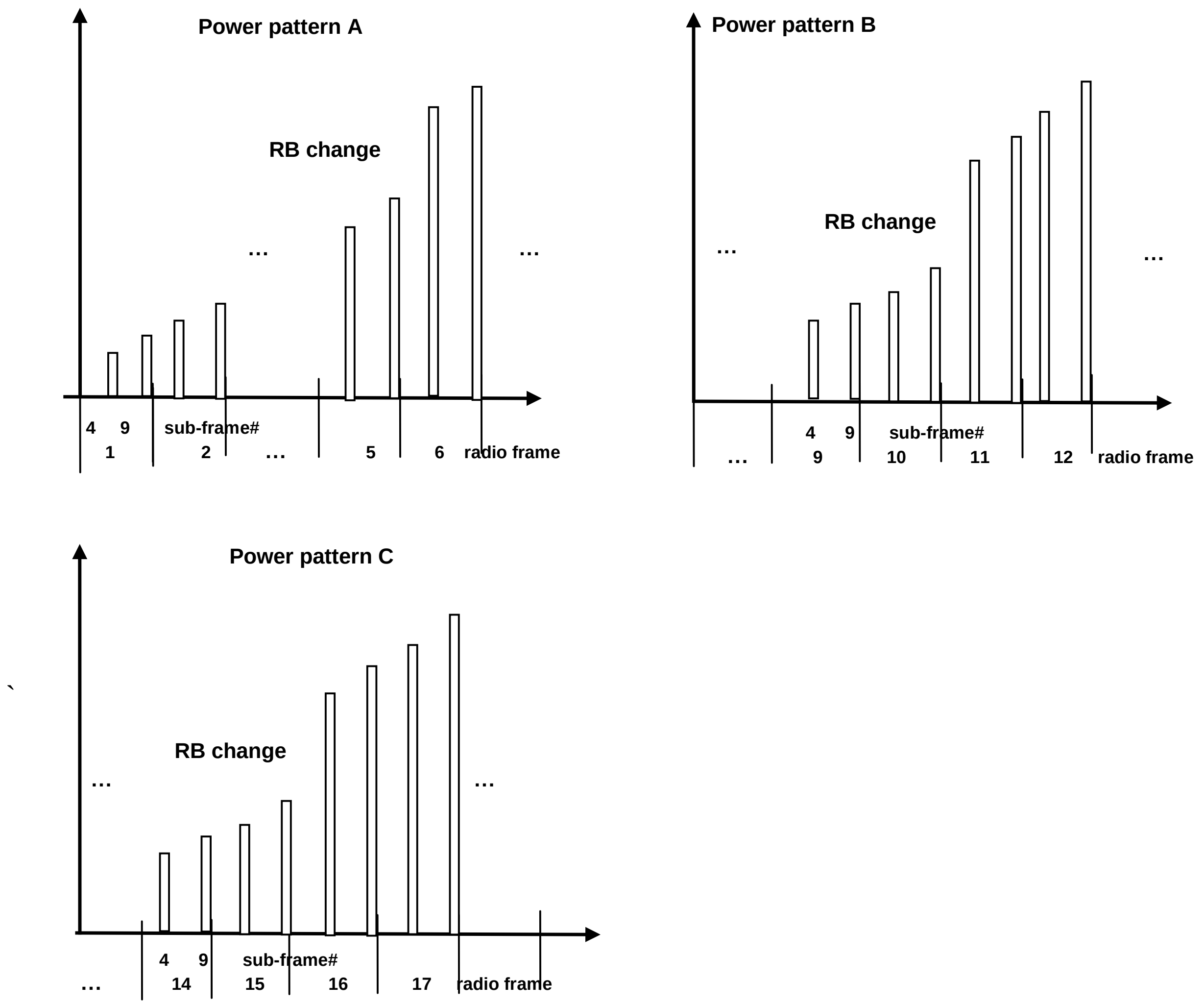

Figure 6.3.4.3.4.2-3: TDD ramping up test power patterns

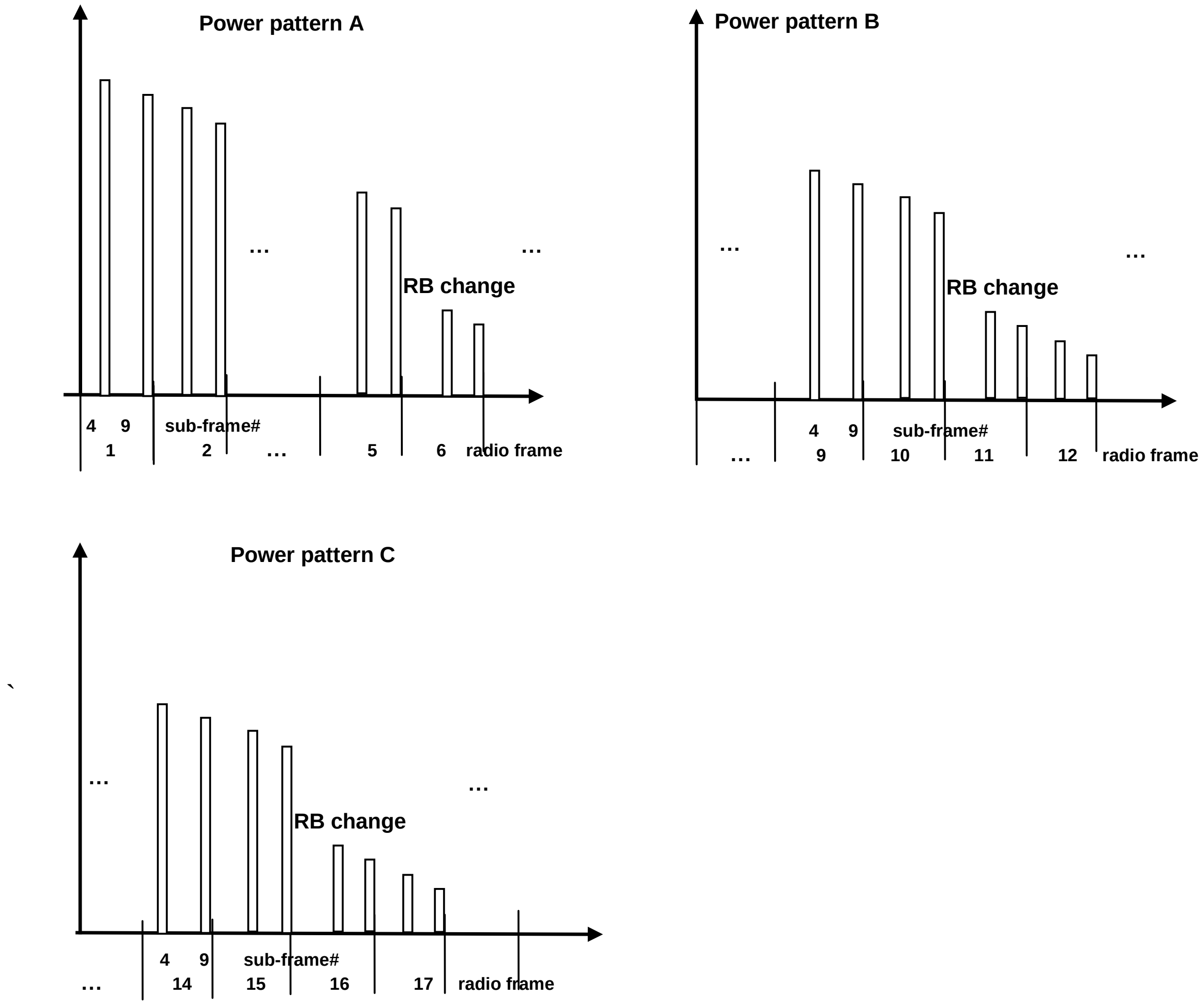

Figure 6.3.4.3.4.2-4: TDD ramping down test power patterns

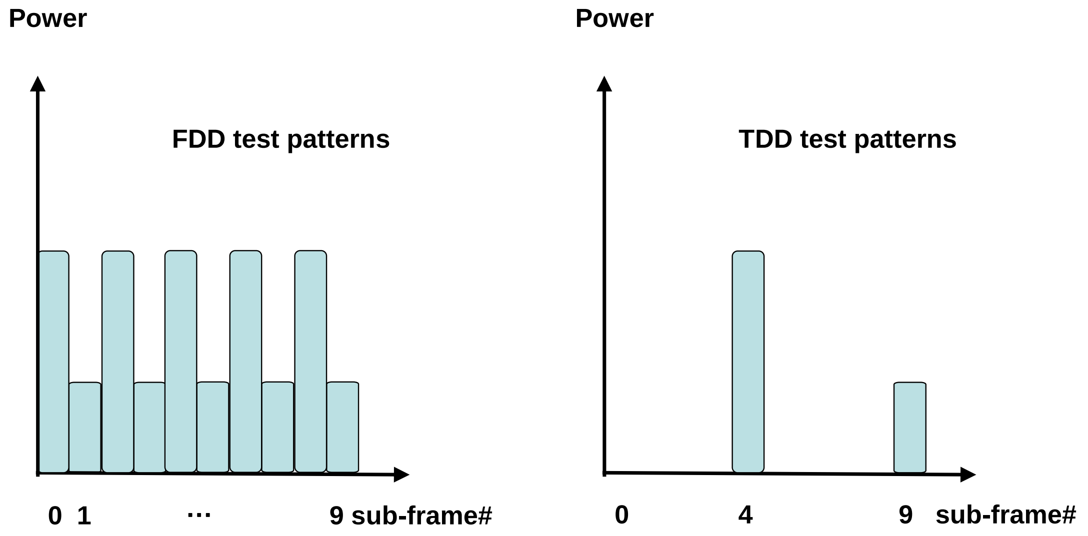

Figure 6.3.4.3.4.2-5: Alternating Test Power patterns

1. Sub test: ramping up pattern
   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 6.3.4.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands to the UE using 1dB power step size 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 -33 dBm, where:
      - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
      - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.
   1.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-1 (FDD pattern A: sub-test is divided in 4 arbitrary radio frames with 10 active uplink sub-frames per radio frame) and Figure 6.3.4.3.4.2-3 (TDD pattern A: sub-test is divided in 20 arbitrary radio frames with 2 active uplink sub-frames per radio frame). Uplink RB allocation as defined in table 6.3.4.3.5-1/6.3.4.3.5-3/ 6.3.4.3.5-5 depending on channel bandwidth. On the PDCCH format 0_1 for the scheduling of the PUSCH the SS will transmit a +1dB TPC command for every first slot in a sub-frame. Note that the measurement need not be done continuously, provided that interruptions are whole numbers of frames, and TPC commands of 0dB are sent during the interruption.
   1.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements 6.3.4.3.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.
   1.4. Repeat the subtest different pattern B, C to move the RB allocation change at different points in the pattern as described in Table 6.3.4.3.5-1/6.3.4.3.5-3/ 6.3.4.3.5-5 to force bigger UE power steps at various points in the power range.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F, clause F.4.2.

2. Sub test: ramping down pattern

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 6.3.4.3.4.1-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -(MU + Uplink power control window size) to -MU dB of the target power level 20.7 dBm, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

- Uplink power control window size is same as defined in step 1.1.

2.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-2 (FDD pattern A: sub-test is divided in 4 arbitrary radio frames with 10 active uplink slots per radio frame) and Figure 6.3.4.3.4.2-4 (TDD pattern A: sub-test is divided in 20 arbitrary radio frames with 2 active uplink sub-frames per radio frame). Uplink RB allocation as defined in table 6.3.4.3.5-2/6.3.4.3.5-4/ 6.3.4.3.5-6 depending on channel bandwidth. On the PDCCH format 0_1 for the scheduling of the PUSCH the SS will transmit a -1dB TPC command for every first slot in a sub-frame. Note that the measurement need not be done continuously, provided that interruptions are whole numbers of frames, and TPC commands of 0dB are sent during the interruption.

2.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements 6.3.4.4.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.

2.4. Repeat the subtest different pattern B, C to move the RB allocation change at different points in the pattern as described in Table 6.3.4.3.5-2/6.3.4.3.5-4/ 6.3.4.3.5-6 to force bigger UE power steps at various points in the power range.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F, clause F.4.3.

3. Sub test: alternating pattern

3.1. 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 6.3.4.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as – (Uplink power control window size / 2) dB to + (Uplink power control window size / 2) dB of the target power level -10 dBm, where:

- Uplink power control window size is same as defined in step 1.1.

3.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.5.2.4.2-5 for 10 sub-frames an uplink RB allocation alternating pattern as defined in table 6.3.4.3.5-7 while transmitting 0dB TPC command for PUSCH via the PDCCH.

3.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements specified in clause 6.3.4.3.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.4.

6.3.4.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.3.4.3.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.3.4.3.5 Test requirement

Each UE power step measured in the test procedure 6.3.4.3.4.2 should satisfy the test requirements specified in Table 6.3.4.3.5-1 thru 6.3.4.3.5-7.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of ramping up and ramping down test patterns. For these exceptions the power tolerance limit is a maximum of ± (6.0 + TT) dB. If there is an exception in the power step caused by the RB change for all test patterns (A, B, C) then fail the UE.

Table 6.3.4.3.5-1: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 15 RBs	TPC=+1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 15	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1: Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames Note 2: The starting resource block shall be RB# 0. Note 3: TT=0.7dB Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.							

Table 6.3.4.3.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 15	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	15 RBs to 1 RB	TPC=-1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames
Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames
Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3.4.3.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 20 RBs	TPC=+1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 20	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 50 RBs	TPC=+1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 50	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80+/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3.4.3.5-4: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1RBs	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 20	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	20 RBs to 1 RB	TPC=-1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 50	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	50 RBs to 1 RB	TPC=-1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3.4.3.5-5: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 81 RBs	TPC=+1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 81	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 75 RBs	TPC=+1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 75	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.						
Note 2:	The starting resource block shall be RB# 0.						
Note 3:	TT=0.7dB						
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.						

Table 6.3.4.3.5-6: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 81	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	81 RBs to 1 RB	TPC=-1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 75	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	75 RBs to 1 RB	TPC=-1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3.4.3.5-7: Test Requirements Relative Power Tolerance for Transmission, alternating sub-test

BW	Test SCS [kHz]	Sub-test ID	Uplink RB allocation	TPC command	Expected power step size (Up or Down) ΔP [dB]	Power step size range (Up or Down) ΔP [dB]	PUSCH [dB]
5	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 15	TPC=0dB	11.76	10dB ≤ ΔP < 15dB	11.76 +/- (4 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
10,15,20, 25,30,40,45, 50	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 20	TPC=0dB	13.01	10dB ≤ ΔP < 15dB	13.01 +/- (4 + TT)
		4	Alternating 1 and 50	TPC=0dB	16.99	15dB ≤ ΔP	16.99 +/- (5 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 24	TPC=0dB	13.80	10dB ≤ ΔP < 15dB	13.80 +/- (4 + TT)
	60	1	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
60, 70,80,90,100	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 81	TPC=0dB	19.08	15dB < ΔP	19.08 +/- (5 + TT)
	60	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 75	TPC=0dB	18.75	15dB < ΔP	18.75 +/- (5 + TT)
Note 1: The starting resource block shall be RB# 0. Note 2: TT=0.7dB Note 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.							

6.3.4.4 Aggregate power tolerance

6.3.4.4.1 Test purpose

To verify the ability of the UE transmitter to maintain its power during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant.

6.3.4.4.2 Test applicability

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

6.3.4.4.3 Minimum conformance requirements

The aggregate power control tolerance is the ability of the UE transmitter to maintain its power in a sub-frame(1ms) during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant.

The minimum requirement specified in Table 6.3.4.4.3-1 apply in the power range bounded by the minimum output power as specified in sub-clause 6.3.1 and the maximum output power as specified in sub-clause 6.2.2.

Table 6.3.4.4.3-1: Aggregate power tolerance

TPC command	UL channel	Aggregate power tolerance within 21ms
0 dB	PUCCH	± 2.5 dB
0 dB	PUSCH	± 3.5 dB

The normative reference for this requirement is TS 38.01-1 [2] clause 6.3.4.4

6.3.4.4.4 Test description

6.3.4.4.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3.4.4.4.1-1 and table 6.3.4.4.4.1-2. 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 6.3.4.4.4.1-1: Test Configuration Table: PUCCH sub-test

<table>
<tr><th colspan="3">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td>Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td>Mid range (NOTE 1)</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td>Lowest, Mid, Highest</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td>Lowest, Highest</td></tr>
<tr><th colspan="3">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th>Uplink Configuration</th></tr>
<tr><td></td><td rowspan="2">N/A for aggregate power tolerance testcase</td><td rowspan="2">PUCCH format = Format 1
Length in OFDM symbols = 14</td></tr>
<tr><td>1</td></tr>
<tr><td colspan="3">NOTE 1: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.</td></tr>
</table>

Table 6.3.4.4.4.1-2: Test Configuration Table: PUSCH sub-test

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for aggregate power tolerance testcase	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. NOTE 2: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to G.0, G.1, G.2, G.3.0.
4. The UL and DL Reference Measurement channels are set according to Table 6.3.4.4.4.1-1 (PUCCH sub-test) and Table 6.3.4.4.4.1-2 (PUSCH sub-test)
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 [5] clause 4.5. Message contents are defined in clause 6.3.4.4.4.3.

6.3.4.4.4.2 Test procedure

The procedure is separated in two subtests to verify PUCCH and PUSCH aggregate power control tolerance respectively. The uplink transmission patterns are described in figure 6.3.4.4.4.2-1.

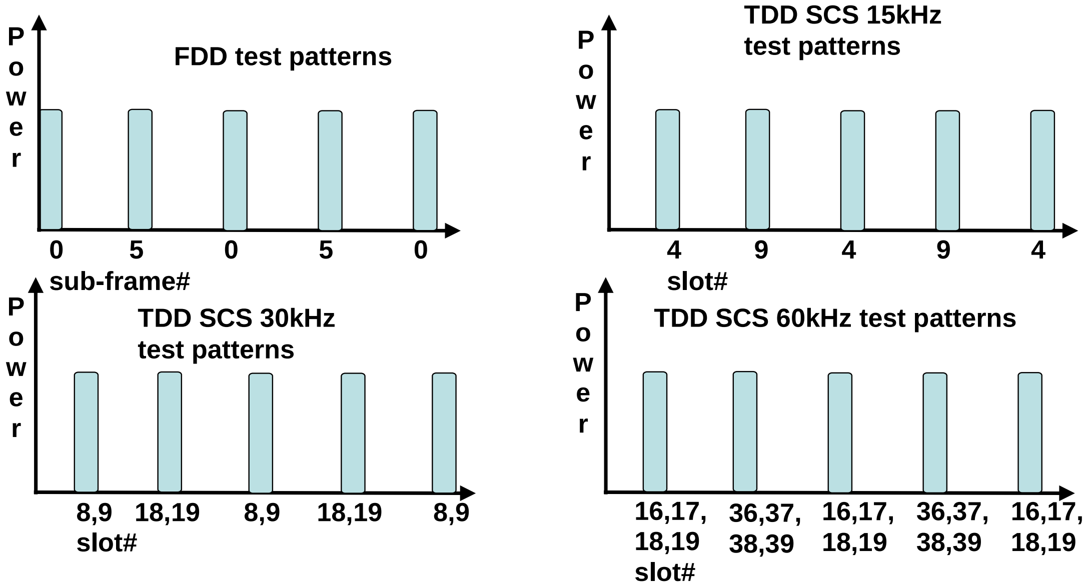

Figure 6.3.4.4.4.2-1 Test uplink transmission

1. PUCCH sub test:

   1.1. The SS transmits PDSCH via PDCCH DCI format 0_1 for C_RNTI to transmit the DL RMC according to Table 6.3.4.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH. Send uplink power control commands for PUCCH to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as – (Uplink power control window size / 2) dB to + (Uplink power control window size / 2) dB of the target power level + 0 dBm, where:

   - Uplink power control window size = 1dB (UE power step size) + 2.0dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 2.0dB for PUCCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

   1.2. Every 5 sub-frames (5ms) transmit to the UE downlink PDSCH MAC padding bits as well as 0 dB TPC command for PUCCH via the PDCCH to make the UE transmit ACK/NACK on the PUCCH for 1 sub-frame(1ms). The downlink transmission is scheduled in the appropriate slots to make the UE transmit PUCCH as described in figure 6.3.4.4.4.2-1

   1.3. Measure the power of 5 consecutive PUCCH transmissions to verify the UE transmitted PUCCH power is maintained within 21ms.

2. PUSCH sub test:

   2.1. The SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the PUSCH. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as – (Uplink power control window size / 2) dB to + (Uplink power control window size / 2) dB of the target power level + 0 dBm, where:

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for PUSCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.4.

   2.2. Every 5 sub-frames (5ms) schedule the UE's PUSCH data transmission for 1 sub-frame(1ms), and transmit 0 dB TPC command for PUSCH via the PDCCH to make the UE transmit PUSCH. The uplink transmission patterns are described in figure 6.3.4.4.4.2-1,

   2.3. Measure the power of 5 consecutive PUSCH transmissions to verify the UE transmitted PUSCH power is maintained within 21ms transmissions.

6.3.4.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.3.4.4.5 Test requirement

The requirement for the power measurements made in step (1.3) and (2.3) of the test procedure shall not exceed the values specified in Table 6.3.4.4.5-1. The power measurement period shall be 1 sub-frame(1ms).

Table 6.3.4.4.5-1: Power control tolerance

TPC command	UL channel	Test requirement measured power
0 dB	PUCCH	Given 5power measurements in the pattern, the 2nd, and later measurements shall be within ± (2.5 + TT) dB of the 1st measurement.
0 dB	PUSCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (3.5 + TT) dB of the 1st measurement.
Note 1: For SCS 30kHz 1 sub-frame corresponds to 2 slots and for SCS 60kHz 1 sub-frame corresponds to 4 slots, so 2 TPC commands will be sent for a single measurement period. Note 2: TT=0.7dB.		

6.3A Output power dynamics for CA

6.3A.1 Minimum output power for CA

6.3A.1.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the minimum output power is defined per carrier and the requirement is specified in subclause 6.3.1.

For intra-band non-contiguous carrier aggregation, the minimum output power is defined per carrier and the requirement is specified in clause 6.3.1.

For intra-band contiguous carrier aggregation, the minimum output power is defined per carrier and the requirement is specified in clause 6.3.1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.1.

6.3A.1.1 Minimum output power for CA (2UL CA)

6.3A.1.1.1 Test purpose

To verify the UE's ability to transmit with a broadband output power for 2UL CA below the value specified in the test requirement when the power is set to a minimum value.

6.3A.1.1.2 Test applicability

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

6.3A.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.1.4 Test description

6.3A.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 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.1.1.4.1-1 or 6.3A.1.1.4.1-2. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3A.1.1.4.1-1: Test Configuration Table for inter-band CA

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.3.5-1		Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A for this test	DFT-s-OFDM QPSK	Outer Full	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.				

Table 6.3A.1.1.4.1-2: Test Configuration Table for intra-band contiguous CA

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.3.5-1		Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A for this test	DFT-s-OFDM QPSK	Outer Full	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in 6.1A-1a NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Table 6.3A.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 [5] clause 4.5. Message contents are defined in clause 6.3A.1.1.4.3.

6.3A.1.1.4.2 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 [5] clause5.5.1. Message contents are defined in clause 6.3A.1.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3).
4. 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 6.3A.1.1.4.1-1 or 6.3A.1.1.4.1-2 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
5. Send continuously uplink power control "down" commands for both carriers in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.
6. Measure the mean power of the UE for each component carrier in the associated measurement channel bandwidth specified in Table 6.3A.1.1.5-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of 1ms in all active uplink slots and in the uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

6.3A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.3A.1.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.3A.1.1.5 Test requirement

The minimum output power of each component carrier, derived in step 6 shall not exceed the values specified in Table 6.3A.1.1.5-1.

Table 6.3A.1.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
25	-39+TT	23.955
30	-38.2+TT	28.815
40	-37+TT	38.895
50	-36+TT	48.615
60	-35.2+TT	58.35
70	-34.6+TT	68.07
80	-34+TT	78.15
90	-33.5+TT	88.23
100	-33+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3A.1.1.5-2		

Table 6.3A.1.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0	1.3
40MHz < BW ≤ 100MHz	1.3	1.3

6.3A.2 Transmit OFF power for CA

6.3A.2.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the transmit OFF power specified in subclause 6.3.2 is applicable for each component carrier when the transmitter is OFF on all component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit on any of its ports.

For intra-band contiguous carrier aggregation, the transmit OFF power specified in clause 6.3.2 is applicable for each component carrier when the transmitter is OFF on all component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit on any of its ports.

For intra-band non-contiguous carrier aggregation, the transmit OFF power specified in clause 6.3.2 is applicable for each component carrier when the transmitter is OFF on all component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit on any of its ports.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.2

6.3A.2.1 Transmit OFF power for CA (2UL CA)

6.3A.2.1.1 Test purpose

To verify that the UE transmit OFF power for 2UL CA is lower than the value specified in the test requirement.

6.3A.2.1.2 Test applicability

The requirements of 6.3A.2.1 apply in test cases 6.3A.3.1 Transmit ON/OFF time mask for CA (2UL CA) to all types of NR UE release 15 and forward that support 2UL CA. Therefore, no test case description and requirements are specified.

6.3A.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.2.0.

6.3A.2.1.4 Test description

This test is covered by clause 6.3A.3.1 Transmit ON/OFF time mask for 2UL CA.

6.3A.2.1.5 Test requirement

The requirement for the transmit OFF power of each component carrier shall not exceed the values specified in Table 6.3A.2.1.5-1.

Table 6.3A.2.1.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50+TT	4.515
10	-50+TT	9.375
15	-50+TT	14.235
20	-50+TT	19.095
25	-50+TT	23.955
30	-50+TT	28.815
40	-50+TT	38.895
50	-50+TT	48.615
60	-50+TT	58.35
80	-50+TT	78.15
100	-50+TT	88.23
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3A.2.1.5-2		

Table 6.3A.2.1.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	FFS	FFS
40MHz < BW ≤ 100MHz	FFS	FFS

6.3A.3 Transmit ON/OFF time mask for CA

6.3A.3.0 Minimum conformance requirements

6.3A.3.0.1 Transmit ON/OFF time mask for intra-band contiguous CA

For s intra-band contiguous carrier aggregation, the general output power ON/OFF time mask specified in clause 6.3.3.2 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in clause 6.3.3.2 shall only be applicable for each component carrier when all the component carriers are OFF.

6.3A.3.0.2 Transmit ON/OFF time mask for intra-band non-contiguous CA

For s intra-band non-contiguous carrier aggregation, the general output power ON/OFF time mask specified in clause 6.3.3.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in clause 6.3.3.1 shall only be applicable for each component carrier when all the component carriers are OFF.

6.3A.3.0.3 Transmit ON/OFF time mask for inter-band CA

6.3A.3.0.3.1 General

For inter-band carrier aggregation with uplink assigned to two NR bands, the general output power ON/OFF time mask specified in clause 6.3.3.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in clause 6.3.3.1 shall only be applicable for each component carrier when all the component carriers are OFF.

6.3A.3.0.3.2 Time mask for switching between two uplink carriers

In addition to the requirements in 6.3A.3.3.1 and the maximum output power requirement specified in Table 6.2A.1.3-1 with uplink assigned to two NR bands, the switching time mask specified in this clause is applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanisms specified in clause 6.1.6 of TS 38.214 [10], where NR UL carrier 1 is capable of one transmit antenna connector and NR UL carrier 2 is capable of two transmit antenna connectors with 3dB boosting on the maximum output power when the capability *uplinkTxSwitchingPowerBoosting* is present and the IE *uplinkTxSwitchingPowerBoosting* is enabled, and the two uplink carriers are in different bands with different carrier frequencies. The UE shall support the switch between single layer transmission with one antenna port and two-layer transmission with two antenna ports on the two uplink carriers following the scheduling commands and rank adaptation, i.e., both single layer and two-layer transmission with 2 antenna ports, and single layer transmission with 1 antenna port shall be supported on NR UL carrier 2.

The switching periods described in Figure 6.3A.3.0.3.2-1a and Figure 6.3A.3.0.3.2-1b are located in either NR carrier 1 or carrier 2 as indicated in RRC signalling *uplinkTxSwitchingPeriodLocation* [7], and the length of uplink switching period *X* is less than the value indicated by UE capability *uplinkTxSwitchingPeriod*.

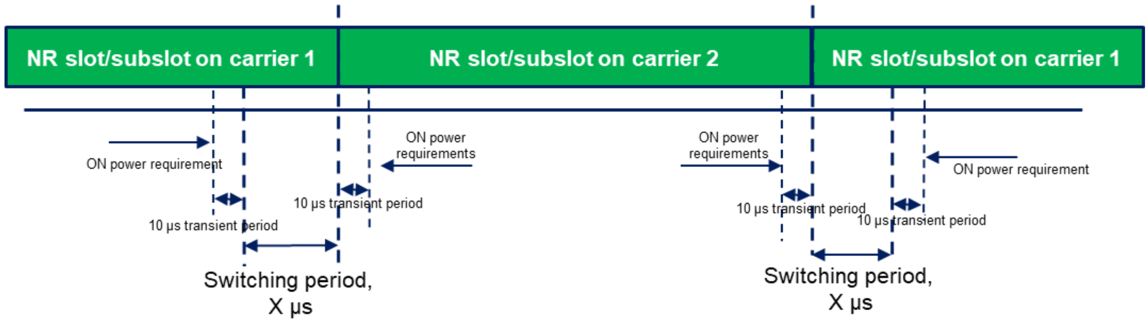

Figure 6.3A.3.0.3.2-1a: Time mask for switching between UL carrier 1 and UL Carrier 2, where the switching period is located in carrier 1

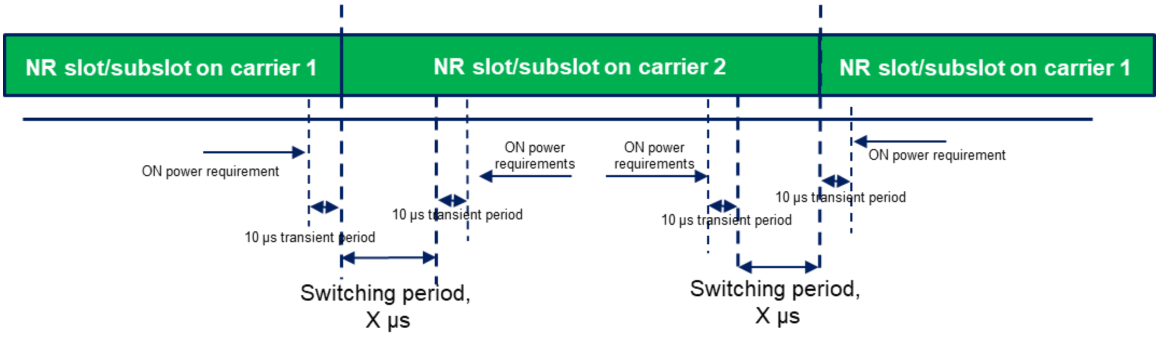

Figure 6.3A.3.0.3.2-1b: Time mask for switching between UL carrier 1 and UL Carrier 2, where the switching period is located in carrier 2

The requirements apply for the case of co-located and synchronized network deployment for the two uplink carriers.

The requirements apply for the case of single TAG for the two uplink carriers, i.e., the same uplink timing for the two carriers as described in clause 4.2 of TS 38.213 [8].

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.3.

6.3A.3.1 Transmit ON/OFF time mask for CA (2UL CA)

6.3A.3.1.1 Test purpose

To verify that the general ON/OFF time mask for CA (2UL CA) meets the requirements given in 6.3A.3.1.5

The transmit power time mask for transmit ON/OFF defines the transient period(s) allowed between transmit OFF power and transmit ON power symbols for CA.

Transmission of the wrong power increases interference to other channels, or increases transmission errors in the uplink channel.

6.3A.3.1.2 Test applicability

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

6.3A.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.3.0.

6.3A.3.1.4 Test description

6.3A.3.1.4.1 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 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.3.1.4.1-1 or 6.3A.3.1.4.1-2. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3A.3.1.4.1-1: Test Configuration Table for inter-band CA

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.5A.3-1		Lowest, Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A for this test	DFT-s-OFDM QPSK	Inner Full	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.				

Table 6.3A.3.1.4.1-2: Test Configuration Table for intra-band contiguous CA

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.5A.3-1		Lowest, Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A for this test	DFT-s-OFDM QPSK	Inner Full	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in 6.1A-1a NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3A.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 [5] clause 4.5. Message contents are defined in clause 6.3A.3.1.4.3.

6.3A.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 [5] clause 5.5.1. Message contents are defined in clause 6.3A.3.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3).
4. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1.4.1-1 or 6.3A.3.1.4.1-2 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for 15kHz SCS, on slots 8 and 18 for 30kHz SCS and on slots 17 and 37 for 60kHz SCS.
5. Send continuously uplink power control "up" commands for both carriers in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
6. On power sub test:
   6.1. Measure the sum of mean output power over all component carriers in the CA configuration of the UE PUSCH transmission during one slot of the radio access mode. For FDD band in inter-band CA with both TDD band and FDD band, only slots overlapping with only UL symbols in TDD are under test.
7. OFF power sub test:
   7.1. Measure the UE transmission OFF power for each component carrier during the slot prior to the PUSCH transmission, excluding a transient period of 10 µs in the end of the slot.
   7.2. Measure the UE transmission OFF power of each component carrier during the slot following the PUSCH transmission, excluding a transient period of 10 µs at the beginning of the slot.

6.3A.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exceptions.

Table 6.3A.3.1.4.3-1: PUSCH-ConfigCommon

Derivation Path: TS 38.508-1[5], Table 4.6.3-90			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon ::= SEQUENCE {			
p0-NominalWithGrant	-100		
}			

Table 6.3A.3.1.4.3-2: TDD-UL-DL-Config

Derivation Path: TS 38.508-1[5], Table 4.6.3-192			
Information Element	**Value/remark**	**Comment**	**Condition**
TDD-UL-DL-ConfigCommon ::= SEQUENCE {			
referenceSubcarrierSpacing	SubcarrierSpacing		
pattern1 SEQUENCE {			
dl-UL-TransmissionPeriodicity	ms5		FR1
	ms10		FR1_15kHz
nrofDownlinkSlots	6		FR1_15kHz
	6		FR1_30kHz
	14		FR1_60kHz
nrofDownlinkSymbols	10		FR1_15kHz
	6		FR1_30kHz
	12		FR1_60kHz
nrofUplinkSlots	3		FR1_15kHz, FR1_30kHz
	4		FR1_60kHz
nrofUplinkSymbols	4		FR1_30kHz
	2		FR1_15kHz,
	8		FR1_60kHz
}			
pattern2	Not present		
}			

Table 6.3A.3.1.4.3-3: PUSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1[5], Table 4.6.3-122			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF {	2 entries		
PUSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
k2	4		FR1_15kHz, FR1_30kHz
	6		FR1_60kHz
mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
PUSCH-TimeDomainResourceAllocation[2] SEQUENCE {		addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [22] Table 8.2-1.	
k2	2	$K_2 + \Delta=4$ acc. to TS 38.214 [21] Table 6.1.2.1.1-5 (NOTE 1)	FR1_15kHz
	6	$K_2 + \Delta=9$ acc. to TS 38.214 [21] Table 6.1.2.1.1-5 (NOTE 1)	FR1_30kHz

mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
}			
NOTE 1: Values are chosen so that first slot of a TDD-UL-DL slot configuration period can be used for the Random Access Response and the last slot (of the same or another period) for the corresponding Msg3.			

Condition	Explanation
FR1_15kHz	FR1 is used under the test. SCS is set to 15kHz.
FR1_30kHz	FR1 is used under the test. SCS is set to 30kHz.
FR1_60kHz	FR1 is used under the test. SCS is set to 60kHz.

Table 6.3A.3.1.4.3-4: ServingCellConfigCommon

Derivation Path: 38.508-1[5], Table 4.6.3-168			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfigCommon ::= SEQUENCE {			
ss-PBCH-BlockPower	18		SCS_15kHz
	21		SCS_30kHz
}			

Condition	Explanation
SCS_15kHz	SCS=15kHz for SS/PBCH block
SCS_30kHz	SCS=30kHz for SS/PBCH block

Table 6.3A.3.1.4.3-5: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.3A.3.1.4.3-6: FrequencyInfoUL-SIB

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		Inter-band CA
	19		intra-band contiguous for CA_n48B
	18		intra-band contiguous for CA_n41C
	17		intra-band contiguous for CA_n77C

6.3A.3.1.5 Test requirement

The requirement for the transmit ON power and transmit OFF power for CA measured in steps 5, 6 and 7 of the test procedure shall not exceed the values specified in Table 6.3A.3.1.5-1.

Table 6.3A.3.1.5-1: General ON/OFF time mask

	Channel bandwidth / minimum output power / measurement bandwidth												
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Transmit OFF power	≤ -50+TT dBm												
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.15	88.23	98.31
Transmit ON power	For inter-band CA configurations, The test requirement of transmit on power of 2UL CA is the same as Test ID 9of Table 6.2A.2.1.5-1 as appropriate For intra-band contiguous CA configurations, The test requirement of transmit on power of 2UL CA is the same as Test ID 3 of Table 6.2A.2.1.5-1a, Table 6.2A.2.1.5-1b and 6.2A.2.1.5-1c as appropriate												
NOTE 1: TT for each frequency and channel bandwidth of OFF power is specified in Table 6.3A.3.1.5-2. NOTE 2: TT or each frequency and channel bandwidth of Transmit ON power is specified in Table 6.2A.2.1.5-3													

Table 6.3A.3.1.5-2: Test Tolerance for OFF power

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	1.5	1.8
40MHz < BW ≤ 100MHz	1.7	1.8

6.3A.3.1_1 Time mask for switching between two uplink carriers

Editor's Note: The improvement for test procedure is FFS

6.3A.3.1_1.1 Test purpose

To verify that the time mask for switching between two uplink carriers meets the requirements given in 6.3A.3.0.3.2.

The time mask for switching between two uplink carriers defines the transient period(s) allowed between two uplink carriers for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present.

6.3A.3.1_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support 2UL inter-band CA and dynamic UL Tx switching.

6.3A.3.1_1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.3.0.3.2.

6.3A.3.1_1.4 Test description

6.3A.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, test channel bandwidths and sub-carrier spacing based on NR CA configuration specified in 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.3.1_1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3A.3.1_1.4.1-1: Test Configuration Table for inter-band CA Uplink switching

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.1.3 for inter band CA in FR1</td><td colspan="3">Mid range for PCC and SCC</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Highest N_{RB_agg}</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.5A.3-1</td><td colspan="3">Highest</td></tr>
<tr><th colspan="5">Test Parameters</th></tr>
<tr><th rowspan="3">Test ID</th><th rowspan="3">Downlink Configuration for PCC & SCC</th><th colspan="3">Uplink Configuration</th></tr>
<tr><th rowspan="2">Modulation for all CCs</th><th colspan="2">RB allocation (NOTE 2)</th></tr>
<tr><th>PCC</th><th>SCC</th></tr>
<tr><td>1</td><td>N/A for this test</td><td>DFT-s-OFDM QPSK</td><td>Inner Full</td><td>Inner Full</td></tr>
<tr><td colspan="5">NOTE 1: PCC is the component carrier with lower center frequency between two component carriers. PCC is configured as Carrier 1 and SCC is configured as Carrier2.
NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 3: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Table 6.3A.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 [5] clause 4.5. Message contents are defined in clause 6.3A.3.1_1.4.3.

6.3A.3.1_1.4.2 Test procedure

1. Sub test 1: Switching period located in Carrier 1

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

   1.2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.3A.3.1_1.4.3 with *uplinkTxSwitchingPeriodLocation-r16* configured TRUE on carrier1 and FALSE on carrier 2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

   1.3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3).

   1.4. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 1 on slot n-1, where slot n is an uplink slot for carrier 2. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

   1.5. The SS sends uplink scheduling information via DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 2 starting on slot n and slot m, with both slot n and slot m being uplink slots for carrier 2 and m ≥ n+20 when SCS=15kHz (m ≥ n+40 when SCS=30 kHz, m ≥ n+80 when SCS=60 kHz). Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

   1.6. Measure the output power of UE PUSCH transmission for carrier 1 during slot n-1 excluding a transient period of 10 µs and a Switching period X µs in the end of slot n-1. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod*.

   1.7. Measure the sum of output power of UE PUSCH transmission on carrier 2 over all antenna connectors during slot n and slot m excluding a transient period of 10 µs in the beginning of slot n and in the end of slot m

   1.8. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 1 on slot m+1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

   1.9. Measure the output power of UE PUSCH transmission for carrier 1 during slot m+1 excluding a switching period X and a transient period of 10 µs in the beginning of slot m+1. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod*.

2. Sub test 2: Switching period located in Carrier 2

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

   2.2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.3A.3.1_1.4.3 with *uplinkTxSwitchingPeriodLocation-r16* configured TRUE on carrier 2 and FALSE on carrier 1.

2.3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3). Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

2.4. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 1 on slot n-1, where slot n is an uplink slot for carrier 2. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2.5. The SS sends uplink scheduling information via DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 2 on slot n (n ≥1) and slot m, with both slot n and slot m being uplink slots for carrier 2 and m ≥ n+20 when SCS=15kHz (m ≥ n+40 when SCS=30 kHz, m ≥ n+80 when SCS=60 kHz). Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2.6. Measure the output power of UE PUSCH transmission for carrier 1 during slot n-1, for carrier 1 excluding a transient period of 10 µs in the end of slot n-1.

2.7. Measure the sum of output power of UE PUSCH transmission on carrier 2 over all antenna connectors during during slot n and slot m excluding a switching period X and a transient period of 10 µs in the beginning of slot n and in the end of slot m. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod.*

2.8. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3A.3.1_1.4.1-1 on carrier 1 on slot m+1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC

2.9. Measure the output power of UE PUSCH transmission for carrier 1 during slot m+1 excluding a transient period of 10 µs in the beginning of slot m+1.

6.3A.3.1_1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exceptions.

Table 6.3A.3.1_1.4.3-1: CellGroupConfig

Derivation Path: TS 38.508-1[5], Table 4.6.3-19			
Information Element	**Value/remark**	**Comment**	**Condition**
CellGroupConfig ::= SEQUENCE {			
uplinkTxSwitchingOption-r16	switchedUL		switchedUL OR Both
	dualUL		dualUL
}			

Condition	Explanation
switchedUL	UE indicated supporting of switchedUL in uplinkTxSwitching-OptionSupport-r16
dualUL	UE indicated supporting of dualUL in uplinkTxSwitching-OptionSupport-r16
Both	UE indicated supporting of both in uplinkTxSwitching-OptionSupport-r16

Table 6.3A.3.1_1.4.3-2: Void

Table 6.3A.3.1_1.4.3-3: ServingCellConfig

Derivation Path: 38.508-1[5], Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
uplinkTxSwitching-r16 CHOICE {			
setup SEQUENCE {			
uplinkTxSwitchingPeriodLocation-r16	TRUE		PL
	FALSE		noPL
uplinkTxSwitchingCarrier-r16	carrier1		1TxCC
	carrier2		2TxCC
}			
}			
}			
}			

Condition	Explanation
PL	The location of UL Tx switching period is configured in this carrier
noPL	The location of UL Tx switching period is not configured in this carrier
1TxCC	The carrier is capable of one transmit antenna connector
2TxCC	The carrier is capable of two transmit antenna connectors

Table 6.3A.3.1_1.4.3-4: Void

Table 6.3A.3.1_1.4.3-5: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.3A.3.1_1.4.3-6: FrequencyInfoUL-SIB for inter-band CA

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	23		

6.3A.3.1_1.5 Test requirement

The requirement for the power of carrier 1 measured in step 1.6, 1.9, 2.6, 2.9 of the test procedure and the power of carrier 2 measured in step 1.7 and 2.7 shall not exceed the values specified in table 6.3A.3.1_1.5-1.

Table 6.3A.3.1_1.5-1: Time mask for switching between two uplink carriers (On power)

	Measured output power
Transmit ON power	Same as Test ID 9 of Table 6.2A.2.1.5-1 as appropriate
NOTE1: TT or each frequency and channel bandwidth of Transmit ON power is specified in Table 6.2A.2.1.5-3	

Table 6.3A.3.1_1.5-2: Void

6.3A.4 Power control for CA

6.3A.4.1 Absolute power tolerance for CA

6.3A.4.1.0 Minimum conformance requirements

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

For intra-band contiguous carrier aggregation the absolute power control tolerance per component carrier is given in Table 6.3.4.2.3-1.

For intra-band non-contiguous carrier aggregation the absolute power control tolerance per component carrier is given in Table 6.3.4.2.3-1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.4.

6.3A.4.1.1 Absolute power tolerance for CA (2UL CA)

Editor's Note:

This test case in incomplete when signalling is absent for dualPA-Architecture IE due to lack of core requirements.

6.3A.4.1.1.1 Test purpose

To verify the ability of the UE transmitter for 2UL CA to set its initial output power to a specific value at the start of a contiguous transmission or non-contiguous transmission on each active component carrier with a long transmission gap, i.e. transmission gap is larger than 20ms.

6.3A.4.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support intra-band contiguous and non-contiguous 2UL CA.

6.3A.4.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.1.0.

6.3A.4.1.1.4 Test description

6.3A.4.1.1.4.1 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 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.4.1.1.4.1-1 for intra-band contiguous CA and table 6.3A.4.1.1.4.1-2 for intra-band non-contiguous CA. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3A.4.1.1.4.1-1: Test Configuration Table for intra-band contiguous CA

<table>
<tr><th colspan="6">Initial Conditions</th></tr>
<tr><td colspan="3">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal</td></tr>
<tr><td colspan="3">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Mid range</td></tr>
<tr><td colspan="3">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Lowest N_{RB_agg}, Highest N_{RB_agg}</td></tr>
<tr><td colspan="3">Test SCS as specified in Table 5.3.5-1</td><td colspan="3">Lowest, Highest</td></tr>
<tr><th colspan="6">Test Parameters</th></tr>
<tr><th rowspan="3">Test ID</th><th rowspan="3" colspan="2">Downlink Configuration for PCC & SCC</th><th colspan="3">Uplink Configuration</th></tr>
<tr><th rowspan="2">Modulation for all CCs</th><th colspan="2">RB allocation (NOTE 1)</th></tr>
<tr><th>PCC</th><th>SCC</th></tr>
<tr><td>1</td><td colspan="2">N/A for this test</td><td>CP-OFDM QPSK</td><td>Outer_Full</td><td>Outer_Full</td></tr>
<tr><td colspan="6">NOTE 1: The specific configuration of each RB allocation is defined in 6.1A-1a for contiguous RB allocation.
NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.1-1.
NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested.</td></tr>
</table>

Table 6.3A.4.1.1.4.1-2: Test Configuration Table for intra-band non-contiguous CA

<table>
<tr><th colspan="12">Initial Conditions</th></tr>
<tr><td colspan="5">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="7">Normal</td></tr>
<tr><td colspan="5">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="7">For test frequencies refer to “Range” columns</td></tr>
<tr><td colspan="5">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="7">Refer to “PCC N_{RB}”and “SCC N_{RB} ” columns</td></tr>
<tr><td colspan="5">Test SCS as specified in Table 5.3.5-1</td><td colspan="7">Lowest, Highest</td></tr>
<tr><th colspan="12">Test Parameters</th></tr>
<tr><th rowspan="3">ID</th><th colspan="7">CA config / CBW</th><th rowspan="3">DL config</th><th colspan="3">UL config</th></tr>
<tr><th colspan="2">PCC</th><th colspan="2">SCC</th><th></th><th></th><th></th><th rowspan="2">CC MOD</th><th colspan="2">RB allocation (NOTE 1)</th></tr>
<tr><th>Band</th><th>Range</th><th>Band</th><th>Range</th><th>PCC N_{RB}</th><th>W_{gap}</th><th>SCC N_{RB}</th><th>PCC</th><th>SCC</th></tr>
<tr><td>2</td><td>nX</td><td>CC1</td><td>nX</td><td>CC2</td><td>Highest N_{RB}</td><td>Max (NOTE 4)</td><td>Highest N_{RB}</td><td>N/A</td><td>CP-OFDM QPSK</td><td>Outer_Full</td><td>Outer_Full</td></tr>
<tr><td colspan="12">NOTE 1: The RB allocation is defined in table 6.1-1 for each CC.
NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.2-1.
NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested.
NOTE 4: The Wgap is defined to be widest possible on band based on the PCC and SCC configuration</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3A.1.1.4.1-1 and Table 6.3A.1.1.4.1-2 as appropriate.
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 [5] clause 4.5. Message contents are defined in clause 6.3A.4.1.1.4.3. Note that PDCCH DCI format 0_1 sent after resetting uplink power with RRC Connection Reconfiguration, should have TPC command 0dB.

6.3A.4.1.1.4.2 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 [5] clause5.5.1. Message contents are defined in clause 6.3A.4.1.1.4.3. Any PDCCH DCI format 0_1 sent to the UE during the configuration should have TPC command 0dB.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3).
4. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 with TPC command 0dB for C_RNTI to schedule the UL RMC according to Table 6.3A.4.1.1.4.1-1 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
5. Measure the initial output power of the first subframe of UE PUSCH first transmission for each component carrier.
6. Repeat for the two test points as indicated in section 6.3A.4.1.1.4.3. The timing of the execution between the two test points shall be larger than 20ms.

6.3A.4.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.3A.4.1.1.4.3-0: ServingCellConfigCommon

Derivation Path: 38.508-1[5], Table 4.6.3-168			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfigCommon ::= SEQUENCE {			
ss-PBCH-BlockPower	18		SCS_15kHz
	21		SCS_30kHz
}			

Condition	Explanation
SCS_15kHz	SCS=15kHz for SS/PBCH block
SCS_30kHz	SCS=30kHz for SS/PBCH block

Table 6.3A.4.1.1.4.3-1: UplinkPowerControlCommon: Test point 1

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-114	Test point 1 to verify a UE relative low initial power transmission	
}			

Table 6.3A.4.1.1.4.3-2: UplinkPowerControlCommon: Test point 2

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-108	Test point 2 to verify a UE relative high initial power transmission	
}			

6.3A.4.1.1.5 Test requirement

For intra-band contiguous CA, the absolute power control tolerance per component carrier measured in step (5) of the test procedure is not to exceed the values specified in Table 6.3A.4.1.1.5-1 and 6.3A.4.1.1.5-2.

Table 6.3A.4.1.1.5-1: Absolute power tolerance: test point 1

		Channel bandwidth / expected output power (dBm)												
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	1 M
Expected Measured power	SCS15	-17.6	-14.4	-12.6	-11.3	-10.4	-9.6	-8.3	-7.3	N/A	N/A	N/A	N/A	N
	SCS30	-18.2	-14.8	-12.8	-11.5	-10.5	-9.7	-8.3	-7.4	-6.5	-5.8	-5.2	-4.7	-4
	SCS60		-15.2	-13.0	-11.8	-10.7	-9.8	-8.5	-7.5	-6.6	-5.9	-5.3	-4.8	-4
Power tolerance		± (9+TT)dB												
Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.1.1.5-3.														

Table 6.3A.4.1.1.5-2: Absolute power tolerance: test point 2

		Channel bandwidth / expected output power (dBm)												
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	1 M
Expected Measured power	SCS15	-11.6	-7.6	-6.6	-5.3	-4.4	-3.6	-2.3	-1.3	N/A	N/A	N/A	N/A	N
	SCS30	-12.2	-8.8	-6.8	-5.5	-4.5	-3.7	-2.3	-1.4	-0.5	0.2	0.8	1.3	1
	SCS60	N/A	-9.2	-7	-5.8	-4.7	-3.8	-2.5	-1.5	-0.6	0.1	0.7	1.2	1
Power tolerance		± (9+TT)dB												
Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.1.1.5-3.														

Table 6.3A.4.1.1.5-3: Test Tolerance

	f ≤ 3.0GHz	**3.0GHz < f ≤ 4.2GHz**	**4.2GHz < f ≤ 6.0GHz**
BW ≤ 40MHz	**1.0 dB**	**1.4 dB**	**1.4 dB**
40MHz < BW ≤ 100MHz	**1.4 dB**	**1.4 dB**	**1.4 dB**

6.3A.4.2 Relative power tolerance for CA

6.3A.4.2.0 Minimum conformance requirements

For intra-band contiguous and non-contiguous carrier aggregation, the requirements apply when the power of the target and reference sub-frames on each component carrier exceed the minimum output power as defined in subclause 6.3A.1.0 and the total power is limited by P_{UMAX} as defined in subclause 6.2A.4.0. The UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.4.3.3-1;

b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.4.3.3-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subframes;

c) for RACH on the primary component carrier, the requirements given in Table 6.3.4.3.3-1 for PRACH.

For a) and b) above, the power step ΔP between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.4.

6.3A.4.2.1 Relative power tolerance for CA (2UL CA)

Editor's Note: This test case is incomplete for UL intra-band non-contiguous CA because MPR and P_{CMAX_L} are not evaluated.

6.3A.4.2.1.1 Test purpose

To verify the ability of the UE transmitter to set its output power of each component carrier in a target sub-frame(1ms) relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is less than or equal to 20ms.

6.3A.4.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support intra-band contiguous 2UL CA.

6.3A.4.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.1.4 Test description

6.3A.4.2.1.4.1 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 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.4.2.1.4.1-1 and table 6.3A.4.2.1.4.1-2. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3A.4.2.1.4.1-1: Test Configuration Table for intra-band contiguous CA

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.3.5-1		Lowest, Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocations (Note 3) (L_{CRB} @ RB_{start})**	
			PCC	**SCC**
1	N/A for this test	DFT-s-OFDM QPSK	5@(N_{RB}-5) 5@(N_{RB}-5) 1@(N_{RB}-1) 8@(N_{RB}-8)	1@0 8@0 1@0 8@0
NOTE 1: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.1-1. NOTE 2: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested. NOTE 3: The UL allocation is changed as part of the test procedure. The Test Configuration Table entries list the combinations used, with the sequence of usage as determined by the test procedure for each sub-test.				

Table 6.3A.4.2.1.4.1-2: Test Configuration Table for intra-band non-contiguous CA

Initial Conditions							
Test Environment as specified in TS 38.508-1 [5] subclause 4.1					Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1					Refer to Range column		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1					Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.3.5-1					Lowest, Highest		
Test Parameters							
Test ID	**Range**			**DL Config**	**Uplink Configuration**		
					Modulation for all CCs	**RB allocations (Note 3) (L_{CRB} @ RB_{start})**	
	PCC	**Wgap**	**SCC**			**PCC**	**SCC**
1	CC1	Max Wgap	CC2	N/A	DFT-s-OFDM QPSK	5@0 5@0 1@0 8@0	1@0 8@0 1@0 8@0
NOTE 1: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.2-1. NOTE 2: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested. NOTE 3: The UL allocation is changed as part of the test procedure. The Test Configuration Table entries list the combinations used, with the sequence of usage as determined by the test procedure for each sub-test.							

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Table 6.3A.4.2.1.4.1-1 and Table 6.3A.4.2.1.4.1-2 as appropriate.
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 [5] clause 4.5. Message contents are defined in clause 6.3A.4.2.1.4.3.

6.3A.4.2.1.4.2 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 [5] clause5.5.1. Message contents are defined in clause 6.3A.4.2.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133, clause 9.3).
4. The procedure is separated in various subtests to verify different aspects of relative power control. The power changes of the subtests are shown by diagrams in the Test Procedure. In this test case, the term P_{CMAX_L} – MAX{T_L, $T_{LOW}(P_{CMAX\_L})$ } defined in TS 38.101 [2] clause 6.2.4A is used, to ensure the UE is not tested outside its power capability.
5. Sub test: SCC power increase

   5.1. 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 6.3A.4.2.1.4.1-1 for intra-band contiguous CA and Table 6.3A.4.2.1.4.1-2 for intra-band non-contiguous CA on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet,\ 0}$ and $SCC_{RefSet,\ 0}$ respectively, as defined in Table 6.3A.4.2.1.4.2-1. The powers and allocations are chosen so the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame. Measure $PCC_{RefMeas,\ 0}$ and $SCC_{RefMeas,\ 0}$ in the Reference subframe, and after the SCC allocation is increased, measure $PCC_{TargetMeas,\ 0}$ and $SCC_{TargetMeas,\ 0}$ in the Target subframe.

Table 6.3A.4.2.1.4.2-1: Power settings and RB allocations for SCC power increase, step n=0

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet,\ 0}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ 0}$) +7	$SCC_{RefSet,\ 0}$, dBm/$N_{RB\ alloc}$	-17
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas,\ 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas,\ 0}$
Target subframe			
$PCC_{TargetSet,\ 0}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ 0}$) +7	$SCC_{TargetSet,\ 0}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ 0}$) +9
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas,\ 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas,\ 0}$

   5.2. Calculate the Total uplink power across both CCs in dBm as $10log_{10}((PCC_{TargetMeas,\ n}$ in mW) + ($SCC_{TargetMeas,\ n}$ in mW)). If (P_{CMAX_L} – MAX{T_L, $T_{LOW}(P_{CMAX\_L})$ } - Total uplink power) > 1dB, continue to step 5.3. Otherwise, go to step 5.6.

5.3. For the PCC, calculate the change in power as ($PCC_{TargetMeas, n}$ - $PCC_{RefMeas, n}$) and compare to the PCC Test requirement specified in Table 6.3A.4.2.1.5-1. If the result meets the Test requirement, continue to step 5.4. Otherwise, fail the UE for this subtest.

5.4. For the SCC, calculate the change in power as ($SCC_{TargetMeas, n}$ - $SCC_{RefMeas, n}$) and compare to the SCC Test requirement specified in Table 6.3A.4.2.1.5-1. If the result meets the Test requirement, continue to step 5.5. Otherwise, fail the UE for this subtest.

5.5. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, n+1}$ and $SCC_{RefSet, n+1}$ respectively, as defined in Table 6.3A.4.2.1.4.2-2. Measure $PCC_{RefMeas, n}$ and $SCC_{RefMeas, n}$.in the Reference subframe, and after the SCC allocation is increased, measure $PCC_{TargetMeas, n}$ and $SCC_{TargetMeas, n}$.in the Target subframe. Repeat steps 5.2 to 5.4.

Table 6.3A.4.2.1.4.2-2: Power settings and RB allocations for SCC power increase, step n+1

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet, n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, n+1}$) +7	$SCC_{RefSet, n+1}$, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas, n}$ +2dB)
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas, n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas, n+1}$
Target subframe			
$PCC_{TargetSet, n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, n+1}$) +7	$SCC_{TargetSet, n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, n+1}$) +9
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas, n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas, n+1}$

5.6. If the requirements specified in Table 6.3A.4.2.1.5-1 are all met, pass the UE for this subtest.

6. Sub test: SCC power decrease

6.1. 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 6.3A.4.2.1.4.1-1 for intra-band contiguous CA and Table 6.3A.4.2.1.4.1-2 for intra-band non-contiguous CA on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, 0}$ and $SCC_{RefSet, 0}$ respectively, as defined in Table 6.3A.4.2.1.4.2-3.The powers and allocations are chosen so the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame. Measure $PCC_{RefMeas, 0}$ and $SCC_{RefMeas, 0}$ in the Reference subframe, and after the SCC allocation is decreased, measure $PCC_{TargetMeas, 0}$ and $SCC_{TargetMeas, 0}$ in the Target subframe.

Table 6.3A.4.2.1.4.2-3: Power settings and RB allocations for SCC power decrease, step n=0

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet, 0}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, 0})$ -2	$SCC_{RefSet, 0}$, $dBm/N_{RB\ alloc}$	P_{CMAX_L} – $MAX\{T_L, T_{LOW}(P_{CMAX\_L})\}$ -5
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	8
Measured power, $dBm/N_{RB\ alloc}$	$PCC_{RefMeas, 0}$	Measured power, $dBm/N_{RB\ alloc}$	$SCC_{RefMeas, 0}$
Target subframe			
$PCC_{TargetSet, 0}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, 0})$ -2	$SCC_{TargetSet, 0}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, 0})$ -9
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	1
Measured power, $dBm/N_{RB\ alloc}$	$PCC_{TargetMeas, 0}$	Measured power, $dBm/N_{RB\ alloc}$	$SCC_{TargetMeas, 0}$

6.2. If the uplink (power for each CC – (-20dBm)) is > 1dB, continue to step 6.3. Otherwise, go to step 6.6.

6.3. For the PCC, calculate the change in power as ($PCC_{TargetMeas, n}$ - $PCC_{RefMeas, n}$) and compare to the PCC Test requirement specified in Table 6.3A.4.2.1.5-2. If the result meets the Test requirement, continue to step 6.4. Otherwise, fail the UE for this subtest.

6.4. For the SCC, calculate the change in power as ($SCC_{TargetMeas, n}$ - $SCC_{RefMeas, n}$) and compare to the SCC Test requirement specified in Table 6.3A.4.2.1.5-2. If the result meets the Test requirement, continue to step 6.5. Otherwise, fail the UE for this subtest.

6.5. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, n+1}$ and $SCC_{RefSet, n+1}$ respectively, as defined in Table 6.3A.4.2.1.4.2-4. Measure $PCC_{RefMeas, n}$ and $SCC_{RefMeas, n}$.in the Reference subframe, and after the SCC allocation is decreased, measure $PCC_{TargetMeas, n}$ and $SCC_{TargetMeas, n}$.in the Target subframe. Repeat steps 6.2 to 6.4.

Table 6.3A.4.2.1.4.2-4: Power settings and RB allocations for SCC power decrease, step n+1

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet, n+1}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, n+1})$ -2	$SCC_{RefSet, n+1}$, $dBm/N_{RB\ alloc}$	$SCC_{TargetMeas, n}$ -2dB
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	8
Measured power, $dBm/N_{RB\ alloc}$	$PCC_{RefMeas, n+1}$	Measured power, $dBm/N_{RB\ alloc}$	$SCC_{RefMeas, n+1}$
Target subframe			
$PCC_{TargetSet, n+1}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, n+1})$ -2	$SCC_{TargetSet, n+1}$, $dBm/N_{RB\ alloc}$	$(SCC_{RefSet, n+1})$ -9
PCC allocation, $N_{RB\ alloc}$	5	SCC allocation, $N_{RB\ alloc}$	1
Measured power, $dBm/N_{RB\ alloc}$	$PCC_{TargetMeas, n+1}$	Measured power, $dBm/N_{RB\ alloc}$	$SCC_{TargetMeas, n+1}$

6.6. If the requirements specified in Table 6.3A.4.2.1.5-2 are all met, pass the UE for this subtest.

7. Sub test: PCC and SCC power increase together

7.1. 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 6.3A.4.2.1.4.1-1 for intra-band contiguous CA and Table 6.3A.4.2.1.4.1-2 for intra-band non-contiguous CA on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, 0}$ and $SCC_{RefSet, 0}$ respectively, as defined in Table 6.3A.4.2.1.4.2-5. The powers and allocations are chosen so the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame. Measure $PCC_{RefMeas, 0}$ and $SCC_{RefMeas, 0}$ in the Reference subframe, and after the PCC and SCC allocation are increased, measure $PCC_{TargetMeas, 0}$ and $SCC_{TargetMeas, 0}$ in the Target subframe.

Table 6.3A.4.2.1.4.2-5: Power settings and RB allocations for PCC and SCC power increase, step n=0

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet, 0}$, dBm/$N_{RB\ alloc}$	-17	$SCC_{RefSet, 0}$, dBm/$N_{RB\ alloc}$	-17
PCC allocation, $N_{RB\ alloc}$	1	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas, 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas, 0}$
Target subframe			
$PCC_{TargetSet, 0}$, dBm/$N_{RB\ alloc}$	($PCC_{RefSet, 0}$) +9	$SCC_{TargetSet, 0}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, 0}$) +9
PCC allocation, $N_{RB\ alloc}$	8	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas, 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas, 0}$

7.2. Calculate the Total uplink power across both CCs in dBm as $10\log_{10}((PCC_{TargetMeas, n}$ in mW) + ($SCC_{TargetMeas, n}$ in mW)). If (P_{CMAX_L} – MAX{T_L, $T_{LOW}(P_{CMAX\_L})$ } - Total uplink power) > 1dB, continue to step 7.3. Otherwise, go to step 7.6.

7.3. For the PCC, calculate the change in power as ($PCC_{TargetMeas, n}$ - $PCC_{RefMeas, n}$) and compare to the PCC Test requirement specified in Table 6.3A.4.2.1.5-3. If the result meets the Test requirement, continue to step 7.4. Otherwise, fail the UE for this subtest.

7.4. For the SCC, calculate the change in power as ($SCC_{TargetMeas, n}$ - $SCC_{RefMeas, n}$) and compare to the SCC Test requirement specified in Table 6.3A.4.2.1.5-3. If the result meets the Test requirement, continue to step 7.5. Otherwise, fail the UE for this subtest.

7.5. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, n+1}$ and $SCC_{RefSet, n+1}$ respectively, as defined in Table 6.3A.4.2.1.4.2-6. Measure $PCC_{RefMeas, n}$ and $SCC_{RefMeas, n}$.in the Reference subframe, and after the PCC and SCC allocation are increased, measure $PCC_{TargetMeas, n}$ and $SCC_{TargetMeas, n}$.in the Target subframe. Repeat steps 7.2 to 7.4.

Table 6.3A.4.2.1.4.2-6: Power settings and RB allocations for PCC and SCC power increase, step n+1

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet,\ n+1}$, dBm/$N_{RB\ alloc}$	(Max ($PCC_{TargetMeas,\ n}$, $SCC_{TargetMeas,\ n}$)) +2dB	$SCC_{RefSet,\ n+1}$, dBm/$N_{RB\ alloc}$	(Max ($PCC_{TargetMeas,\ n}$, $SCC_{TargetMeas,\ n}$)) +2dB
PCC allocation, $N_{RB\ alloc}$	1	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas,\ n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas,\ n+1}$
Target subframe			
$PCC_{TargetSet,\ n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ n+1}$) +9	$SCC_{TargetSet,\ n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ n+1}$) +9
PCC allocation, $N_{RB\ alloc}$	8	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas,\ n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas,\ n+1}$

7.6. If the requirements specified in Table 6.3A.4.2.1.5-3 are all met, pass the UE for this subtest.

8. Sub test: PCC and SCC power decrease together

8.1. 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 6.3A.4.2.1.4.1-1 for intra-band contiguous CA and Table 6.3A.4.2.1.4.1-2 for intra-band non-contiguous CA on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet,\ 0}$ and $SCC_{RefSet,\ 0}$ respectively, as defined in Table 6.3A.4.2.1.4.2-7. The powers and allocations are chosen so the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame. Measure $PCC_{RefMeas,\ 0}$ and $SCC_{RefMeas,\ 0}$ in the Reference subframe, and after the PCC and SCC allocation are decreased, measure $PCC_{TargetMeas,\ 0}$ and $SCC_{TargetMeas,\ 0}$ in the Target subframe.

Table 6.3A.4.2.1.4.2-7: Power settings and RB allocations for PCC and SCC power decrease, step n=0

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet,\ 0}$, dBm/$N_{RB\ alloc}$	P_{CMAX_L} – MAX{T_L, $T_{LOW}(P_{CMAX\_L})$ } -6	$SCC_{RefSet,\ 0}$, dBm/$N_{RB\ alloc}$	P_{CMAX_L} – MAX{T_L, $T_{LOW}(P_{CMAX\_L})$ } -6
PCC allocation, $N_{RB\ alloc}$	8	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas,\ 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas,\ 0}$
Target subframe			
$PCC_{TargetSet,\ 0}$, dBm/$N_{RB\ alloc}$	($PCC_{RefSet,\ 0}$) -9	$SCC_{TargetSet,\ 0}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet,\ 0}$) -9
PCC allocation, $N_{RB\ alloc}$	1	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas,\ 0}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas,\ 0}$

8.2. If the uplink (power for each CC – (-20dBm)) is > 1dB, continue to step 8.3. Otherwise, go to step 8.6.

8.3. For the PCC, calculate the change in power as ($PCC_{TargetMeas, n}$ - $PCC_{RefMeas, n}$) and compare to the PCC Test requirement specified in Table 6.3A.4.2.1.5-4. If the result meets the Test requirement, continue to step 8.4. Otherwise, fail the UE for this subtest.

8.4. For the SCC, calculate the change in power as ($SCC_{TargetMeas, n}$ - $SCC_{RefMeas, n}$) and compare to the SCC Test requirement specified in Table 6.3A.4.2.1.5-4. If the result meets the Test requirement, continue to step 8.5. Otherwise, fail the UE for this subtest.

8.5. Send the appropriate TPC commands for PUSCH on each component carrier to the UE to ensure that the UE transmits PUSCH on the PCC and on the SCC with powers nearest to $PCC_{RefSet, n+1}$ and $SCC_{RefSet, n+1}$ respectively, as defined in Table 6.3A.4.2.1.4.2-8. Measure $PCC_{RefMeas, n}$ and $SCC_{RefMeas, n}$.in the Reference subframe, and after the PCC and SCC allocation are decreased**,** measure $PCC_{TargetMeas, n}$ and $SCC_{TargetMeas, n}$.in the Target subframe. Repeat steps 8.2 to 8.4.

Table 6.3A.4.2.1.4.2-8: Power settings and RB allocations for PCC and SCC power decrease, step n+1

PCC		SCC	
Parameter	**Value**	**Parameter**	**Value**
Reference subframe			
$PCC_{RefSet, n+1}$, dBm/$N_{RB\ alloc}$	(Min ($PCC_{TargetMeas, n}$, $SCC_{TargetMeas, n}$)) -2dB	$SCC_{RefSet, n+1}$, dBm/$N_{RB\ alloc}$	(Min ($PCC_{TargetMeas, n}$, $SCC_{TargetMeas, n}$)) -2dB
PCC allocation, $N_{RB\ alloc}$	8	SCC allocation, $N_{RB\ alloc}$	8
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{RefMeas, n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{RefMeas, n+1}$
Target subframe			
$PCC_{TargetSet, n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, n+1}$) -9	$SCC_{TargetSet, n+1}$, dBm/$N_{RB\ alloc}$	($SCC_{RefSet, n+1}$) -9
PCC allocation, $N_{RB\ alloc}$	1	SCC allocation, $N_{RB\ alloc}$	1
Measured power, dBm/$N_{RB\ alloc}$	$PCC_{TargetMeas, n+1}$	Measured power, dBm/$N_{RB\ alloc}$	$SCC_{TargetMeas, n+1}$

8.6. If the requirements specified in Table 6.3A.4.2.1.5-4 are all met, pass the UE for this subtest.

6.3A.4.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exception:

Table 6.3A.4.2.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.3A.4.2.1.5 Test requirement

For intra-band contiguous carrier aggregation bandwidth class C and intra-band non-contiguous CA, the relative power control tolerance per component carrier measured in steps 5, 6, 7 and 8 of the test procedures should satisfy the applicable test requirements specified in Tables 6.3A.4.2.1.5-1 to 6.3A.4.2.1.5-5.

Table 6.3A.4.2.1.5-1: Test requirements for SCC power increase

Parameter	Condition	Unit	Minimum	Maximum
($PCC_{TargetMeas,\ n}$ - $PCC_{RefMeas,\ n}$)	Normal	dB	-0.7-TT	0.7+TT
($SCC_{TargetMeas,\ n}$ - $SCC_{RefMeas,\ n}$)	Normal	dB	5.5-TT	12.5+TT

Table 6.3A.4.2.1.5-2: Test requirements for SCC power decrease

Parameter	Condition	Unit	Minimum	Maximum
($PCC_{TargetMeas,\ n}$ - $PCC_{RefMeas,\ n}$)	Normal	dB	-0.7-TT	0.7+TT
($SCC_{TargetMeas,\ n}$ - $SCC_{RefMeas,\ n}$)	Normal	dB	-12.5-TT	-5.5+TT

Table 6.3A.4.2.1.5-3: Test requirements for PCC and SCC power increase together

Parameter	Condition	Unit	Minimum	Maximum
($PCC_{TargetMeas,\ n}$ - $PCC_{RefMeas,\ n}$)	Normal	dB	5.5-TT	12.5+TT
($SCC_{TargetMeas,\ n}$ - $SCC_{RefMeas,\ n}$)	Normal	dB	5.5-TT	12.5+TT

Table 6.3A.4.2.1.5-4: Test requirements for PCC and SCC power decrease together

Parameter	Condition	Unit	Minimum	Maximum
($PCC_{TargetMeas,\ n}$ - $PCC_{RefMeas,\ n}$)	Normal	dB	-12.5-TT	-5.5+TT
($SCC_{TargetMeas,\ n}$ - $SCC_{RefMeas,\ n}$)	Normal	dB	-12.5-TT	-5.5+TT

Table 6.3A.4.2.1.5-5: Test Tolerance

	f ≤ 6.0GHz
BW ≤ 100MHz	0.7 dB

6.3A.4.3 Aggregate power tolerance for CA

6.3A.4.3.0 Minimum conformance requirements

For intra-band contiguous and non-contiguous carrier aggregation, the aggregate power tolerance per component carrier is given in Table 6.3.4.4.3-1. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3A.4.

6.3A.4.3.1 Aggregate power tolerance for CA (2UL CA)

Editor's Note: This test case in incomplete when signalling is absent for dualPA-Architecture IE due to lack of core requirements.

6.3A.4.3.1.1 Test purpose

To verify the ability of the UE transmitter to maintain its power during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant on all active component carriers.

6.3A.4.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support intra-band contiguous 2UL CA.

6.3A.4.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.3.0.

6.3A.4.3.1.4 Test description

6.3A.4.3.1.4.1 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 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in table 6.3A.4.3.1.4.1-2 and 6.3A.4.3.1.4.1-3. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH before measurement is specified in Annex C.2.

Table 6.3A.4.3.1.4.1-1: Void

Table 6.3A.4.3.1.4.1-2: Test Configuration Table for intra-band contiguous CA: PUSCH sub-test

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg}		
Test SCS as specified in Table 5.3.5-1		Lowest, Highest		
Test Parameters				
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**		
		Modulation for all CCs	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A for this test	CP-OFDM QPSK	Outer Full	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in 6.1A-1a for contiguous RB alloc. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.1-1. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested.				

Table 6.3A.4.3.1.4.1-3: Test Configuration Table for intra-band non-contiguous CA

<table>
<tr><th colspan="13">Initial Conditions</th></tr>
<tr><td colspan="5">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="8">Normal</td></tr>
<tr><td colspan="5">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="8">For test frequencies refer to “Range” columns</td></tr>
<tr><td colspan="5">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="8">Refer to PCC N_{RB}”and “SCC N_{RB} ” columns</td></tr>
<tr><td colspan="5">Test SCS as specified in Table 5.3.5-1</td><td colspan="8">Lowest, Highest</td></tr>
<tr><th colspan="13">Test Parameters</th></tr>
<tr><th rowspan="3">ID</th><th colspan="7">CA config / CBW</th><th rowspan="3">DL config</th><th colspan="3">UL config</th></tr>
<tr><th colspan="2">PCC</th><th colspan="2">SCC</th><th></th><th></th><th></th><th rowspan="2">CC MOD</th><th colspan="2">RB allocation (NOTE 1)</th></tr>
<tr><th>Band</th><th>Range</th><th>Band</th><th>Range</th><th>PCC N_{RB}</th><th>W_{gap}</th><th>SCC N_{RB}</th><th>PCC</th><th>SCC</th></tr>
<tr><td>1</td><td>nX</td><td>CC1</td><td>nX</td><td>CC2</td><td>Lowest N_{RB_agg}</td><td>Max (NOTE 4)</td><td>Lowest N_{RB_agg}</td><td rowspan="2">N/A</td><td rowspan="2">CP-OFDM QPSK</td><td>Outer_Full</td><td>Outer_Full</td></tr>
<tr><td>2</td><td>nX</td><td>CC1</td><td>nX</td><td>CC2</td><td>Highest N_{RB_agg}</td><td>Max (NOTE 4)</td><td>Highest N_{RB_agg}</td><td>Outer_Full</td><td>Outer_Full</td></tr>
<tr><td colspan="13">NOTE 1: RB allocation is defined in table 6.1-1 for each CC.
NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.2-1.
NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested.
NOTE 4: The Wgap is defined to be widest possible on band based on the PCC and SCC configuration</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3A.3.1.4.1-1 for intra-band contiguous CA and Table 6.3A.3.1.4.1-3 for intra-band non-contiguous CA.
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 [5] clause 4.5. Message contents are defined in clause 6.3A.4.3.1.4.3.

6.3A.4.3.1.4.2 Test procedure

For intra-band contiguous UL CA:

The procedure is separated in two subtests to verify PUCCH and PUSCH aggregate power control tolerance respectively. The uplink transmission patterns for each component carrier are described in figure 6.3A.4.3.1.4.2-1.

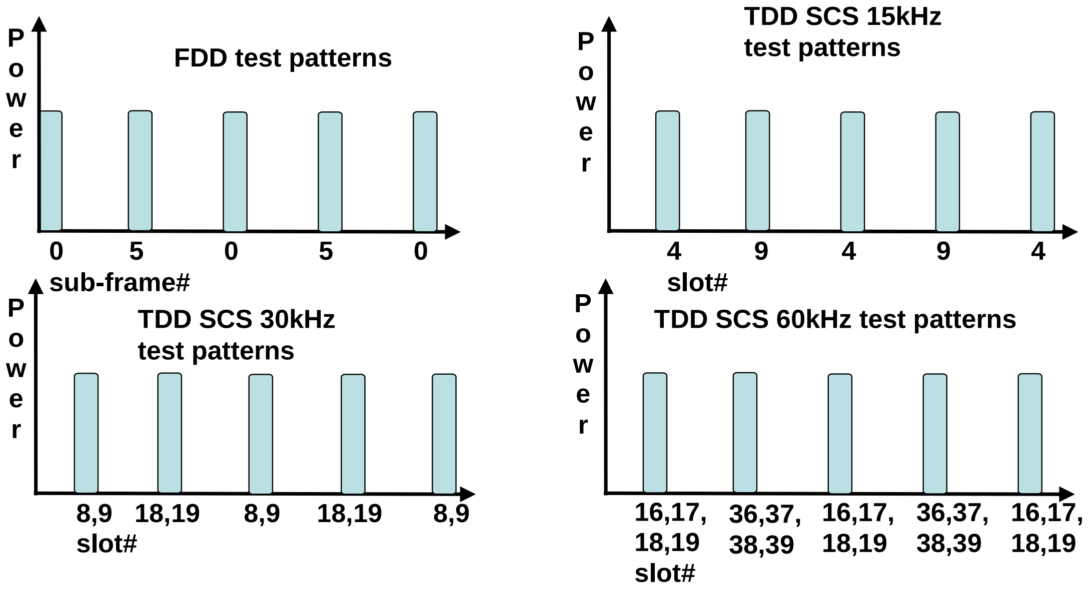

Figure 6.3A.4.3.1.4.2-1 Test uplink transmission

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 [5] clause5.5.1. Message contents are defined in clause 6.3A.4.3.1.4.3. Any PDCCH DCI format 0_1 sent to the UE during the configuration should have TPC command 0dB.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3)

4. PUSCH sub test:

   4.1. The SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the PUSCH according to Table 6.3A.4.3.1.4.1-1 on PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH to the UE using 1dB power step size to ensure that the UE output power on PCC and SCC measured by the test system is within the Uplink power control window, defined as – (Uplink power control window size / 2) dB to + (Uplink power control window size / 2) dB of the target power level + 0 dBm, where:

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for PUSCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.4.

   4.2. Every 5 sub-frames (5ms) schedule the UE's PUSCH data transmission for 1 sub-frame(1ms), and transmit 0 dB TPC command for PUSCH via the PDCCH to make the UE transmit PUSCH. The uplink transmission patterns are described in figure 6.3A.4.3.1.4.2-1,

   4.3. Measure the power on both PCC and SCC of 5 consecutive PUSCH transmissions to verify the UE transmitted PUSCH power is maintained within 21ms transmissions on each component carrier.

For intra-band non-contiguous UL CA:

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 [5] clause5.5.1. Message contents are defined in clause 6.3A.4.3.1.4.3. Any PDCCH DCI format 0_1 sent to the UE during the configuration should have TPC command 0dB.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause 9.3)

4. The SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the PUSCH according to Table 6.3A.4.3.1.4.1-3 on PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH to the UE using 1dB power step size to ensure that the UE output power on PCC and SCC measured by the test system is within the Uplink power control window, defined as – (Uplink power control window size / 2) dB to + (Uplink power control window size / 2) dB of the target power level + 0 dBm, where:

5. Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for PUSCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.4.

6. Every 5 sub-frames (5ms) schedule the UE's PUSCH data transmission for 1 sub-frame(1ms), and transmit 0 dB TPC command for PUSCH via the PDCCH to make the UE transmit PUSCH. The uplink transmission patterns are described in figure 6.3A.4.3.1.4.2-1.

7. Measure the power on both PCC and SCC of 5 consecutive PUSCH transmissions to verify the UE transmitted PUSCH power is maintained within 21ms transmissions on each component carrier.

6.3A.4.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.3A.4.3.1.4.3-1: Void

6.3A.4.3.1.5 Test requirement

For intra-band contiguous CA, the aggregate power control tolerance per component carrier measured in step (4.3) and step (5.3) of the test procedure is not to exceed the values specified in Table 6.3A.4.3.1.5-1.

For intra-band non-contiguous CA, the aggregate power control tolerance per component carrier measured in step 7 of the test procedure is not to exceed the values specified in Table 6.3A.4.3.1.5-1.

Table 6.3A.4.3.1.5-1: Aggregate power tolerance for CA

TPC command	UL channel	Test requirement measured power
0 dB	PUSCH on PCC and SCC	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (3.5 + TT) dB of the 1st measurement.
Note 1: For SCS 30kHz 1 sub-frame corresponds to 2 slots and for SCS 60kHz 1 sub-frame corresponds to 4 slots, so 2 TPC commands will be sent for a single measurement period. Note 2: TT = 0.7dB.		

6.3B Output power dynamics for NR-DC

For inter-band NR-DC with one uplink carrier assigned per NR band, the output power dynamics for the corresponding inter-band CA configuration as specified in subclause 6.3A applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.3A.

6.3B.1 Minimum output power for NR-DC

For inter-band dual connectivity, the minimum output power for the corresponding inter-band CA configuration as specified in clause 6.3A.1 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.3A.1.

6.3B.2 Transmit OFF power for NR-DC

For inter-band dual connectivity, the transmit OFF power for the corresponding inter-band CA configuration as specified in clause 6.3A.2 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.3A.2.

6.3B.3 Transmit ON/OFF time mask for NR-DC

For inter-band dual connectivity, the transmit ON/OFF time mask for the corresponding inter-band CA configuration as specified in clause 6.3A.3 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.3A.3.

6.3C Output power dynamics for SUL

6.3C.1 Minimum output power for SUL

6.3C.1.1 Test purpose

Same test purpose as in clause 6.3.1.1

6.3C.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.1.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.1.

6.3C.1.4 Test description

Same test description as specified in clause 6.3.1.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.3.1.4.1-1 → use Table 6.3C.1.4-1

Table 6.3C.1.4-1: Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Low, Mid, High range for SUL carrier
Mid-range for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Lowest, Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="3">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="5">Test Parameters for Channel Bandwidths</th></tr>
<tr><th rowspan="2">Test ID</th><th>Downlink Configuration</th><th>Uplink Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td rowspan="2">N/A</td><td rowspan="2">N/A</td><th>Modulation</th><th>RB allocation (NOTE 2)</th></tr>
<tr><td>1</td><td>DFT-s-OFDM QPSK</td><td>Outer Full</td></tr>
<tr><td colspan="5">NOTE 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.
NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier,and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, additionally the following exception shown in Table 6.3C.1.4-2 is considered.

Table 6.3C.1.4-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.3C.1.4-3: Void

6.3C.1.5 Test requirement

The minimum output power, derived in step 3 shall not exceed the values specified in Table 6.3C.1.5-1.

Table 6.3C.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
25	-39+TT	23.955
30	-38.2+TT	28.815
40	-37+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3C.1.5-2		

Table 6.3C.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0 dB	1.3 dB
40MHz < BW ≤ 100MHz	1.3 dB	1.3 dB

6.3C.2 Transmit OFF power for SUL

6.3C.2.1 Test purpose

Same test purpose as in clause 6.3.2.1

6.3C.2.2 Test applicability

The requirements of this test apply in test cases 6.3C.3 Transmit ON/OFF time mask for SUL to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.2.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.2.

6.3C.2.4 Test description

This test is covered by clause 6.3C.3 Transmit ON/OFF time mask for SUL.

6.3C.2.5 Test requirement

The requirement for the transmit OFF power for SUL shall not exceed the values specified in Table 6.3C.2.5-1.

Table 6.3C.2.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50+TT	4.515
10	-50+TT	9.375
15	-50+TT	14.235
20	-50+TT	19.095
25	-50+TT	23.955
30	-50+TT	28.815
40	-50+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3C.2.5-2		

Table 6.3C.2.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB

6.3C.3 Transmit ON/OFF time mask for SUL

6.3C.3.0 Minimum conformance requirements

6.3C.3.0.1 General ON/OFF time mask for SUL

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.3.2

6.3C.3.0.2 Time mask for switching between two uplink carriers

The switching time mask specified in this clause is applicable for an uplink band pair of a SUL configuration when the capability *uplinkTxSwitchingPeriod* is present, is only applicable for uplink switching mechanisms specified in clause 6.16 of TS 38.214 [10], where NR SUL carrier 1 is capable of one transmit antenna connector and NR UL carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies. The UE shall support the switch between single layer transmission with one antenna port and two-layer transmission with two antenna ports on the two uplink carriers following the scheduling commands and rank adaptation, i.e., both single layer and two-layer transmission with 2 antenna ports, and single layer transmission with 1 antenna port shall be supported on NR UL carrier 2.

The switching periods described in Figure 6.3C.3.1-1a and Figure 6.3C.3.1-1b are located in either NR carrier 1 or carrier 2 as indicated in RRC signalling *uplinkTxSwitchingPeriodLocation* [7], and the length of uplink switching period *X* is less than the value indicated by UE capability *uplinkTxSwitchingPeriod*.

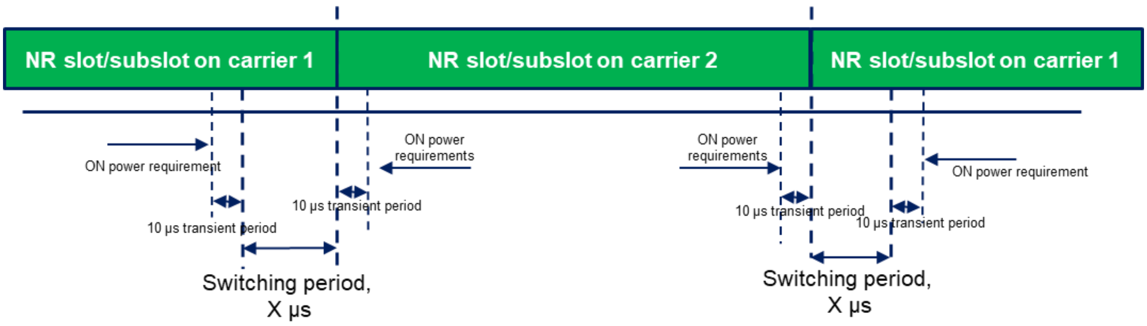

Figure 6.3C.3.0.2-1a: Time mask for switching between SUL carrier 1 and UL Carrier 2, where the switching period is located in carrier 1

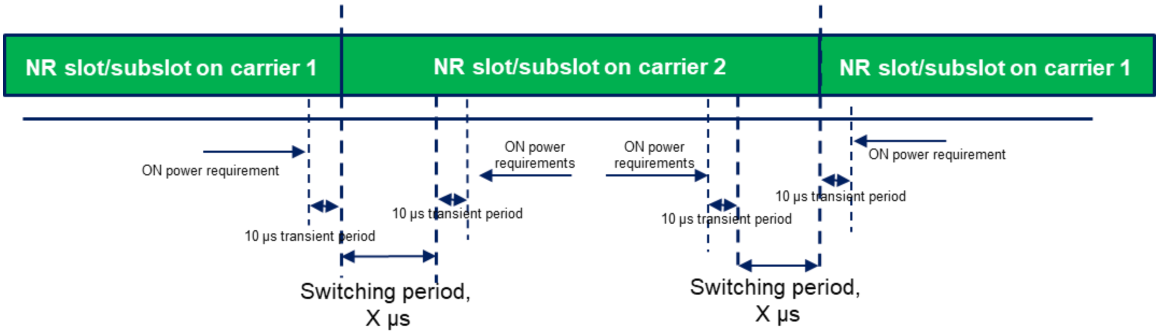

Figure 6.3C.3.0.2-1b: Time mask for switching between SUL carrier 1 and UL Carrier 2, where the switching period is located in carrier 2

The requirements apply for the case of co-located and synchronized network deployment for the two uplink carriers.

The requirements apply for the case of single TAG for the two uplink carriers, i.e., the same uplink timing for the two carriers as described in clause 4.2 of TS 38.213 [8].

6.3C.3.1 General transmit ON/OFF time mask for SUL

6.3C.3.1.1 Test purpose

Same test purpose as in clause 6.3.3.2.1

6.3C.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3C.3.0.1.

6.3C.3.1.4 Test description

Same test description as specified in clause 6.3.3.2.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.3.3.2.4.1-1 → use Table 6.3C.3.1.4-1

Table 6.3C.3.1.4-1: Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="3">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="2">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="3">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Low, Mid, High range for SUL carrier
Mid-range for Non-SUL carrier</td></tr>
<tr><td colspan="3">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Lowest, Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="3">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="5">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th>Uplink Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td></td><td rowspan="2">N/A</td><td rowspan="2">N/A</td><th>Modulation</th><th>RB allocation (NOTE 2)</th></tr>
<tr><td>1</td><td>DFT-s-OFDM QPSK</td><td>Inner Full</td></tr>
<tr><td colspan="5">NOTE 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.
NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.3C.3.1.4-2: Void

6.3C.3.1.5 Test requirement

The requirement for the power measured in steps 2, 3 and 4 of the test procedure shall not exceed the values specified in Table 6.3C.3.1.5-1.

Table 6.3C.3.1.5-1: General ON/OFF time mask

	Channel bandwidth / minimum output power / measurement bandwidth						
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**
Transmit OFF power	≤ -50+TT dBm						
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895
Transmitted ON Power	Same as Table 6.2.1.5-1						
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3C.3.5-2 and Table 6.2.1.5-3.							

Table 6.3C.3.1.5-2: Test Tolerance for OFF power

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

Table 6.3C.3.1.5-3: Void

6.3C.3.2 General transmit ON/OFF time mask for switching between two uplink carriers

Editor's Note: The improvement for test procedure is FFS

6.3C.3.2.1 Test purpose

To verify that the time mask for switching between two uplink carriers meets the requirements given in 6.3C.3.0.2.

The time mask for switching between two uplink carriers defines the transient period(s) allowed between two uplink carriers for an uplink band pair of an a SUL configuration when the capability uplinkTxSwitchingPeriod is present

6.3C.3.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support SUL configuration and dynamic UL Tx switching.

6.3C.3.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3C.3.0.2.

6.3C.3.2.4 Test description

6.3C.3.2.4.1 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 SUL configuration specified in 5.5C. All of these configurations shall be tested with applicable test parameters for each SUL configuration, and are shown in table 6.3C.3.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3C.3.2.4.1-1: Test Configuration Table for SUL Tx switching

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for both carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest for SUL carrier and Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1			15kHz for SUL carrier, lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths					
Test ID	**Downlink Configuration**	**Uplink Configuration**		**SUL Configuration**	
1	N/A	Modulation	RB allocation (NOTE 2)	**Modulation**	**RB allocation (NOTE 2)**
		DFT-s-OFDM QPSK	Inner Full	DFT-s-OFDM QPSK	Inner Full
NOTE 1: SUL carrier is configured as Carrier 1 and Non-SUL carrier is configured as Carrier2. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1.					

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

6.3C.3.2.4.2 Test procedure

1. Sub test 1: Switching period located in Carrier 1 (SUL carrier)

   1.1 SS send an NR RRCReconfiguration message according to 6.3C.3.2.4.3 with *uplinkTxSwitchingPeriodLocation-r16* configured TRUE on carrier1 and FALSE on carrier 2.1.2 SS send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

1.3 SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 1 on slot n-1, where slot n is an uplink slot for carrier 2. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.4 The SS sends uplink scheduling information via DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 2 starting on slot n and slot m, with both slot n and slot m being uplink slots for carrier 2 and m ≥ n+20 when SCS=15kHz (m ≥ n+40 when SCS=30 kHz, m ≥ n+80 when SCS=60 kHz). Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

1.5 Measure the output power of UE PUSCH transmission for carrier 1 during slot n-1 excluding a transient period of 10 µs and a Switching period X µs in the end of slot n-1. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod*.

1.6 Measure the sum of output power of UE PUSCH transmission on carrier 2 over all antenna connectors during slot n and slot m excluding a transient period of 10 µs in the beginning of slot n and in the end of slot m.

1.7 SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 1 on slot m+1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.8 Measure the output power of UE PUSCH transmission for carrier 1 during slot m+1 excluding a switching period X and a transient period of 10 µs in the beginning of slot m+1. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod*.

2. Sub test 2: Switching period located in Carrier 2 (Non-SUL carrier)

2.1 SS send an NR RRCReconfiguration message according to 6.3C.3.2.4.3 with *uplinkTxSwitchingPeriodLocation-r16* configured FALSE on carrier1 and TRUE on carrier 2.

2.2 SS send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

2.3 SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 1 on slot n-1, where slot n is an uplink slot for carrier 2. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2.4 The SS sends uplink scheduling information via DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 2 starting on slot n and slot m, with both slot n and slot m being uplink slots for carrier 2 and m ≥ n+20 when SCS=15kHz (m ≥ n+40 when SCS=30 kHz, m ≥ n+80 when SCS=60 kHz). Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2.5 Measure the output power of UE PUSCH transmission for carrier 1 during slot n-1 excluding a transient period of 10 µs in the end of slot n-1.

2.6 Measure the sum of output power of UE PUSCH transmission on carrier 2 over all antenna connectors during slot n and slot m excluding a transient period of 10 μs and a Switching period X μs in the beginning of slot n and in the end of slot m. The length of uplink switching period X is indicated by UE capability *uplinkTxSwitchingPeriod*.

2.7 SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3C.3.2.4.1-1 on carrier 1 on slot m+1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2.8 Measure the output power of UE PUSCH transmission for carrier 1 during slot m+1 excluding a transient period of 10 μs in the beginning of slot m+1.

6.3C.3.2.4.3 Message contents

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, and following exceptions:

Table 6.3C.3.2.4.3-2: ServingCellConfig

Derivation Path: 38.508-1[5], Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
uplinkTxSwitching-r16 CHOICE {			
setup SEQUENCE {			
uplinkTxSwitchingPeriodLocation-r16	TRUE		PL
	FALSE		noPL
uplinkTxSwitchingCarrier-r16	carrier1		1TxCC
	carrier2		2TxCC
}			
}			
}			
}			

Condition	Explanation
PL	The location of UL Tx switching period is configured in this carrier
noPL	The location of UL Tx switching period is not configured in this carrier
1TxCC	The carrier is capable of one transmit antenna connector
2TxCC	The carrier is capable of two transmit antenna connectors

Table 6.3C.3.2.4.3-4: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.3C.3.2.4.3-5: P-Max

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	23		

6.3C.3.2.4.3 Test requirement

The requirement for the power of carrier 1 measured in step 1.5, 1.8, 2.5, 2.8 of the test procedure and the power of carrier 2 measured in step 1.6 and 2.6 shall not exceed the values specified in table 6.3C.3.2.4.3-1.

Table 6.3C.3.2.4.3-1: General SUL Time mask for switching between two uplink carriers (On power)

	Measured output power
Transmit ON power	Same as table 6.2.1.5-1 for NUL carrier and table 6.2C.3.5-1 for SUL carrier
NOTE 1: TT or each frequency and channel bandwidth of Transmit ON power is specified in Table 6.2.1.5-3	

6.3C.4 Power control for SUL

6.3C.4.1 Absolute power tolerance for SUL

6.3C.4.1.1 Test purpose

Same test purpose as in clause 6.3.4.2.1

6.3C.4.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.4.1.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.4.2.

6.3C.4.1.4 Test description

Same test description as specified in clause 6.3.4.2.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.3.4.2.4.1-1 → use Table 6.3C.4.1.4-1

Table 6.3C.4.1.4-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid-range for SUL and Non-SUL carrier	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier	
Test SCS as specified in Table 5.3.5-1			15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier	
Test Parameters				
Test ID	**Downlink Configuration**	**Uplink Configuration**	**SUL Configuration**	
			Modulation	**RB allocation (NOTE 2)**
1	N/A	N/A	CP-OFDM QPSK	Outer_Full
NOTE 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 2: The specific configuration of each RF allocation is defined in Table 6.1-1.				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.3C.4.1.4-2: Void

6.3C.4.1.5 Test requirement

The requirement for the power measured in step (2) of the test procedure is not to exceed the values specified in Table 6.3C.4.1.5-1 and 6.3C.4.1.5-2.

Table 6.3C.4.1.5-1: Absolute power tolerance: test point 1

	Channel bandwidth / expected output power (dBm)						
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**
Expected Measured power	-17.6	-14.4	-12.6	-11.3	-10.4	-9.6	-8.3
Power tolerance	± (9+TT)dB						
Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3C.1.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3C.4.1.5-3.							

Table 6.3C.4.1.5-2: Absolute power tolerance: test point 2

	Channel bandwidth / expected output power (dBm)						
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**
Expected Measured power	-3.6	0.4	1.4	2.7	3.6	4.4	5.7
Power tolerance	± (9+TT)dB						
Note 1: The higher power limit shall not exceed the maximum output power requirements defined in sub-clause 6.2C.3.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3C.4.1.5-3.							

Table 6.3C.4.1.5-3: Test Tolerance

	f ≤ 3.0GHz	**3.0GHz < f ≤ 4.2GHz**	**4.2GHz < f ≤ 6.0GHz**
BW ≤ 40MHz	1.0 dB	1.4 dB	1.4 dB

6.3C.4.2 Relative power tolerance for SUL

6.3C.4.2.1 Test purpose

Same test purpose as in clause 6.3.4.3.1

6.3C.4.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.4.2.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.4.3.

6.3C.4.2.4 Test description

Same test description as specified in clause 6.3.4.3.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.3.4.3.4.1-1 → use Table 6.3C.4.2.4-1

Table 6.3C.4.2.4-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.3.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range for SUL carrier Mid-range for Non-SUL carrier	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier	
Test SCS as specified in table 5.3.5-1			15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier	
Test Parameters				
Ch BW	**Downlink Configuration**	**Uplink Configuration**	**SUL Configuration**	
			Modulation	**RB allocation (NOTE 1)**
5MHz	N/A		DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-1 See Table 6.3C.4.2.5-2 See Table 6.3C.4.2.5-5
10MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
15MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
20MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
25MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
30MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
40MHz			DFT-s-OFDM QPSK	See Table 6.3C.4.2.5-3 See Table 6.3C.4.2.5-4 See Table 6.3C.4.2.5-5
NOTE 1: The starting resource block shall be RB# 0 NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.

- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.3C.4.2.4-2: Void

6.3C.4.2.5 Test requirement

Each UE power step measured in the test procedure 6.3.4.3.4.2 should satisfy the test requirements specified in Table 6.3C.4.2.5-1 thru 6.3C.4.2.5-5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of ramping up and ramping down test patterns. For these exceptions the power tolerance limit is a maximum of ± (6.0 + TT) dB. If there is an exception in the power step caused by the RB change for all test patterns (A, B, C) then fail the UE.

Table 6.3C.4.2.5-1: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 15 RBs	TPC=+1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 15	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1: Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames Note 2: The starting resource block shall be RB# 0. Note 3: TT=0.7dB Note 4: Applicable if P_{UMAX} ≥ P ≥ P_{min}. P_{min} as defined in sub-clause 6.3C.1.							

Table 6.3C.4.2.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 15	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	15 RBs to 1 RB	TPC=-1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1: Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames Note 2: The starting resource block shall be RB# 0. Note 3: TT=0.7dB Note 4: Applicable if $P_{UMAX} \geq P \geq P_{min.}$ P_{min} as defined in sub-clause 6.3C.1.							

Table 6.3C.4.2.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 20 RBs	TPC=+1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 20	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 50 RBs	TPC=+1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 50	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if $P_{UMAX} \geq P \geq P_{min}$. P_{min} as defined in sub-clause 6.3C.1.

Table 6.3C.4.2.5-4: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1RBs	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 20	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	20 RBs to 1 RB	TPC=-1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 50	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	50 RBs to 1 RB	TPC=-1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if $P_{UMAX} \geq P \geq P_{min}$. P_{min} as defined in sub-clause 6.3C.1.

Table 6.3C.4.2.5-5: Test Requirements Relative Power Tolerance for Transmission, alternating sub-test

BW	Test SCS [kHz]	Sub-test ID	Uplink RB allocation	TPC command	Expected power step size (Up or Down) ΔP [dB]	Power step size range (Up or Down) ΔP [dB]	PUSCH [dB]
5	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 15	TPC=0dB	11.76	10dB ≤ ΔP < 15dB	11.76 +/- (4 + TT)
10,15,20, 25,30,40	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 20	TPC=0dB	13.01	10dB ≤ ΔP < 15dB	13.01 +/- (4 + TT)
		4	Alternating 1 and 50	TPC=0dB	16.99	15dB ≤ ΔP	16.99 +/- (5 + TT)
Note 1: The starting resource block shall be RB# 0. Note 2: TT=0.7dB Note 3: Applicable if $P_{UMAX} \geq P \geq P_{min}$. P_{min} as defined in sub-clause 6.3C.1.							

6.3C.4.3 Aggregate power tolerance for SUL

6.3C.4.3.1 Test purpose

Same test purpose as in clause 6.3.4.3.1

6.3C.4.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.3C.4.3.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.3.4.4.

6.3C.4.3.4 Test description

Same test description as specified in clause 6.3.4.4.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.3.4.4.4.1-1 → use Table 6.3C.4.3.4-1

Instead of table 6.3.4.4.4.1-2 → use Table 6.3C.4.3.4-2

Table 6.3C.4.3.4-1: Test Configuration Table: PUCCH sub-test

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for SUL and Non-SUL carrier
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier
Test SCS as specified in Table 5.3.5-1			15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	**SUL Configuration**
			PUCCH format = Format 1 Length in OFDM symbols = 14
1	N/A	N/A	

Table 6.3C.4.3.4-2: Test Configuration Table: PUSCH sub-test

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for SUL and Non-SUL carrier	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier	
Test SCS as specified in Table 5.3.5-1			15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier	
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	Uplink Configuration	**SUL Configuration**	
			Modulation	**RB allocation (NOTE 1)**
1	N/A	N/A	CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.3C.4.3.4-2: Void

6.3C.4.3.5 Test requirement

The requirement for the power measurements made in step (1.3) and (2.3) of the test procedure shall not exceed the values specified in Table 6.3C.4.3.5-1. The power measurement period shall be 1 sub-frame(1ms).

Table 6.3C.4.3.5-1: Power control tolerance

TPC command	UL channel	Test requirement measured power
0 dB	PUCCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (2.5 + TT) dB of the 1st measurement.
0 dB	PUSCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (3.5 + TT) dB of the 1st measurement.
Note 1: TT=0.7dB.		

6.3D Output power dynamics for UL MIMO

6.3D.1 Minimum output power for UL MIMO

6.3D.1.1 Test purpose

To verify the UE's ability to transmit with a UL MIMO broadband output power below the value specified in the test requirement when the power is set to a minimum value.

6.3D.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.1.3 Minimum conformance requirements

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each UE antenna connector in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3D.1.3-1.

Table 6.3D.1.3-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40	4.515
10	-40	9.375
15	-40	14.235
20	-40	19.095
25	-39	23.955
30	-38.2	28.815
40	-37	38.895
45	-36.5	43.575
50	-36	48.615
60	-35.2	58.35
70	-34.6	68.07
80	-34	78.15
90	-33.5	88.23
100	-33	98.31

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.1.

6.3D.1.4 Test description

6.3D.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 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3D.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 6.3D.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**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.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3D.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 [5] clause 4.5. Message contents are defined in clause 6.3D.1.4.3.

6.3D.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 6.3D.1.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.
3. Measure the sum of mean power of the UE at each UE antenna connector in the associated measurement channel bandwidth specified in Table 6.3D.1.5-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of 1ms over all active uplink slots and in the uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

6.3D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.3D.1.5 Test requirement

The minimum output power, derived in step 3 shall not exceed the values specified in Table 6.3D.1.5-1.

Table 6.3D.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
25	-39+TT	23.955
30	-38.2+TT	28.815
40	-37+TT	38.895
45	-36.5+TT	43.575
50	-36+TT	48.615
60	-35.2+TT	58.35
70	-34.6+TT	68.07+TT
80	-34+TT	78.15
90	-33.5+TT	88.23
100	-33+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3D.1.5-2		

Table 6.3D.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0 dB	1.3 dB
40MHz < BW ≤ 100MHz	1.3 dB	1.3 dB

6.3D.2 Transmit OFF power for UL MIMO

6.3D.2.1 Test purpose

To verify that the UE transmit OFF power for UL MIMO is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3D.2.2 Test applicability

The requirements of this test apply in test cases 6.3D.3 Transmit ON/OFF time mask for UL MIMO to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.2.3 Minimum conformance requirements

The transmit OFF power is defined as the mean power at each transmit connector in a duration of at least one sub-frame (1ms) excluding any transient periods.

The transmit OFF power at each transmit connector shall not exceed the values specified in Table 6.3D.2.3-1.

Table 6.3D.2.3-1: Transmit OFF power

Channel bandwidth	(MHz)	5,10,15,20,25,30,35,40,45,50	60,70,80,90,100
REF_SCS	(kHz)	15	30
Transmit OFF power	(dBm)	-50	
Measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000	

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.2.

6.3D.2.4 Test description

This test is covered by clause 6.3D.3 Transmit ON/OFF time mask for UL MIMO.

6.3D.2.5 Test requirement

The requirement for the transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3D.2.5-1.

Table 6.3D.2.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50+TT	4.515
10	-50+TT	9.375
15	-50+TT	14.235
20	-50+TT	19.095
25	-50+TT	23.955
30	-50+TT	28.815
40	-50+TT	38.895
45	-50+TT	43.575
50	-50+TT	48.615
60	-50+TT	58.35
70	-50+TT	68.07
80	-50+TT	78.15
90	-50+TT	88.23
100	-50+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3D.2.5-2		

Table 6.3D.2.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

6.3D.3 Transmit ON/OFF time mask for UL MIMO

6.3D.3.1 Test purpose

To verify that the general ON/OFF time mask for UL MIMO meets the requirements given in 6.3D.3.5

The transmit power time mask for transmit ON/OFF defines the transient period(s) allowed between transmit OFF power as defined in sub-clause 6.3D.2 and transmit ON power symbols (transmit ON/OFF)

Transmission of the wrong power increases interference to other channels, or increases transmission errors in the uplink channel.

6.3D.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.3.3 Minimum conformance requirements

For UE supporting UL MIMO, the ON/OFF time mask requirements in subclause 6.3.3.2.3 apply to each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.3.2.3 apply to each transmit antenna connector with the UL MIMO configurations specified in Table 6.3D.3.3-1.

Table 6.3D.3.3-1: UL MIMO configuration in closed-loop spatial multiplexing scheme

Transmission scheme	DCI format	Codebook Index
Codebook based uplink	DCI format 0_1	Codebook index 0

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.3

6.3D.3.4 Test description

6.3D.3.4.1 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 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, and are shown in table 6.3D.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3D.3.4.1-1: Test Configuration Table

<table>
<tr><th colspan="4">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="2">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Low range, Mid range, High range</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Lowest, Mid, Highest</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">Lowest, Highest</td></tr>
<tr><th colspan="4">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><td></td><td rowspan="2">N/A for minimum output power test case</td><td>Modulation</td><td>RB allocation (NOTE 1)</td></tr>
<tr><td>1</td><td>CP-OFDM QPSK</td><td>Inner Full</td></tr>
<tr><td colspan="4">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3D.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 [5] clause 4.5. Message contents are defined in clause 6.3D.3.4.3.

6.3D.3.4.2 Test procedure

1. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3D.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for15kHz SCS, on slots 8 and 18 for 30kHz SCS and on slots 17 and 37 for 60kHz SCS. The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. On power sub test:

   3.1. Measure the sum output power at two transmit antenna connectors of the UE PUSCH transmission during one slot.
4. OFF power sub test:

   4.1. Measure the UE transmission OFF power at each antenna connectors during the slot prior to the PUSCH transmission, excluding a transient period of 10 μs at the end of the slot.

   4.2. Measure the UE transmission OFF power at each antenna connectors during the slot following the PUSCH transmission, excluding a transient period of 10 μs at the beginning of the slot.

6.3D.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and following exceptions.

Table 6.3D.3.4.3-1: PUSCH-ConfigCommon

Derivation Path: TS 38.508-1[5], Table 4.6.3-119			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon ::= SEQUENCE {			
p0-NominalWithGrant	-100		
}			

Table 6.3D.3.4.3-2: TDD-UL-DL-Config

Derivation Path: TS 38.508-1[5], Table 4.6.3-192			
Information Element	**Value/remark**	**Comment**	**Condition**
TDD-UL-DL-ConfigCommon ::= SEQUENCE {			
referenceSubcarrierSpacing	SubcarrierSpacing		
pattern1 SEQUENCE {			
dl-UL-TransmissionPeriodicity	ms5		FR1
	ms10		FR1_15kHz
nrofDownlinkSlots	6		FR1_15kHz
	6		FR1_30kHz
	14		FR1_60kHz
nrofDownlinkSymbols	10		FR1_15kHz
	6		FR1_30kHz
	12		FR1_60kHz
nrofUplinkSlots	3		FR1_15kHz, FR1_30kHz
	4		FR1_60kHz
nrofUplinkSymbols	4		FR1_30kHz
	2		FR1_15kHz,
	8		FR1_60kHz
}			
pattern2	Not present		
}			

Table 6.3D.3.4.3-3: PUSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1[5], Table 4.6.3-122			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF {	2 entries		
PUSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
k2	4		FR1_15kHz, FR1_30kHz
	6		FR1_60kHz
mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
PUSCH-TimeDomainResourceAllocation[2] SEQUENCE {		addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [22] Table 8.2-1.	
k2	2	K_2+ Δ=4 acc. to TS 38.214 [21] Table 6.1.2.1.1-5 (NOTE 1)	FR1_15kHz
	6	K_2+ Δ=9 acc. to TS 38.214 [21] Table 6.1.2.1.1-5 (NOTE 1)	FR1_30kHz

mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
}			
NOTE 1: Values are chosen so that first slot of a TDD-UL-DL slot configuration period can be used for the Random Access Response and the last slot (of the same or another period) for the corresponding Msg3.			

Condition	Explanation
FR1_15kHz	FR1 is used under the test. SCS is set to 15kHz.
FR1_30kHz	FR1 is used under the test. SCS is set to 30kHz.
FR1_60kHz	FR1 is used under the test. SCS is set to 60kHz.

Table 6.3D.3.4.3-4: ServingCellConfigCommon

Derivation Path: 38.508-1[5], Table 4.6.3-168			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfigCommon ::= SEQUENCE {			
ss-PBCH-BlockPower	18		SCS_15kHz
	21		SCS_30kHz
}			

Condition	Explanation
SCS_15kHz	SCS=15kHz for SS/PBCH block
SCS_30kHz	SCS=30kHz for SS/PBCH block

Table 6.3D.3.4.3-5: *P-Max*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-89			
Information Element	**Value/remark**	**Comment**	**Condition**
P-Max	23		Power class 2 or power class 1.5

6.3D.3.5 Test requirement

The requirement for the power measured in steps 2, 3 and 4 of the test procedure shall not exceed the values specified in Table 6.3D.3.5-1.

Table 6.3D.3.5-1: General ON/OFF time mask

	Channel bandwidth / minimum output power / measurement bandwidth													
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	45 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Transmit OFF power	≤ -50+TT dBm													
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	43.575	48.615	58.35	68.07	78.15	88.23	98.31
Transmit ON power	Same as test ID 1 in Table 6.2D.2.5-1													
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3D.3.2.5-2														

Table 6.3D.3.5-2: Test Tolerance for OFF power

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

Table 6.3D.3.5-3: Void

6.3D.4 Power control for UL MIMO

6.3D.4.1 Absolute power tolerance for UL MIMO

6.3D.4.1.1 Test purpose

To verify the ability of the UE transmitter for UL MIMO to set its initial output power to a specific value at the start of a contiguous transmission or non-contiguous transmission with a long transmission gap, i.e. transmission gap is larger than 20ms.

6.3D.4.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.4.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.4.2 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL MIMO configurations described in Table 6.3D.4.1.3-1

Table 6.3D.4.1.3-1: UL MIMO configuration in closed-loop spatial multiplexing scheme

Transmission scheme	DCI format	Codebook Index
Codebook based uplink	DCI format 0_1	Codebook index 0

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.4.

6.3D.4.1.4 Test description

6.3D.4.1.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3D.4.1.4.1-1. 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 6.3D.4.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB Allocation**	**Modulation**	**RB allocation (NOTE 1)**
1	N/A for Absolute power tolerance test case		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3D.4.1.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.3D.4.1.4.3. Note that PDCCH DCI format 0_1 sent after resetting uplink power with RRC Connection Reconfiguration, should have TPC command 0dB.

6.3D.4.1.4.2 Test procedure

Same test procedure as clause 6.3.4.2.4.2 with following exceptions.

The power of UE PUSCH first transmissions should be measured as the sum power at each antenna connector.

6.3D.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and following exceptions.

Table 6.3D.4.1.4.3-1: UplinkPowerControlCommon: Test point 1

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-114	Test point 1 to verify a UE relative low initial power transmission	
}			

Table 6.3D.4.1.4.3-2: UplinkPowerControlCommon: Test point 2

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-ConfigCommon::= SEQUENCE {			
p0-NominalWithGrant	-100	Test point 2 to verify a UE relative high initial power transmission	
}			

Table 6.3D.4.1.4.3-3: ServingCellConfigCommon

Derivation Path: 38.508-1[5], Table 4.6.3-168			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfigCommon ::= SEQUENCE {			
ss-PBCH-BlockPower	18		SCS_15kHz
	21		SCS_30kHz
}			

Condition	Explanation
SCS_15kHz	SCS=15kHz for SS/PBCH block
SCS_30kHz	SCS=30kHz for SS/PBCH block

6.3D.4.1.5 Test requirement

The requirement for the power measured in step (2) of the test procedure is not to exceed the values specified in Table 6.3D.4.1.5-1 and 6.3D.4.1.5-2.

Table 6.3D.4.1.5-1: Absolute power tolerance: test point 1

		Channel bandwidth / expected output power (dBm)													
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Expected Measured power	SCS15	-17.6	-14.4	-12.6	-11.3	-10.4	-9.6	-8.3	-7.8	-7.3	N/A	N/A	N/A	N/A	N/A
	SCS30	-18.2	-14.8	-12.8	-11.5	-10.5	-9.7	-8.3	-7.9	-7.4	-6.5	-5.8	-5.2	-4.7	-4.2
	SCS60		-15.2	-13	-11.8	-10.7	-9.8	-8.5	-8	-7.5	-6.6	-5.9	-5.3	-4.8	-4.3
Power tolerance		± (9+TT)dB													
Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3.															

Table 6.3D.4.1.5-2: Absolute power tolerance: test point 2

		Channel bandwidth / expected output power (dBm)													
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Expected Measured power	SCS15	-3.6	0.4	1.4	2.7	3.6	4.4	5.7	6.2	6.7	N/A	N/A	N/A	N/A	N/A
	SCS30	-4.2	-0.8	1.2	2.5	3.5	4.3	5.7	6.2	6.6	7.5	8.2	8.8	9.3	9.8
	SCS60	N/A	-1.2	1	2.2	3.3	4.2	5.5	6	6.5	7.4	8.1	8.7	9.2	9.7
Power tolerance		± (9+TT)dB													
Note 1: The higher power limit shall not exceed the maximum output power requirements defined in sub-clause 6.2.1.3 Note 2: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3.															

Table 6.3D.4.1.5-3: Test Tolerance

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0 dB	1.4 dB
40MHz < BW ≤ 100MHz	1.4 dB	1.4 dB

6.3D.4.2 Relative power tolerance for UL MIMO

6.3D.4.2.1 Test purpose

To verify the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is ≤ 20ms.

6.3D.4.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.4.2.3 Minimum conformance requirements

For UE supporting UL MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.4.3 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL MIMO configurations described in Table 6.3D.4.2.3-1

Table 6.3D.4.2.3-1: UL MIMO configuration in closed-loop spatial multiplexing scheme

Transmission scheme	DCI format	Codebook Index
Codebook based uplink	DCI format 0_1	Codebook index 0

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.4

6.3D.4.2.4 Test description

6.3D.4.2.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3D.4.2.4.1-1. 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 6.3D.4.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.3.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test Parameters				
Ch BW	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB Allocation**	**Modulation**	**RB allocation (NOTE 1)**
5MHz	N/A for Relative power tolerance test case		CP-OFDM QPSK	See Table 6.3D.4.2.5-1 See Table 6.3D.4.2.5-2 See Table 6.3D.4.2.5-7
10MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
15MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
20MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
25MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
30MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
40MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
45MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
50MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-3 See Table 6.3D.4.2.5-4 See Table 6.3D.4.2.5-7
60MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-5 See Table 6.3D.4.2.5-6 See Table 6.3D.4.2.5-7
70MHz			CP-OFDM QPSK	See Table 6.3.4.3.5-5 See Table 6.3.4.3.5-6 See Table 6.3.4.3.5-7
80MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-5 See Table 6.3D.4.2.5-6 See Table 6.3D.4.2.5-7
90MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-5 See Table 6.3D.4.2.5-6 See Table 6.3D.4.2.5-7
100MHz			CP-OFDM QPSK	See Table 6.3D.4.2.5-5 See Table 6.3D.4.2.5-6 See Table 6.3D.4.2.5-7
Note 1: The starting resource block shall be RB# 0				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3D.4.2.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.3D.4.2.4.3.

6.3D.4.2.4.2 Test procedure

Same test procedure as clause 6.3.4.3.4.2 with following exceptions.

The power of PUSCH transmissions should be measured as the sum power at each antenna connector.

Step 1.1 in ramping up pattern sub test should be changed into following description:

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 6.3.4.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send the appropriate TPC commands for PUSCH to the UE to ensure that the UE transmits PUSCH at -31.8 dBm +/- 2.7 dB.

6.3D.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.3D.4.2.5 Test requirement

Each UE power step measured in the test procedure 6.3D.4.2.4.2 should satisfy the test requirements specified in Table 6.3D.4.2.5-1 thru 6.3D.4.2.5-7.

Table 6.3D.4.2.5-1: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 15 RBs	TPC=+1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 15	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames
Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames
Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3D.4.2.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 15	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	15 RBs to 1 RB	TPC=-1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames
Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames
Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3D.4.2.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 20 RBs	TPC=+1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 20	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 50 RBs	TPC=+1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 50	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80+/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3D.4.2.5-4: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 45MHz, 50MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1RBs	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 20	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	20 RBs to 1 RB	TPC=-1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 50	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	50 RBs to 1 RB	TPC=-1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3D.4.2.5-5: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 81 RBs	TPC=+1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 81	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 75 RBs	TPC=+1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 75	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1: Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes. Note 2: The starting resource block shall be RB# 0. Note 3: TT=0.7dB Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.							

Table 6.3D.4.2.5-6: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 81	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	81 RBs to 1 RB	TPC=-1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 75	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	75 RBs to 1 RB	TPC=-1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.

Table 6.3D.4.2.5-7: Test Requirements Relative Power Tolerance for Transmission, alternating sub-test

BW	Test SCS [kHz]	Sub-test ID	Uplink RB allocation	TPC command	Expected power step size (Up or Down) ΔP [dB]	Power step size range (Up or Down) ΔP [dB]	PUSCH [dB]
5	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 15	TPC=0dB	11.76	10dB ≤ ΔP < 15dB	11.76 +/- (4 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
10,15,20, 25,30,40,45,50	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 20	TPC=0dB	13.01	10dB ≤ ΔP < 15dB	13.01 +/- (4 + TT)
		4	Alternating 1 and 50	TPC=0dB	16.99	15dB ≤ ΔP	16.99 +/- (5 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 24	TPC=0dB	13.80	10dB ≤ ΔP < 15dB	13.80 +/- (4 + TT)
	60	1	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
60,70,80,90,100	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 81	TPC=0dB	19.08	15dB < ΔP	19.08 +/- (5 + TT)
	60	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 75	TPC=0dB	18.75	15dB < ΔP	18.75 +/- (5 + TT)
Note 1: The starting resource block shall be RB# 0. Note 2: TT=0.7dB Note 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1.							

6.3D.4.3 Aggregate power tolerance for UL MIMO

6.3D.4.3.1 Test purpose

To verify the ability of the UE with UL MIMO to maintain its power during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant.

6.3D.4.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.3D.4.3.3 Minimum conformance requirements

For UE supporting UL MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.4.4 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL MIMO configurations described in Table 6.3D.4.3.3-1

Table 6.3D.4.3.3-1: UL MIMO configuration in closed-loop spatial multiplexing scheme

Transmission scheme	DCI format	Codebook Index
Codebook based uplink	DCI format 0_1	Codebook index 0

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3D.4

6.3D.4.3.4 Test description

6.3D.4.3.4.1 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, 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3D.4.3.4.1-1 and table 6.3D.4.3.4.1-2. 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 6.3D.4.3.4.1-1: Test Configuration Table: PUCCH sub-test

Initial Conditions		
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest
Test SCS as specified in Table 5.3.5-1		Lowest, Highest
Test Parameters for Channel Bandwidths		
Test ID	**Downlink Configuration**	**Uplink Configuration**
	N/A for aggregate power tolerance testcase	PUCCH format = Format 1 Length in OFDM symbols = 14
1		

Table 6.3D.4.3.4.1-2: Test Configuration Table: PUSCH sub-test

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for aggregate power tolerance testcase	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL and DL Reference Measurement channels are set according to Table 6.3D.4.3.4.1-1 (PUCCH sub-test) and Table 6.3D.4.3.4.1-2 (PUSCH sub-test)
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 [5] clause 4.5. Message contents are defined in clause 6.3D.4.3.4.3.

6.3D.4.3.4.2 Test procedure

Same test procedure as clause 6.3.4.4.4.2 with following exceptions.

The power of PDCCH /PUSCH transmissions should be measured as the sum power at each antenna connector.

6.3D.4.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.3D.4.3.5 Test requirement

The requirement for the power measurements made in step (1.3) and (2.3) of the test procedure shall not exceed the values specified in Table 6.3D.4.3.5-1. The power measurement period shall be 1 sub-frame.

Table 6.3D.4.3.5-1: Power control tolerance

TPC commands	UL channel	Test requirement measured power
0 dB	PUCCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (2.5dB + TT) of the 1st measurement.
0 dB	PUSCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (3.5dB + TT) of the 1st measurement.
Note 1: For SCS 30kHz 1 sub-frame corresponds to 2 slots, so 2 TPC commands will be sent for a single measurement period. For SCS 60kHz 1 sub-frame corresponds to 4 slot, so 4 TPC commands will be sent for a single measurement period.		

6.3E Output power dynamics for V2X

6.3E.1 Minimum output power for V2X

6.3E.1.0 Minimum conformance requirements

6.3E.1.0.1 General

When UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions for NR V2X operating bands in Table 5.2E-1, the minimum output power is specified in Table 6.3E.1.0.1-1. The minimum output power is defined as the mean power in at least one sub-frame 1 ms.

Table 6.3E.1.0.1-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
10	-30	9.375
20	-30	19.095
30	-28.2	28.815
40	-27	38.895

For NR V2X UE with two transmit antenna connectors, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1 ms). The minimum output power shall not exceed the values specified for single carrier.

If the UE transmits on one antenna connector at a time, the requirements specified for single carrier shall apply to the active antenna connector.

6.3E.1.0.2 Minimum output power for V2X con-current operation

For the inter-band con-current NR V2X operation, the requirements specified in subclause 6.3.1.3 shall apply for the uplink in licensed band and the requirements specified in subclause 6.3E.1.0 shall apply for the sidelink in licensed band or Band n47.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3E.1

6.3E.1.1 Minimum output power for V2X / non-concurrent operation

6.3E.1.1.1 Test purpose

Same test purpose as in 6.3.1.1.

6.3E.1.1.2 Test applicability

This test case applies to all types of UE release 16 and forward that support NR V2X sidelink communication.

6.3E.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3E.1.0.

6.3E.1.1.4 Test description

6.3E.1.1.4.1 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 5.2E.1-1 and table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.3E.1.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annex A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.3E.1.1.4.1-1: Test Configuration Table for minimum output power

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.8		Low range, High range	
Test Channel Bandwidths as specified TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Freq**	**V2X Configuration to Transmit**	
		Modulation	**PSCCH and PSSCH RB allocation (Note 1)**
1	Default	QPSK	Outer_Full
3	Default	16QAM	Outer_Full
5	Default	64QAM	Outer_Full
6	Default	256QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1E-1.			

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.3E.1.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.3E.1.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Ge ographical area #1, as defined in TS38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.3E.1.1.4.2 Test procedure

1. The UE starts to perform the NR sidelink communication according to *SL-PreconfigurationNR*. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the NR sidelink RMC.
2. Measure the mean power of the UE in the channel bandwidth according to the test configuration from Table 6.3E.1.1.4.1-1. The period of measurement shall be at least continuous duration of one active sub-frame (1ms) excluding guard symbols.

6.3E.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10 with the following exceptions.

Table 6.3E.1.1.4.3-1: *SL-ResourcePool*

Derivation Path: TS 38.508-1 [5], Table 4.6.6-25			
Information Element	**Value/remark**	**Comment**	**Condition**
SL-ResourcePool-r16 ::= SEQUENCE {			
sl-PSCCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sl-TimeResourcePSCCH-r16	As defined in Table 6.1E-2		
sl-FreqResourcePSCCH-r16	As defined in Table 6.1E-2		
}			
}			
sl-SubchannelSize-r16	As defined in Table 6.1E-2		
sl-StartRB-Subchannel-r16	As defined in Table 6.1E-2		
sl-NumSubchannel-r16	As defined in Table 6.1E-2		
}			

Table 6.3E.1.1.4.3-2: *SL-TxPower*

Derivation Path: TS 38.508-1 [5], Table 4.6.6-33			
Information Element	**Value/remark**	**Comment**	**Condition**
SL-TxPower-r16 ::= CHOICE {			
txPower	-30		
}			

6.3E.1.1.5 Test requirement

The minimum output power, derived in step 2 shall not exceed the values specified in Table 6.3E.1.1.5-1.

Table 6.3E.1.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
10	-30+TT	9.375
20	-30+TT	19.095
30	-28.2+TT	28.815
40	-27+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3.1.5-2		

Table 6.3E.1.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0 dB	1.3 dB

6.3E.1.1D Minimum output power for V2X / non-concurrent operation / SL-MIMO

Editor's Note: The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Preconfiguration is not complete in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

- Measurement period of PSFCH and PSBCH is FFS.

- Connection diagram for SL-MIMO is TBD

6.3E.1.1D.1 Test purpose

Same test purpose as in 6.3E.1.1.

6.3E.1.1D.2 Test applicability

This test case applies to all types of UE release 16 and forward that support NR V2X sidelink communication and SL-MIMO.

6.3E.1.1D.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3E.1.0.

6.3E.1.1D.4 Test description

6.3E.1.1D.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 5.2E.1-1 and table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.3E.1.1D.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.3E.1.1D.4.1-1: Test Configuration Table for minimum output power for SL-MIMO

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.8		Low range, High range	
Test Channel Bandwidths as specified TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Freq**	**V2X Configuration to Transmit**	
		Modulation	**PSCCH and PSSCH RB allocation (Note 1)**
1	Default	QPSK	Outer_Full
2	Default	16QAM	Outer_Full
3	Default	64QAM	Outer_Full
4	Default	256QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1E-1.			

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.

2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.3E.1.1D.4.3.

3. The V2X Reference Measurement Channel is set according to Table 6.3E.1.1D.4.1-1.

4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.

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

6. Ensure the UE is in state 4-A as defined in TS 38.508-1 [4], subclause 4.4A using generic procedure parameter Sidelink (*On*), Cast Type (*Unicast*), GNSS Sync (*On*) and *Transmit Mode with SL-MIMO.*

6.3E.1.1D.4.2 Test procedure

1. The UE starts to perform the NR sidelink communication according to *SL-PreconfigurationNR* with 2-layer MIMO codebook TPMI 0. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the NR sidelink RMC.

2. Measure the sum of mean power of the UE at each transmit antenna connector in the channel bandwidth according to the test configuration from Table 6.3E.1.1D.4.1-1. The period of measurement shall be at least continuous duration of one active sub-frame (1ms) excluding guard symbols.

6.3E.1.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10 with the following exceptions.

Table 6.3E.1.1D.4.3-1: *SL-ResourcePool*

Derivation Path: TS 38.508-1 [5], Table 4.6.6-25			
Information Element	**Value/remark**	**Comment**	**Condition**
SL-ResourcePool-r16 ::= SEQUENCE {			
sl-PSCCH-Config-r16 CHOICE {			
setup SEQUENCE {			
sl-TimeResourcePSCCH-r16	As defined in Table 6.1E-2		
sl-FreqResourcePSCCH-r16	As defined in Table 6.1E-2		
}			
}			
sl-SubchannelSize-r16	As defined in Table 6.1E-2		
sl-StartRB-Subchannel-r16	As defined in Table 6.1E-2		
sl-NumSubchannel-r16	As defined in Table 6.1E-2		
}			

Table 6.3E.1.1D.4.3-2: *SL-TxPower*

Derivation Path: TS 38.508-1 [5], Table 4.6.6-33			
Information Element	**Value/remark**	**Comment**	**Condition**
SL-TxPower-r16 ::= CHOICE {			
txPower	-30		
}			

6.3E.1.1D.5 Test requirement

The minimum output power, derived in step 2 shall not exceed the values specified in Table 6.3E.1.1D.5-1.

Table 6.3E.1.1D.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
10	-30+TT	9.375
20	-30+TT	19.095
30	-28.2+TT	28.815
40	-27+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3E.1.1D.5-2		

Table 6.3E.1.1D.5-2: Test Tolerance (UE maximum output power)

	f ≤ 3.0GHz	4.2GHz < f ≤ 6.0GHz
BW ≤ 40MHz	FFS	FFS

6.3E.2 Transmit OFF power for V2X

6.3E.2.0 Minimum conformance requirements

6.3E.2.0.1 General

When UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions for NR V2X operating bands in Table 5.2E.1-1, the requirements specified in Table 6.3E.2.0.1-1 apply.

Table 6.3E.2.0.1-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
10	-50	9.375
20	-50	19.095
30	-50	28.815
40	-50	38.895

For NR V2X UE supporting SL MIMO, the transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3E.2.0.1-1 for single carrier. Transmit off power is defined as the mean power in at least one sub-frame 1 ms.

6.3E.2.0.2 Transmit OFF power for V2X con-current operation

For the inter-band con-current NR V2X operation, the requirements specified in clause 6.3.2 shall apply for the uplink in licensed band and the requirements specified in Table 6.3E.2.0.1-1 shall apply for the sidelink in licensed band or Band n47.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3E.2.

6.3E.2.1 Transmit OFF power for V2X / non-concurrent operation

Editor's Note: This test is incomplete. The following aspects are not yet determined:

- 6.3E.3.2.1 General time mask for V2X / non-concurrent operation is FFS.

6.3E.2.1.1 Test purpose

To verify that the UE transmit OFF power is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3E.2.1.2 Test applicability

The requirements of this test apply in test case 6.3E.3.2.1 General time mask for V2X / non-concurrent operation to all types of NR UE release 16 and forward that support NR V2X sidelink communication.

6.3E.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3E.2.0.

6.3E.2.1.4 Test description

This test is covered by clause 6.3E.3.2.1 General time mask for V2X / non-concurrent operation.

6.3E.2.1.5 Test requirement

The requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3E.2.1.5-1.

Table 6.3E.2.1.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
10	-50+TT	9.375
20	-50+TT	19.095
30	-50+TT	28.815
40	-50+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3E.2.1.5-2		

Table 6.3E.2.1.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB

6.3E.2.1D Transmit OFF power for V2X / non-concurrent operation / SL-MIMO

Editor’s Note: This test is incomplete. The following aspects are not yet determined:

- 6.3E.3.2.1D General time mask for V2X / non-concurrent operation / SL-MIMO is FFS.

6.3E.2.1D.1 Test purpose

To verify that the UE transmit OFF power is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3E.2.1D.2 Test applicability

The requirements of this test apply in test case 6.3E.3.2.1D General time mask for V2X / non-concurrent operation / SL-MIMO to all types of NR UE release 16 and forward that support NR V2X sidelink communication and SL-MIMO.

6.3E.2.1D.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3E.2.0.

6.3E.2.1D.4 Test description

This test is covered by clause 6.3E.3.2.1D General time mask for V2X / non-concurrent operation / SL-MIMO.

6.3E.2.1D.5 Test requirement

The requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3E.2.1D.5-1.

Table 6.3E.2.1D.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
10	-50+TT	9.375
20	-50+TT	19.095
30	-50+TT	28.815
40	-50+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3E.2.1D.5-2		

Table 6.3E.2.1D.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB

6.3E.2.2 Transmit OFF power for V2X / con-current operation

Editor's Note: This test is incomplete. The following aspects are not yet determined:

- 6.3E.3.2.2 General time mask for V2X / con-current operation is FFS.

6.3E.2.2.1 Test purpose

To verify that the UE transmit OFF power is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3E.2.2.2 Test applicability

The requirements of this test apply in test case 6.3E.3.2.2 General time mask for V2X / con-current operation to all types of NR UE release 16 and forward that support NR V2X sidelink communication.

6.3E.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3E.2.0.

6.3E.2.2.4 Test description

This test is covered by clause 6.3E.3.2.2 General time mask for V2X / con-current operation.

6.3E.2.2.5 Test requirement

The requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3E.2.2.5-1.

Table 6.3E.2.2.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
10	-50+TT	9.375
20	-50+TT	19.095
30	-50+TT	28.815
40	-50+TT	38.895
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3E.2.2.5-2		

Table 6.3E.2.2.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB

6.3F Output power dynamics for shared spectrum channel access

6.3F.1 Minimum output power

Editor's Note: This test is incomplete. The following aspects are not yet determined:

- Test configuration table is FFS

- MU and TT for >6GHz (band n96).

- Test state and generic procedure are TBD in 38.508-1

6.3F.1.1 Test purpose

To verify the UE's ability to transmit with a broadband output power below the value specified in the test requirement when the power is set to a minimum value.

6.3F.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.3F.1.3 Minimum conformance requirements

The minimum controlled output power of the UE is defined as the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

The minimum output power is defined as the mean power in at least one sub-frame 1 ms. The minimum output power shall not exceed the values specified in Table 6.3F.1.3-1.

Table 6.3F.1.3-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40	4.515
10	-40	9.375
15	-40	14.235
20	-40	19.095
25	-39	23.955
30	-38.2	28.815
40	-37	38.895
45	-36.5	43.575
50	-36	48.615
60	-35.2	58.35
70	-34.6	68.07
80	-34	78.15
90	-33.5	88.23
100	-33	98.31

The normative reference for requirement is TS 38.101-1 [2] clause 6.3F.1 and 6.3.1.

6.3F.1.4 Test description

6.3F.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 operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.3F.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 6.3F.1.4.1-1: Test Configuration Table

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3F.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 [5] clause 4.5. Message contents are defined in clause 6.3F.1.4.3.

6.3F.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 6.3F.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.
3. Measure the mean power of the UE in the associated measurement channel bandwidth specified in Table 6.3F.1.5-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

6.3F.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.3F.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.3F.1.5 Test requirement

The minimum output power, derived in step 3 shall not exceed the values specified in Table 6.3F.1.5-1.

Table 6.3F.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
25	-39+TT	23.955
30	-38.2+TT	28.815
40	-37+TT	38.895
45	-36.5+TT	43.575
50	-36+TT	48.615
60	-35.2+TT	58.35
70	-34.6+TT	68.07
80	-34+TT	78.15
90	-33.5+TT	88.23
100	-33+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3F.1.5-2		

Table 6.3F.1.5-2: Test Tolerance (Minimum output power)

	4.2GHz < f ≤ 5.925GHz	5.925GHz < f ≤ 7.125GHz
BW ≤ 40MHz	1.3 dB	TBD
40MHz < BW ≤ 100MHz	1.3 dB	TBD

6.3F.2 Transmit OFF power for shared spectrum channel access

6.3F.2.1 Test purpose

To verify that the UE transmit OFF power is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3F.2.2 Test applicability

The requirements of this test apply in test case 6.3F.3 Transmit ON/OFF time mask for shared spectrum channel access to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.3F.2.3 Minimum conformance requirements

Transmit OFF power is defined as the mean power in the channel bandwidth when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of its ports.

The Transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The Transmit OFF power shall not exceed the values specified in Table 6.3F.2.3-1.

Table 6.3F.2.3-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50	4.515
10	-50	9.375
15	-50	14.235
20	-50	19.095
25	-50	23.955
30	-50	28.815
40	-50	38.895
50	-50	48.615
60	-50	58.35
70	-50	68.07
80	-50	78.15
90	-50	88.23
100	-50	98.31

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3F.2 and 6.3.2.

6.3F.2.4 Test description

This test is covered by clause 6.3F.3 Transmit ON/OFF time mask.

6.3F.2.5 Test requirement

The requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3F.2.5-1.

Table 6.3F.2.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
10	-50+TT	9.375
20	-50+TT	19.095
40	-50+TT	38.895
60	-50+TT	58.35
80	-50+TT	78.15
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3F.2.5-2		

Table 6.3F.2.5-2: Test Tolerance (Transmit OFF power)

	4.2GHz < f ≤ 5.925GHz	5.925GHz < f ≤ 7.125GHz
BW ≤ 40MHz	1.8 dB	TBD
40MHz < BW ≤ 100MHz	1.8 dB	TBD

6.3F.3 Transmit ON/OFF time mask for shared spectrum channel access

6.3F.3.1 General

The transmit power time mask defines the transient period(s) allowed between transmit OFF power as defined in clause 6.3F.2 and transmit ON power symbols (transmit ON/OFF). The transmit power ON/OFF time mask specified in clause 6.3F.3.2 supersedes the ON/OFF masks specified in clause 6.3.3; however, between continuous ON-power transmissions the requirements in clause 6.3.3 apply. Unless otherwise stated the requirements in clause 6.5F apply also in transient periods.

6.3F.3.2 General ON/OFF time mask

Editor's Note: This test is incomplete. The following aspects are not yet determined:

- Test points are TBD

- MU and TT for >6GHz (band n96).

- RMC in Annex A.

- Test coverage for UL-MIMO

- Message exceptions

- Test state and generic procedure are TBD in 38.508-1

6.3F.3.2.1 Test purpose

To verify that the general ON/OFF time mask meets the requirements given in 6.3F.3.2.5.

The transmit power time mask for transmit ON/OFF defines the transient period(s) allowed between transmit OFF power as defined in sub-clause 6.3F.2 and transmit ON power symbols (transmit ON/OFF)

Transmission of the wrong power increases interference to other channels, or increases transmission errors in the uplink channel.

6.3F.3.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.3F.3.2.3 Minimum conformance requirements

The general ON/OFF time mask defines the observation period between transmit OFF and ON power and between transmit ON and OFF power for each SCS as illustrated below in Figure 6.3F.3.2.3-1. ON/OFF scenarios include: contiguous, and non-contiguous transmission, etc.

The OFF power measurement period is defined in a duration of at least one slot excluding any transient periods. The ON power is defined as the mean power over the duration of at least one slot excluding any transient period and non-transmitted symbols. The leading transient period starts 5us before the beginning of the first symbol of transmission and extends 10us into the transmission including the CP extension if applicable. The trailing transient period starts 5us before the end of transmission and extends 5us beyond the end of transmission.

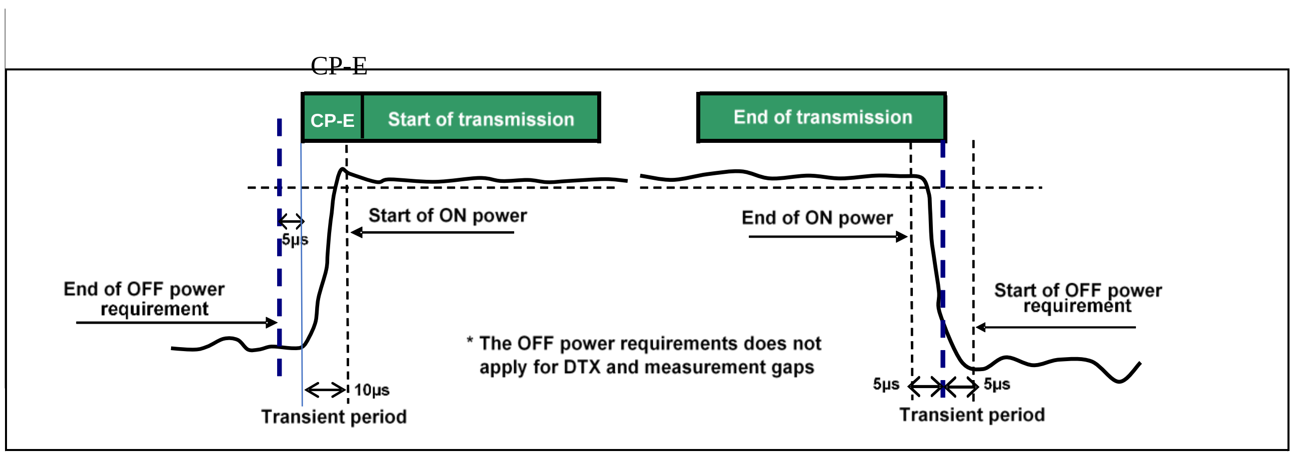

Figure 6.3F.3.2.3-1: General ON/OFF time mask for shared spectrum channel access

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3F.3.2.

6.3F.3.2.4 Test description

6.3F.3.2.4.1 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 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, and are shown in table 6.3F.3.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3F.3.2.4.1-1: Test Configuration Table

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3F.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 [5] clause 4.5. Message contents are defined in clause 6.3F.3.2.4.3.

6.3F.3.2.4.2 Test procedure

1. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3F.3.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots TBD.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. ON power sub test:

3.1. Measure the output power of the UE PUSCH transmission during one slot, excluding a transient period of 10 µs in the beginning of the slot and 5 µs in the end of the slot.

4. OFF power sub test:

4.1. Measure the UE transmission OFF power during the slot prior to the PUSCH transmission, excluding a transient period of 5 µs in the end of the slot.

4.2. Measure the UE transmission OFF power during the slot following the PUSCH transmission, excluding a transient period of 5 µs at the beginning of the slot.

6.3F.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exceptions.

FFS

6.3F.3.2.5 Test requirement

The requirement for the power measured in steps 2, 3 and 4 of the test procedure shall not exceed the values specified in Table 6.3F.3.2.5-1.

Table 6.3F.3.2.5-1: General ON/OFF time mask

	Channel bandwidth / minimum output power / measurement bandwidth				
	10 MHz	20 MHz	40 MHz	60 MHz	80 MHz
Transmit OFF power	≤ -50+TT dBm				
Transmission OFF Measurement bandwidth	9.375	19.095	38.895	58.35	78.15
Transmit ON power	TBD				
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3F.3.2.5-2					

Table 6.3F.3.2.5-2: Test Tolerance for OFF power

	4.2GHz < f ≤ 5.925GHz	5.925GHz < f ≤ 7.125GHz
BW ≤ 40MHz	1.8 dB	TBD
40MHz < BW ≤ 100MHz	1.8 dB	TBD

Table 6.3F.3.2.5-3: Test Tolerance for ON power

	4.2GHz < f ≤ 5.925GHz	5.925GHz < f ≤ 7.125GHz
BW ≤ 40MHz	1.8 dB	TBD
40MHz < BW ≤ 100MHz	1.8 dB	TBD

6.3G Output power dynamics for Tx Diversity

6.3G.1 Minimum output power for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.3G.1.1 Test purpose

Same test purpose as in 6.3.1.1.

6.3G.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.1.3 Minimum conformance requirements

For UE supporting Tx diversity, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1 ms). The minimum output power shall not exceed the values specified in Table 6.3.1.3-1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.1.

6.3G.1.4 Test description

Same test description as specified in clause 6.3.1.4 with following exceptions:

Step 3 of Test procedure as in 6.3.1.4.2 is replaced by:

3. Measure the sum of mean power at each antenna connector in the associated measurement channel bandwidth specified in Table 6.3G.1.5-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

6.3G.1.5 Test requirement

The minimum output power, derived in step 3 shall not exceed the values specified in Table 6.3G.1.5-1.

Table 6.3G.1.5-1: Minimum output powerChannel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
25	-39+TT	23.955
30	-38.2+TT	28.815
40	-37+TT	38.895
45	-36.5+TT	43.575
50	-36+TT	48.615
60	-35.2+TT	58.35
70	-34.6+TT	68.07
80	-34+TT	78.15
90	-33.5+TT	88.23
100	-33+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3G.1.5-2		

Table 6.3G.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.0 dB	1.3 dB
40MHz < BW ≤ 100MHz	1.3 dB	1.3 dB

6.3G.2 Transmit OFF power for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.3G.2.1 Test purpose

Same test purpose as in 6.3.2.1.

6.3G.2.2 Test applicability

The requirements of this test apply in test cases 6.3G.3 Transmit ON/OFF time mask for Tx Diversity to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.2.3 Minimum conformance requirements

For UE supporting Tx diversity, the transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1 ms) excluding any transient periods.

The transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3.2.3-1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.2.

6.3G.2.4 Test description

This test is covered by clause 6.3G.3 Transmit ON/OFF time mask.

6.3G.2.5 Test requirement

For each transmit antenna connector, the requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3G.2.5-1.

Table 6.3G.2.5-1: Transmit OFF powerChannel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50+TT	4.515
10	-50+TT	9.375
15	-50+TT	14.235
20	-50+TT	19.095
25	-50+TT	23.955
30	-50+TT	28.815
40	-50+TT	38.895
45	-50+TT	43.575
50	-50+TT	48.615
60	-50+TT	58.35
70	-50+TT	68.07
80	-50+TT	78.15
90	-50+TT	88.23
100	-50+TT	98.31
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3G.2.5-2		

Table 6.3G.2.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

6.3G.3 Transmit ON/OFF time mask for Tx Diversity

6.3G.3.1 General ON/OFF time mask for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.3G.3.1.1 Test purpose

Same test purpose as in 6.3.3.2.1.

6.3G.3.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.3.1.3 Minimum conformance requirements

For UE supporting Tx diversity, the general ON/OFF time mask requirements in clause 6.3.3.2.3 apply at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.3.

6.3G.3.1.4 Test description

Same test description as in clause 6.3.3.2.4 with following exceptions:

- The ON power is measured as sum of both transmit antenna connectors.
- The OFF power is measured at each transmit antenna connector.

6.3G.3.1.5 Test requirement

The measured ON power and OFF power shall not exceed the values specified in Table 6.3G.3.1.5-1.

Table 6.3G.3.1.5-1: General ON/OFF time mask	Channel bandwidth / minimum output power / measurement bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**
Transmit OFF power	≤ -50+TT dBm												
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	43.575	48.615	58.35	68.07	78.15	88.23
Transmit ON power	Same as Table 6.2G.2.5-1 and Table 6.2G.2.5-2												
NOTE 1: TT of OFF power for each frequency and channel bandwidth is specified in Table 6.3G.3.1.5-2 NOTE 2: TT of ON power for each frequency and channel bandwidth is specified in Table 6.3G.3.1.5-3													

Table 6.3G.3.1.5-2: Test Tolerance for OFF power

	f ≤ 3.0GHz	**3.0GHz < f ≤ 6GHz**
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

Table 6.3G.3.1.5-3: Test Tolerance for ON power

	f ≤ 3.0GHz	**3.0GHz < f ≤ 6GHz**
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

6.3G.3.2 PRACH time mask for Tx Diversity

6.3G.3.2.1 Test purpose

Same test purpose as in 6.3.3.4.1.

6.3G.3.2.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.3.2.3 Minimum conformance requirements

For UE supporting Tx diversity, the PRACH time mask requirements in clause 6.3.3.4.3 apply at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.3.

6.3G.3.2.4 Test description

Same test description as in clause 6.3.3.4.4 with following exceptions:

- The ON power is measured as sum of both transmit antenna connectors.
- The OFF power is measured at each transmit antenna connector.

6.3G.3.2.5 Test requirement

The measured ON power and OFF power shall not exceed the values specified in Table 6.3G.3.2.5-1.

Table 6.3G.3.2.5-1: PRACH time mask

	Channel bandwidth / minimum output power / measurement bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Transmit OFF power	≤ -50+TT dBm												
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.15	88.23	98.31
Expected PRACH Transmission ON Measured Power for PRACH Format 0 and PRACH Format A3 for SCS 30kHz	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm	-1 dBm
Expected PRACH Transmission ON Measured Power for PRACH Format A3 for SCS 15kHz and SCS 60kHz	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm	-2 dBm
ON Power Tolerance	± (9+TT)dB												
NOTE 1: TT of OFF power for each frequency and channel bandwidth is specified in Table 6.3G.3.2.5-2 NOTE 2: TT of ON power for each frequency and channel bandwidth is specified in Table 6.3.3.4.5-2													

Table 6.3G.3.2.5-2: Test Tolerance (Transmit OFF power and PRACH time mask)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6.0GHz
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

6.3G.3.3 SRS time mask for Tx Diversity

6.3G.3.3.1 Test purpose

Same test purpose as in 6.3.3.6.1.

6.3G.3.3.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.3.3.3 Minimum conformance requirements

For UE supporting Tx diversity, the SRS time mask requirements in clause 6.3.3.6.3 apply at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.3.

6.3G.3.3.4 Test description

Same test description as in clause 6.3.3.6.4 with following exceptions:

- The ON power is measured as sum of both transmit antenna connectors.
- The OFF power is measured at each transmit antenna connector.

6.3G.3.3.5 Test requirement

The measured ON power and OFF power shall not exceed the values specified in Table 6.3G.3.3.5-1.

Table 6.3G.3.3.5-1: SRS time mask

	Channel bandwidth / minimum output power / measurement bandwidth										
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MH**
Transmit OFF power	≤ -50+TT dBm										
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.1
Transmit ON power	Same as Table 6.2G.1.5-1 and Table 6.2G.1.5-2										
NOTE 1: TT of OFF power for each frequency and channel bandwidth is specified in Table 6.3G.3.3.5-2											

Table 6.3G.3.3.5-2: Test Tolerance (Transmit OFF power and SRS time mask)

	f ≤ 3.0GHz	**3.0GHz < f ≤ 6GHz**
BW ≤ 40MHz	1.5 dB	1.8 dB
40MHz < BW ≤ 100MHz	1.7 dB	1.8 dB

6.3G.4 Power control for Tx Diversity

6.3G.4.1 Absolute power tolerance for Tx Diversity

FFS

6.3G.4.2 Relative power tolerance for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.3G.4.2.1 Test purpose

Same test purpose as in 6.3.4.3.1.

6.3G.4.2.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.4.2.3 Minimum conformance requirement

For UE supporting Tx diversity, the relative power tolerance applies to the sum of output power at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.4.

6.3G.4.2.4 Test description

Same test description as in clause 6.3.4.3.4 with the output power is measured as the sum of both antenna connectors.

6.3G.4.2.5 Test requirement

Each UE power step measured in the test procedure 6.3G.4.2.4 should satisfy the test requirements specified in Table 6.3G.4.2.5-1 through 6.3G.4.2.5-7.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of ramping up and ramping down test patterns. For these exceptions the power tolerance limit is a maximum of ± (6.0 + TT) dB. If there is an exception in the power step caused by the RB change for all test patterns (A, B, C) then fail the UE.

Table 6.3G.4.2.5-1: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 15 RBs	TPC=+1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 15	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 1	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1: Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames Note 2: The starting resource block shall be RB# 0. Note 3: TT=0.7dB Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.							

Table 6.3G.4.2.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 15	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	15 RBs to 1 RB	TPC=-1dB	12.76	10dB ≤ ΔP < 15dB	12.76 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Sub-frames before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Sub-frames before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Sub-frames after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames
Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames
Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.

Table 6.3G.4.2.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 50MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 20 RBs	TPC=+1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 20	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 50 RBs	TPC=+1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 50	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80+/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 10 RBs	TPC=+1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 10	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.

Table 6.3G.4.2.5-4: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz, 25MHz, 30MHz, 40MHz, 50MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
15	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1RBs	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 20	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	20 RBs to 1 RB	TPC=-1dB	14.01	10dB ≤ ΔP < 15dB	14.01 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 50	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	50 RBs to 1 RB	TPC=-1dB	17.99	15dB ≤ ΔP	17.99 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 10	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	10 RBs to 1 RB	TPC=-1dB	11.00	10dB ≤ ΔP < 15dB	11.00 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2:	The starting resource block shall be RB# 0.
Note 3:	TT=0.7dB
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.

Table 6.3G.4.2.5-5: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp up sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Up) ΔP [dB]	Power step size range (Up) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 24 RBs	TPC=+1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 24	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 81 RBs	TPC=+1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 81	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 5 RBs	TPC=+1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 5	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	1RB	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	1RB to 75 RBs	TPC=+1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 75	TPC=+1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
Note 1:	Position of RB change: Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes. Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.						
Note 2:	The starting resource block shall be RB# 0.						
Note 3:	TT=0.7dB						
Note 4:	Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.						

Table 6.3G.4.2.5-6: Test Requirements Relative Power Tolerance for Transmission, channel BW 60MHz, 70MHz, 80MHz, 90MHz, 100MHz ramp down sub-test

Test SCS [kHz]	Sub-test ID	Applicable sub-frames	Uplink RB allocation	TPC command	Expected power step size (Down) ΔP [dB]	Power step size range (Down) ΔP [dB]	PUSCH [dB]
30	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/-0.7 + TT
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 24	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	24 RBs to 1 RB	TPC=-1dB	14.80	10dB ≤ ΔP < 15dB	14.80 +/- (4 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	3	Subframes before RB change	Fixed = 81	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	81 RBs to 1 RB	TPC=-1dB	20.08	15dB < ΔP	20.08 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
60	1	Subframes before RB change	Fixed = 5	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	5 RBs to 1 RB	TPC=-1dB	7.99	4dB ≤ ΔP < 10dB	7.99 +/- (3.5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
	2	Subframes before RB change	Fixed = 75	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)
		RB change	75 RBs to 1 RB	TPC=-1dB	19.75	15dB < ΔP	19.75 +/- (5 + TT)
		Subframes after RB change	Fixed = 1	TPC=-1dB	1	ΔP ≤ 1 dB	1 +/- (0.7 + TT)

Note 1: Position of RB change:
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.
Note 2: The starting resource block shall be RB# 0.
Note 3: TT=0.7dB
Note 4: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.

Table 6.3G.4.2.5-7: Test Requirements Relative Power Tolerance for Transmission, alternating sub-test

BW	Test SCS [kHz]	Sub-test ID	Uplink RB allocation	TPC command	Expected power step size (Up or Down) ΔP [dB]	Power step size range (Up or Down) ΔP [dB]	PUSCH [dB]
5	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 15	TPC=0dB	11.76	10dB ≤ ΔP < 15dB	11.76 +/- (4 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
10,15,20, 25,30,40,50	15	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 20	TPC=0dB	13.01	10dB ≤ ΔP < 15dB	13.01 +/- (4 + TT)
		4	Alternating 1 and 50	TPC=0dB	16.99	15dB ≤ ΔP	16.99 +/- (5 + TT)
	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 24	TPC=0dB	13.80	10dB ≤ ΔP < 15dB	13.80 +/- (4 + TT)
	60	1	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		2	Alternating 1 and 10	TPC=0dB	10.00	10dB ≤ ΔP < 15dB	10.00 +/- (4 + TT)
60, 70,80,90,100	30	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 81	TPC=0dB	19.08	15dB < ΔP	19.08 +/- (5 + TT)
	60	1	Alternating 1 and 2	TPC=0dB	3.01	3dB ≤ ΔP < 4dB	3.01 +/- (3 + TT)
		2	Alternating 1 and 5	TPC=0dB	6.99	4dB ≤ ΔP < 10dB	6.99 +/- (3.5 + TT)
		3	Alternating 1 and 75	TPC=0dB	18.75	15dB < ΔP	18.75 +/- (5 + TT)
Note 1: The starting resource block shall be RB# 0. Note 2: TT=0.7dB Note 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3G.1.							

6.3G.4.3 Aggregate power tolerance for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.3G.4.3.1 Test purpose

Same test purpose as in 6.3.4.4.1.

6.3G.4.3.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.3G.4.3.3 Minimum conformance requirements

For UE supporting Tx diversity, the absolute power tolerance applies to the sum of output power at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.3G.4.

6.3G.4.3.4 Test description

Same test description as in clause 6.3.4.4.4 with the output power is measured as the sum of both antenna connectors.

6.3G.4.3.5 Test requirement

The requirement for the power measurements made in step 1.3 and 2.3 of the test procedure shall not exceed the values specified in Table 6.3G.4.3.5-1. The power measurement period shall be 1 sub-frame(1ms).

Table 6.3G.4.3.5-1: Power control tolerance

TPC command	UL channel	Test requirement measured power
0 dB	PUCCH	Given 5power measurements in the pattern, the 2nd, and later measurements shall be within ± (2.5 + TT) dB of the 1st measurement.
0 dB	PUSCH	Given 5 power measurements in the pattern, the 2nd, and later measurements shall be within ± (3.5 + TT) dB of the 1st measurement.
Note 1: For SCS 30kHz 1 sub-frame corresponds to 2 slots and for SCS 60kHz 1 sub-frame corresponds to 4 slots, so 2 TPC commands will be sent for a single measurement period. Note 2: TT=0.7dB.		

6.4 Transmit signal quality

In this clause a multitude of results are derived, all using one common algorithm returning these results: Global In-Channels TX-Test Annex E. Each sub clause of this clause contains a procedure and test requirements described for a specific measurement. If all relevant test parameters in different sub clauses are the same, then the results, returned by the Global In-Channel TX-Test, may be used across the applicable sub clauses.

6.4.1 Frequency error

6.4.1.1 Test purpose

This test verifies the ability of both, the receiver and the transmitter, to process frequency correctly.

Receiver: to extract the correct frequency from the stimulus signal, offered by the System simulator, under ideal propagation conditions and low level.

Transmitter: to derive the correct modulated carrier frequency from the results, gained by the receiver.

6.4.1.2 Test applicability

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

6.4.1.3 Minimum conformance requirements

The UE basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency shall be accurate to within ±0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency received from the NR Node B.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4.1

6.4.1.4 Test description

6.4.1.4.1 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 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 6.4.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range (NOTE 3)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest	
Test SCS as specified in Table 5.3.5-1			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**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. NOTE 3: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The DL and UL Reference Measurement channels are set according to Table 6.4.1.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.4.1.4.3

6.4.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4.1.4.1-1. 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 6.4.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.2.5-1. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at P_{UMAX} level for the duration of the test. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

4. Measure the Frequency Error using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

5. For UEs supporting DSS, repeat steps 1~4 on the applicable bands as specified in Section 5.4.2.1 with message contents being according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-61 and Table 4.6.3-62 with condition DSS.

6.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4.1.5 Test requirement

The 10 frequency error Δf results must fulfil the test requirement:

$|\Delta f| \leq (0.1 \text{ PPM} + 15 \text{ Hz})$

6.4.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs),
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.4.2 are defined using the measurement methodology specified in Annex E.

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE (as defined in TS 38.331 [6]), carrier leakage measurement requirement in subclause 6.4.2.2 and 6.4.2.3 shall be waived, and the RF correction with regard to the carrier leakage and IQ image shall be omitted during the calculation of transmit modulation quality.

6.4.2.1 Error Vector Magnitude

6.4.2.1.1 Test Purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clause 6.4.2.4.3. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and the duration of PUCCH/PUSCH channel, or one hop, if frequency hopping is enabled for PUCCH and PUSCH in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient as defined in subclause 6.3.3.3.

6.4.2.1.2 Test applicability

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

6.4.2.1.3 Minimum conformance requirements

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1.3-1 for the parameters defined in Table 6.4.2.1.3-2. For EVM evaluation purposes, all PRACH preamble formats 0-4 and all 5 PUCCH formats are considered to have the same EVM requirement as QPSK modulated.

Table 6.4.2.1.3-1: Requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	30
QPSK	%	17.5
16 QAM	%	12.5
64 QAM	%	8
256 QAM	%	3.5

Table 6.4.2.1.3-2: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ Table 6.3.1.3-1
UE Output Power for 256 QAM	dBm	≥ Table 6.3.1-1 + 10 dB
Operating conditions		Normal conditions

The normative reference for this requirement is TS 38.101 [2] clause 6.4.2.1.

6.4.2.1.4 Test description

6.4.2.1.4.1 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 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 6.4.2.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.1.4.1-1: Test Configuration Table for PUSCH

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range (NOTE 4)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		All	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation (NOTE 3)**	**RB allocation (NOTE 1)**
1[3]		DFT-s-OFDM PI/2 BPSK	Inner Full
2[3]		DFT-s-OFDM PI/2 BPSK	Outer Full
3		DFT-s-OFDM QPSK	Inner Full
4		DFT-s-OFDM QPSK	Outer Full
5		DFT-s-OFDM 16 QAM	Inner Full
6		DFT-s-OFDM 16 QAM	Outer Full
7		DFT-s-OFDM 64 QAM	Outer Full
8		DFT-s-OFDM 256 QAM	Outer Full
9		CP-OFDM QPSK	Inner Full
10		CP-OFDM QPSK	Outer Full
11		CP-OFDM 16 QAM	Inner Full
12		CP-OFDM 16 QAM	Outer Full
13		CP-OFDM 64 QAM	Outer Full
14		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

Table 6.4.2.1.4.1-2: Test Configuration Table for PUCCH

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4.2.1.4.1-1		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4.2.1.4.1-1		
Test SCS as specified in Table 5.3.5-1			See Table 6.4.2.1.4.1-1		
Test Parameters					
ID	**Downlink Configuration**		**Uplink Configuration**		
	Modulation	RB allocation	Waveform	PUCCH format	RB index
1	CP-OFDM QPSK	Full RB (Note 1)	CP-OFDM	PUCCH format = Format 1 (Note 4) Length in OFDM symbols = 14	0
2	CP-OFDM QPSK	Full RB (Note 1)	CP-OFDM	PUCCH format = Format (Note 4)1 Length in OFDM symbols = 14	N_{RB}-1
3	CP-OFDM QPSK	Full RB (Note 1)	DFT-s-OFDM	PUCCH format = Format 3 (Note 3) Length in OFDM symbols = 14	0
4	CP-OFDM QPSK	Full RB (Note 1)	DFT-s-OFDM	PUCCH format = Format 3 (Note 3) Length in OFDM symbols = 14	N_{RB}-1
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: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: For FDD, set K1 value (PDSCH-to-HARQ-timing-indicator) as follows: K1 = 2 if mod(i,5) = 0 K1 = 2 if mod(i,5) = 1 K1 = 4 if mod(i,5) = 2 K1 = 3 if mod(i,5) = 3 K1 = 2 if mod(i,5) = 4 where i is slot index per frame NOTE 4: For PUCCH format = Format 1, TDD and SCS 30 kHz, schedule the DL RMC as follows: if mod(i,10) = 3: Scheduled Other slots: Not scheduled where i is slot index per frame					

Table 6.4.2.1.4.1-3: Test Configuration for PRACH

Initial Conditions		
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4.2.1.4.1-1	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4.2.1.4.1-1	
Test SCS as specified in Table 5.3.5-1	SCS defined in TS 38.211 [8] subclause 6.3.3.2 determined by PRACH Configuration Index	
PRACH preamble format		
	FDD	**TDD**
PRACH Configuration Index	17	12
RS EPRE setting for test point 1 (dBm/15kHz)	-71	
RS EPRE setting for test point 2 (dBm/15kHz)	-86	

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4.2.1.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.4.2.1.4.3

6.4.2.1.4.2 Test procedure

Test procedure for PUSCH:

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 6.4.2.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

1.2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at $P_{UMAX\ level,}$ allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

1.3. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

1.4. For modulations except 256QAM, send uplink power control commands to the UE using 1dB power step size 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 Pmin, where:

- Pmin is the minimum output power according to Table 6.3.1.3-1.
- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

For 256 QAM, send uplink power control commands to the UE using 1dB power step size 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 Pmin + 10 dB, where Pmin, MU and Uplink power control window size are defined above.

1.5. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Table 6.4.2.1.4.2-1: Void

Test procedure for PUCCH:

2.1. PUCCH is set according to Table 6.4.2.1.4.1-2.

2.2. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4.2.1.4.1-2. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH. There is no PUSCH transmission.

2.3. SS send appropriate TPC commands for PUCCH to the UE until the UE transmit PUCCH at P_{UMAX} level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

2.4. Measure PUCCH EVM using Global In-Channel Tx-Test (Annex E).

2.5. Send uplink power control commands for PUCCH to the UE using 1dB power step size to ensure that the UE PUCCH 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 Pmin, where:

- Pmin is the minimum output power according to Table 6.3.1.3-1.
- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
- Uplink power control window size = 1dB (UE power step size) + 2.0dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 2.0dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

2.6. Measure PUCCH EVM using Global In-Channel Tx-Test (Annex E).

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Test procedure for PRACH:

3.1. The SS shall set RS EPRE according to Table 6.4.2.1.4.1-3.

3.2. PRACH is set according to Table 6.4.2.1.4.1-3.

3.3. The SS shall signal a Random Access Preamble ID via a PDCCH order to the UE and initiate a Non-contention based Random Access procedure.

3.4. The UE shall send the signalled preamble to the SS.

3.5. In response to the preamble, the SS shall transmit a random access response not corresponding to the transmitted random access preamble, or send no response.

3.6. The UE shall consider the random access response reception not successful then re-transmit the preamble with the calculated PRACH transmission power.

3.7. Repeat step 5 and 6 until the SS collect enough PRACH preambles. Measure the EVM in PRACH channel using Global In-Channel Tx-Test (Annex E).

6.4.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.4.2.1.4.3-1: *RACH-ConfigCommon:* PRACH measurement

Derivation Path: TS 38.508-1[5], Table 4.6.3-128			
Information Element	**Value/remark**	**Comment**	**Condition**
RACH-ConfigCommon::= SEQUENCE {			
rach-ConfigGeneric	RACH-ConfigGeneric		
totalNumberOfRA-Preambles	Not present		
ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE {			
one	n8		FR1
}			
groupBconfigured	Not present		
ra-ContentionResolutionTimer	sf64		
rsrp-ThresholdSSB	RSRP-Range		
rsrp-ThresholdSSB-SUL	Not present		
	RSRP-Range		SUL
prach-RootSequenceIndex CHOICE {			
l139	Set according to table 4.4.2-2 for the NR Cell.		PRACH Format A3
l839	0	NR Cell 1	PRACH Format 0
	TBD	Other than NR Cell 1	PRACH Format 0
}			
msg1-SubcarrierSpacing	SubcarrierSpacing		
restrictedSetConfig	unrestrictedSet		
msg3-transformPrecoder	Not present	transform precoding is disabled for Msg3 PUSCH transmission and any PUSCH transmission scheduled with DCI format 0_0	
}			

Table 6.4.2.1.4.3-2: *RACH-ConfigGeneric:* PRACH measurement

Derivation Path: TS 38.508-1[5], Table 4.6.3-130			
Information Element	**Value/remark**	**Comment**	**Condition**
RACH-ConfigGeneric ::= SEQUENCE {			
prach-ConfigurationIndex	17	Paired Spectrum	PRACH Format 0
	12	Unpaired Spectrum	PRACH Format 0
msg1-FDM	four		FR1
msg1-FrequencyStart	0		
zeroCorrelationZoneConfig	15		
preambleReceivedTargetPower	-92		Test point 1
	-74		Test point 2
preambleTransMax	n7		
powerRampingStep	dB0		
ra-ResponseWindow	sl20		
}			

Table 6.4.2.1.4.3-3: PUSCH-TimeDomainResourceAllocationList: PRACH measurement

Derivation Path: TS 38.508-1[5], Table 4.6.3-122			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF PUSCH-TimeDomainResourceAllocation {	2 entries		
PUSCH-TimeDomainResourceAllocation[2] SEQUENCE {		entry 2 addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [22] Table 8.2-1.	
k2	6	K2+ Δ=8 acc. to TS 38.214 [21] Table 6.1.2.1.1-5	Unpaired Spectrum for SCS15kHz and PRACH Format 0
}			
}			

Table 6.4.2.1.4.3-4: PDSCH-ServingCellConfig: PUCCH format3 measurement

Derivation Path: TS 38.508-1[15], Table 4.6.3-102			
Information Element	**Value/remark**	**Comment**	**Condition**
PDSCH-ServingCellConfig ::= SEQUENCE {			
codeBlockGroupTransmission	Not present		
xOverhead	Not present		
nrofHARQ-ProcessesForPDSCH	n6		FDD
pucch-Cell	Not present		
maxMIMO-Layers	Not present		
processingType2Enabled	Not present		
pdsch-CodeBlockGroupTransmissionList-r16	Not present		
}			

6.4.2.1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4.2.1.5-1.

The PUSCH $\overline{EVM}_{DMRS}$, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4.2.1.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4.2.1.5-1: Test requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	30 + TT
QPSK	%	17.5 + TT
16 QAM	%	12.5 + TT
64 QAM	%	8 + TT
256 QAM	%	3.5 + TT
Note 1: TT is defined in Table 6.4.2.1.5-2.		

Table 6.4.2.1.5-2: Test Tolerance

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	0
QPSK	%	0
16 QAM	%	0
64 QAM	%	0
256 QAM	%	0.3 for 15 dBm < P_{UL} 0.8 for -25 dBm < P_{UL}≤ 15 dBm 1.1 for -40dBm ≤ P_{UL} ≤ -25dBm

The PUCCH EVM derived in Annex E.5.9.2 shall not exceed 17.5 %.

The PRACH EVM derived in Annex E.6.9.2 shall not exceed 17.5%.

6.4.2.1a Error Vector Magnitude including symbols with transient period

6.4.2.1a.1 Test Purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

6.4.2.1a.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support short transient period capability.

6.4.2.1a.3 Minimum conformance requirements

In 6.4.2.1, EVM has been defined by excluding the symbols which have a transient period. In this section, measurement interval is defined for the symbols with a transient period to include these symbols in the RMS average EVM computation when the UE reports a transient period capability other than the default. Before calculating the EVM, the measured waveform is corrected for sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM. The symbols with transient period should not be used for equalization. Only CP-OFDM waveform is used for conformance testing.

In the case of PUSCH or PUCCH transmissions when the mean power, modulation or RB allocation across slot or subslot boundaries is expected to change the EVM result over the symbols where the transient occurs is calculated according to Table 6.4.2.1a.3-1.

Table 6.4.2.1a.3-1: EVM definition for reported transient period

Reported transient capability (us)	EVM definition	tp_{start} (µs)	SCS[4]
2	$EVM_{after} = \max(\overline{EVM_{l\_tp}}, \overline{EVM_h})$ $EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h\_tp}})$	-0.5	15kHz or 30kHz[5]
4	$EVM_{after} = \max(\overline{EVM_{l\_tp}}, \overline{EVM_h})$ $EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h\_tp}})$	-1	15kHz
7	$EVM_{after} = \min(\overline{EVM_{l\_tp}}, \overline{EVM_h})$ $EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h\_tp}})$	-2.7	15kHz
NOTE 1: $\overline{EVM_l}$, $\overline{EVM_h}$, $\overline{EVM_{l\_tp}}$,and $\overline{EVM_{h\_tp}}$ are defined in Annex E.4.7 NOTE 2: EVM_{after} is the EVM for a symbol right after a transition; EVM_{before} is the EVM for a symbol right before a transition NOTE 3: tp_{start} denotes the start position of the EVM exclusion window as shown in Annex E.4.7 NOTE 4: SCS denotes the SCS that can be used in the conformance test NOTE 5: 30kHz shall be used in the conformance test unless the UE signals in *supportedSubCarrierSpacingUL* in *FeatureSetPerCC* that it only supports 15kHz in the corresponding band			

The RMS average of the basic EVM measurements over 108 subframes for the symbols where the transient occurs for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1a.3-2 for the parameters defined in Table 6.4.2.1a.3-3. This requirement can be verified with 64 QAM and 256 QAM modulation.

Table 6.4.2.1a.3-2: Requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
64 QAM	%	10
256 QAM	%	8

Table 6.4.2.1a.3-3: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ Table 6.3.1-1
UE Output Power for 256 QAM	dBm	≥ Table 6.3.1-1 + 10 dB
Operating conditions		Normal conditions

The normative reference for this requirement is TS 38.101 [2] clause 6.4.2.1a.

6.4.2.1a.4 Test description

6.4.2.1a.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 6.4.2.1a.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.1a.4.1-1: Test Configuration Table for PUSCH

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range (NOTE 4)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		15 kHz (Note 3)	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM 64 QAM	Outer Full
2		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: For UE supporting 2 us transient period, 30kHz shall be used in the conformance test unless the UE signals in *supportedSubCarrierSpacingUL* in *FeatureSetPerCC* that it only supports 15kHz in the corresponding band. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.4.2.1a.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 [5] clause 4.5. Message contents are defined in clause 6.4.2.1a.4.3

6.4.2.1a.4.2 Test procedure

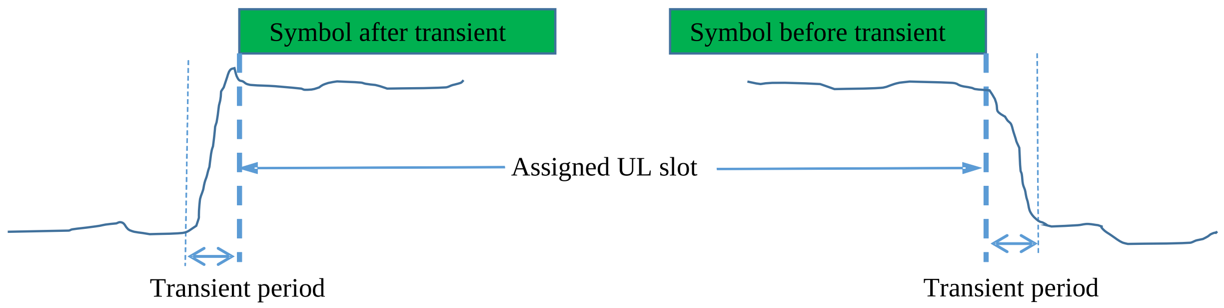

Figure 6.4.2.1a.4.2-1: Error Vector Magnitude including symbols with transient period

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 6.4.2.1a.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for 15 kHz SCS, on slots 8 and 18 for 30 kHz SCS and on slots 17 and 37 for 60 kHz SCS.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at $P_{UMAX\ level,}$ allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) applying tp_{start} of Table 6.4.2.1a.3-1 according to the declared enhanced transient capability. For TDD, only slots consisting of only UL symbols are under test as indicated in Figure 6.4.2.1a.4.2-1.
4. For CP-OFDM 64 QAM modulations, send uplink power control commands to the UE using 1dB power step size 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 Pmin, where:
   - Pmin is the minimum output power according to Table 6.3.1.3-1.
   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

   For CP-OFDM 256 QAM modulations, send uplink power control commands to the UE using 1dB power step size 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 Pmin + 10 dB, where Pmin, MU and Uplink power control window size are defined above.

5. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) applying tp_{start} of Table 6.4.2.1a.3-1 according to the declared enhanced transient capability. For TDD, only slots consisting of only UL symbols are under test.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

6.4.2.1a.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.4.2.1a.4.3-1: TDD-UL-DL-Config

Derivation Path: TS 38.508-1[5], Table 4.6.3-192			
Information Element	**Value/remark**	**Comment**	**Condition**
TDD-UL-DL-ConfigCommon ::= SEQUENCE {			
referenceSubcarrierSpacing	SubcarrierSpacing		
pattern1 SEQUENCE {			
dl-UL-TransmissionPeriodicity	ms5		FR1
	ms10		FR1_15kHz
nrofDownlinkSlots	6		FR1_15kHz
	6		FR1_30kHz
	14		FR1_60kHz
nrofDownlinkSymbols	10		FR1_15kHz
	6		FR1_30kHz
	12		FR1_60kHz
nrofUplinkSlots	3		FR1_15kHz, FR1_30kHz
	4		FR1_60kHz
nrofUplinkSymbols	4		FR1_30kHz
	2		FR1_15kHz,
	8		FR1_60kHz
}			
pattern2	Not present		
}			

6.4.2.1a.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4.2.1a.5-1.

The PUSCH $\overline{EVM}_{DMRS}$, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4.2.1a.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4.2.1a.5-1: Test requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
64 QAM	%	10 + TT
256 QAM	%	8 + TT
Note 1: TT is defined in Table 6.4.2.1a.5-2.		

Table 6.4.2.1a.5-2: Test Tolerance

Parameter	Unit	Average EVM Level
64 QAM	%	0
256 QAM	%	0.3 for 15 dBm < P_{UL} 0.8 for -25 dBm < P_{UL}≤ 15 dBm 1.1 for -40dBm ≤ P_{UL} ≤ -25dBm

6.4.2.2 Carrier leakage

6.4.2.2.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency or centre frequency of aggregated transmission bandwidth configuration. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal.

The purpose of this test is to exercise the UE transmitter to verify its modulation quality in terms of carrier leakage.

6.4.2.2.2 Test applicability

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

6.4.2.2.3 Minimum conformance requirements

Carrier leakage is an additive sinusoid waveform whose frequency is the same as the modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

In the case that uplink sharing, the carrier leakage may have 7.5 kHz shift with the carrier frequency.

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-1.

Table 6.4.2.2.3-1: Requirements for Carrier Leakage

Parameter	Relative Limit (dBc)
Output power > 10 dBm	-28
0 dBm ≤ Output power ≤ 10 dBm	-25
-30 dBm ≤ Output power < 0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4.2.2.

6.4.2.2.4 Test description

6.4.2.2.4.1 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 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 6.4.2.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.2.4.1-1: Test Configuration

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Mid	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1, 3)**
1		DFT-s-OFDM QPSK	Inner_1RB_Left
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: When the signalled DC carrier position is at Inner_1RB_Left, use Inner_1RB_Right for UL RB allocation.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to AnnexC.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4.2.2.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.4.2.2.4.3.

7. In case the parameter 3300 or 3301 is reported from the UE via *txDirectCurrentLocation* IE, do not proceed to test procedure and mark the test not applicable with reasoning in the test report.

6.4.2.2.4.2 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 6.4.2.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send uplink power control commands to the UE using 1dB power step size 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 10 dBm, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

   - Uplink power control window size = 1dB (UE power step size) + 0.7 dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

3. Measure carrier leakage using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

4. Send uplink power control commands to the UE using 1dB power step size 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 0 dBm, where MU and Uplink power control window size are defined above.

5. Measure carrier leakage using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

6. Send uplink power control commands to the UE using 1dB power step size 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 -30 dBm, where MU and Uplink power control window size are defined above.

7. Measure carrier leakage using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

8. Send uplink power control commands to the UE using 1dB power step size 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 Pmin, where MU and Uplink power control window size are defined above, Pmin is the minimum output power according to Table 6.3.1.3-1.

9. Measure carrier leakage using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Table 6.4.2.2.4.2-1: Void

Table 6.4.2.1.4.2-2: Void

6.4.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exception:

Table 6.4.2.2.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.4.2.2.5 Test requirement

Each of the *n* carrier leakage results, derived in Annex E.3.1, shall not exceed the values in table 6.4.2.2.5-1. Allocated RBs are not under test.

Table 6.4.2.2.5-1: Test requirements for Relative Carrier Leakage Power

Parameters UE output power	**Relative limit (dBc)**
10 + MU to 10 + (MU + Uplink power control window size) dBm	-28 + TT
0 + MU to 0 + (MU + Uplink power control window size) dBm	-25 + TT
-30 + MU to -30 + (MU + Uplink power control window size) dBm	-20 + TT
Pmin + MU to Pmin + (MU + Uplink power control window size) dBm	-10 + TT
NOTE 1: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs. NOTE 2: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB. NOTE 3: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3). NOTE 4: MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW. NOTE 5: Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1. NOTE 6: Test tolerance TT = 0.8 dB. NOTE 7: Pmin is the minimum output power according to Table 6.3.1.3-1.	

6.4.2.3 In-band emissions

6.4.2.3.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks

The in-band emission is defined as the average emission across 12 sub-carriers and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non–allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain, however, the minimum requirement applies when the in-band emission measurement is averaged over 10 sub-frames. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one or more symbols, accordingly.

The purpose of this test is to exercise the UE transmitter to verify its modulation quality in terms of in-band emissions.

6.4.2.3.2 Test applicability

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

6.4.2.3.3 Minimum conformance requirements

The average of the basic in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-1.

Table 6.4.2.3.3-1: Requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General	dB	$\max\{-25-10\cdot\log_{10}(N_{RB}/L_{CRB}),\ 20\cdot\log_{10}EVM-3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},\ -57\,dBm+10\log_{10}(SCS/15kHz)-\overline{P_{RB}}\}$		Any non-allocated (NOTE 2)
IQ Image	dB	-28	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25	Image frequencies when output power ≤ 10 dBm	
Carrier leakage	dBc	-28	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25	0 dBm ≤ Output power ≤ 10 dBm	
		-20	-30 dBm ≤ Output power < 0 dBm	
		-10	-40 dBm ≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10.

NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.

NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.

NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.

NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.

NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3).

NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).

NOTE 8: EVM is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.

NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.

NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4.2.3.

6.4.2.3.4 Test description

6.4.2.3.4.1 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 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

6.4.2.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.3.4.1-1: Test Configuration Table for PUSCH

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range (NOTE 3)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM QPSK	Inner_1RB_Left
2		DFT-s-OFDM QPSK	Inner_1RB_Right
3		CP-OFDM QPSK	Inner_1RB_Left
4		CP-OFDM QPSK	Inner_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

Table 6.4.2.3.4.1-2: Test Configuration Table for PUCCH

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			See Table 6.4.2.3.4.1-1		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4.2.3.4.1-1		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4.2.3.4.1-1		
Test SCS as specified in Table 5.3.5-1			See Table 6.4.2.3.4.1-1		
Test Parameters					
ID	**Downlink Configuration**		**Uplink Configuration**		
	Modulation	RB allocation	Waveform	PUCCH format	RB index

1	CP-OFDM QPSK	Full RB (Note 1)	DFT-s-OFDM	PUCCH format = Format 3 (Note 4) Length in OFDM symbols = 14	0
2	CP-OFDM QPSK	Full RB (Note 1)	DFT-s-OFDM	PUCCH format = Format 3 (Note 4) Length in OFDM symbols = 14	N_{RB}-1
3	CP-OFDM QPSK	Full RB (Note 1)	CP-OFDM	PUCCH format = Format 1 (Note 5) Length in OFDM symbols = 14	0
4	CP-OFDM QPSK	Full RB (Note 1)	CP-OFDM	PUCCH format = Format 1 (Note 5) Length in OFDM symbols = 14	N_{RB}-1
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: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 4: For FDD, set K1 value (PDSCH-to-HARQ-timing-indicator) as follows: K1 = 2 if mod(i,5) = 0 K1 = 2 if mod(i,5) = 1 K1 = 4 if mod(i,5) = 2 K1 = 3 if mod(i,5) = 3 K1 = 2 if mod(i,5) = 4 where i is slot index per frame NOTE 5: For TDD and SCS 30 kHz, schedule the DL RMC as follows: if mod(i,10) = 3: Scheduled Other slots: Not scheduled where i is slot index per frame					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4.2.3.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.4.2.3.4.3

6.4.2.3.4.2 Test procedure

Test procedure for PUSCH:

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 6.4.2.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.2. Send uplink power control commands to the UE using 1dB power step size 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 10 dBm, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

1.3. Measure In-band emission using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

1.4. Send uplink power control commands to the UE using 1dB power step size 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 0 dBm, where MU and Uplink power control window size are defined above.

1.5. Measure In-band emission using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

1.6. Send uplink power control commands to the UE using 1dB power step size 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 -30 dBm, where MU and Uplink power control window size are defined above.

1.7. Measure In-band emission using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

1.8. Send uplink power control commands to the UE using 1dB power step size 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 Pmin, where MU and Uplink power control window size are defined above and Pmin is the minimum output power according to Table 6.3.1.3-1.

1.9. Measure In-band emission using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.3.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Test procedure for PUCCH:

2.1. PUCCH is set according to Table 6.4.2.3.4.1-2. SS transmits PDSCH via PDCCH DCI format 1-1 for C_RNTI to transmit the DL RMC according to Table 6.4.2.3.4.1-2. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH.

2.2. Send uplink power control commands for PUCCH to the UE using 1dB power step size 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 10 dBm, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
- Uplink power control window size = 1dB (UE power step size) + 2.0 dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

2.3. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

2.4. Send uplink power control commands for PUCCH to the UE using 1dB power step size 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 0 dBm, where MU and Uplink power control window size are defined above.

2.5. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

2.6. Send uplink power control commands for PUCCH to the UE using 1dB power step size 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 -30 dBm, where MU and Uplink power control window size are defined above.

2.7. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

2.8. Send uplink power control commands for PUCCH to the UE using 1dB power step size 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 Pmin, where MU and Uplink power control window size are defined above and Pmin is the minimum output power according to Table 6.3.1.3-1.

2.9. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.3.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Table 6.4.2.3.4.2-1: Void

Table 6.4.2.3.4.2-2: Void

6.4.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.4.2.3.4.3-1: PDSCH-ServingCellConfig: PUCCH format3 measurement

Derivation Path: TS 38.508-1[15], Table 4.6.3-102			
Information Element	**Value/remark**	**Comment**	**Condition**
PDSCH-ServingCellConfig ::= SEQUENCE {			
codeBlockGroupTransmission	Not present		
xOverhead	Not present		
nrofHARQ-ProcessesForPDSCH	n6		FDD
pucch-Cell	Not present		
maxMIMO-Layers	Not present		
processingType2Enabled	Not present		
pdsch-CodeBlockGroupTransmissionList-r16	Not present		
}			

6.4.2.3.5 Test requirement

The averaged In-band emission result, derived in Annex E.4.3 shall not exceed the corresponding values in Tables 6.4.2.3.5-1.

Table 6.4.2.3.5-1: Test requirements for in-band emissions

<table>
<tr><th>Parameter description</th><th>Unit</th><th colspan="2">Limit (NOTE 1)</th><th>Applicable Frequencies</th></tr>
<tr><td>General (NOTE 12)</td><td>dB</td><td colspan="2">$\max\{ -25-10\cdot\log_{10}(N_{RB}/L_{CRB}),$
$20\cdot\log_{10} EVM -3-5\cdot(|\Delta_{RB}|-1)/L_{CRB},$
$-57\,dBm+10\log_{10}(SCS/15kHz)-\overline{P_{RB}}\}$ + TT</td><td>Any non-allocated (NOTE 2)</td></tr>
<tr><td rowspan="2">IQ Image (NOTE 12)</td><td rowspan="2">dB</td><td>-28 + TT</td><td>Image frequencies when output power > 10 dBm</td><td rowspan="2">Image frequencies (NOTES 2, 3)</td></tr>
<tr><td>-25 + TT</td><td>Image frequencies when output power ≤ 10 dBm</td></tr>
<tr><td rowspan="4">Carrier leakage (NOTE 12)</td><td rowspan="4">dBc</td><td>-28 + TT</td><td>Output power > 10 dBm</td><td rowspan="4">Carrier leakage frequency (NOTES 4, 5)</td></tr>
<tr><td>-25 + TT</td><td>0 dBm ≤ Output power ≤ 10 dBm</td></tr>
<tr><td>-20 + TT</td><td>-30 dBm ≤ Output power < 0 dBm</td></tr>
<tr><td>-10 + TT</td><td>-40 dBm ≤ Output power < -30 dBm</td></tr>
<tr><td colspan="5">NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10.
NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.
NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
NOTE 5: The applicable frequencies for this limit depend on the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency, but excluding any allocated RB.
NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3).
NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).
NOTE 8: EVM is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.
NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.
NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.
NOTE 11: Test tolerance TT = 0.8 dB.
NOTE 12: In case the parameter 3300 or 3301 is reported from UE via txDirectCurrentLocation IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies.</td></tr>
</table>

6.4.2.4 EVM equalizer spectrum flatness

6.4.2.4.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block, at which the equalizer coefficients are generated by the EVM measurement process. The basic measurement interval is the same as for EVM.

The EVM equalizer spectrum flatness requirement does not limit the correction applied to the signal in the EVM measurement process but for the EVM result to be valid, the equalizer correction that was applied must meet the EVM equalizer spectrum flatness minimum requirements.

6.4.2.4.2 Test applicability

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

6.4.2.4.3 Minimum conformance requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4.2.4.3-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.4.2.4.3-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4.2.4.3-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.4.2.4.3-1).

Table 6.4.2.4.3-1: Requirements for EVM equalizer spectrum flatness (normal conditions)

Frequency range	Maximum ripple (dB)
$F_{UL\_Meas} – F_{UL\_Low} \geq 3$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 3$ MHz (Range 1)	4 (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 3$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 3$ MHz (Range 2)	8 (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1	

Table 6.4.2.4.3-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple (dB)
$F_{UL\_Meas} – F_{UL\_Low} \geq 5$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 5$ MHz (Range 1)	4 (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 5$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 5$ MHz (Range 2)	12 (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1	

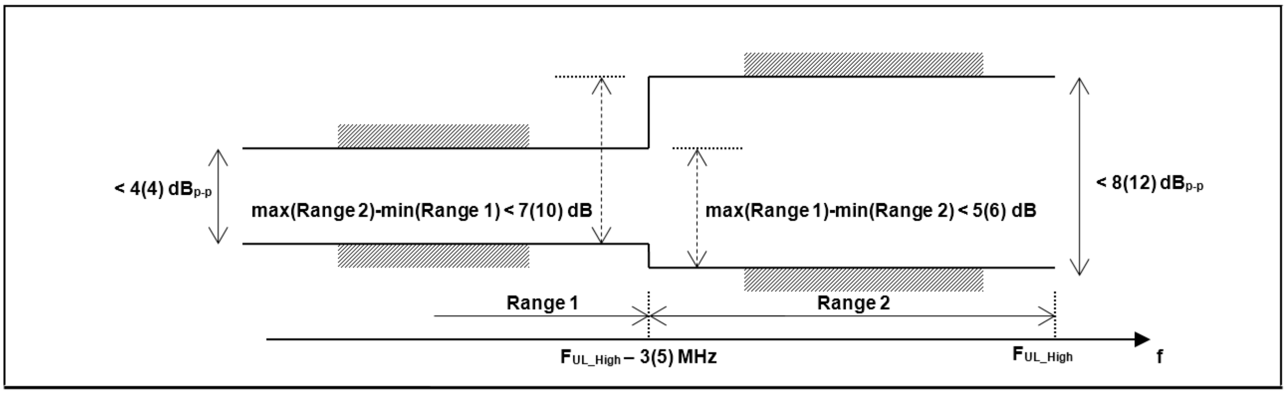

Figure 6.4.2.4.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement are within brackets)

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4.2.4.

6.4.2.4.4 Test description

6.4.2.4.4.1 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 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 6.4.2.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.4.4.1-1: Test Configuration

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range (NOTE 3)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM QPSK	Outer Full
2		CP-OFDM QPSK	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.4.2.4.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.4.2.4.4.3.

6.4.2.4.4.2 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 6.4.2.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.4.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4.2.4.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1. The derived results shall not exceed the values in Figure 6.4.2.4.5-1:

For normal conditions, the maximum ripple in Range 1 and Range 2 shall not exceed the values specified in Table 6.4.2.4.5-1 and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4.2.4.5-1).

For normal conditions, the peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4.2.4.5-1. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4.2.4.5-1).

For extreme conditions, the EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4.2.4.5-2. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 7.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 11.4 dB (see Figure 6.4.2.4.5-1).

Table 6.4.2.4.5-1: Requirements for EVM equalizer spectrum flatness (normal conditions)

Frequency range	Maximum ripple [dB]
$F_{UL\_Meas} - F_{UL\_Low} \geq 3$ MHz and $F_{UL\_High} - F_{UL\_Meas} \geq 3$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} - F_{UL\_Low} < 3$ MHz or $F_{UL\_High} - F_{UL\_Meas} < 3$ MHz (Range 2)	8 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

Table 6.4.2.4.5-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple [dB]
$F_{UL\_Meas} - F_{UL\_Low} \geq 5$ MHz and $F_{UL\_High} - F_{UL\_Meas} \geq 5$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} - F_{UL\_Low} < 5$ MHz or $F_{UL\_High} - F_{UL\_Meas} < 5$ MHz (Range 2)	12 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

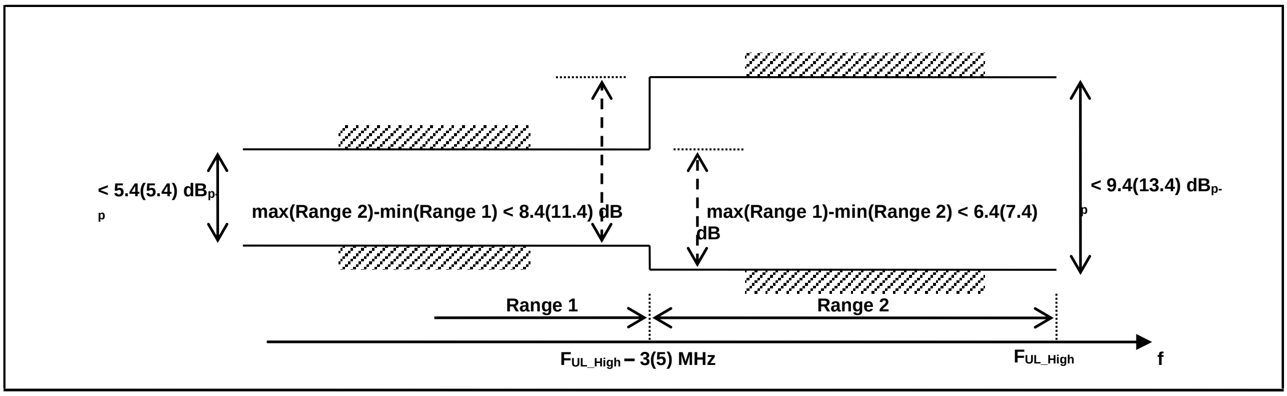

Figure 6.4.2.4.5-1: The test requirements for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated for unshaped modulations (the ETC test requirements are within brackets)

6.4.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK

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

6.4.2.5.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block, at which the equalizer coefficients are generated by the EVM measurement process. The basic measurement interval is the same as for EVM.

6.4.2.5.2 Test applicability

This test case applies to all types of power class 3 capable NR UE release 15 and forward indicating support for UE capability *powerBoosting-pi2BPSK* and operating in TDD bands n40, n41, n77, n78 and n79.

This test case applies to all types of NR UE release 16 and forward indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

6.4.2.5.3 Minimum conformance requirements

These requirements apply if the IE *powerBoostPi2BPSK* is set to 1 for power class 3 capable UE operating in TDD bands n40, n41, n77, n78 and n79 with pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and 40 % or less slots in radio frame are used for UL transmission. These requirements also apply if the IE *dmrs-UplinkTransformPrecoding-r16* is configured and UE indicates support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*. Otherwise the requirements for EVM equalizer spectrum flatness defined in clause 6.4.2.4.3 apply.

The EVM equalizer coefficients across the allocated uplink block shall be modified to fit inside the mask specified in Table 6.4.2.5.3-1 for normal conditions, prior to the calculation of EVM. The limiting mask shall be placed to minimize the change in equalizer coefficients in a sum of squares sense.

Table 6.4.2.5.3-1: Mask for EVM equalizer coefficients for Pi/2 BPSK, normal conditions

Frequency range	Parameter	Maximum ripple (dB)
$\lvert F_{UL\_Meas}$ – F_center$\rvert$ ≤ X MHz (Range 1)	X1	6 (p-p)
$\lvert F_{UL\_Meas}$ – F_center$\rvert$ > X MHz (Range 2)	X2	14 (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_center refers to the center frequency of an allocated block of PRBs NOTE 3: X, in MHz, is equal to 25% of the bandwidth of the PRB allocation NOTE 4: See Figure 6.4.2.5.3-1 for description of X1, X2		

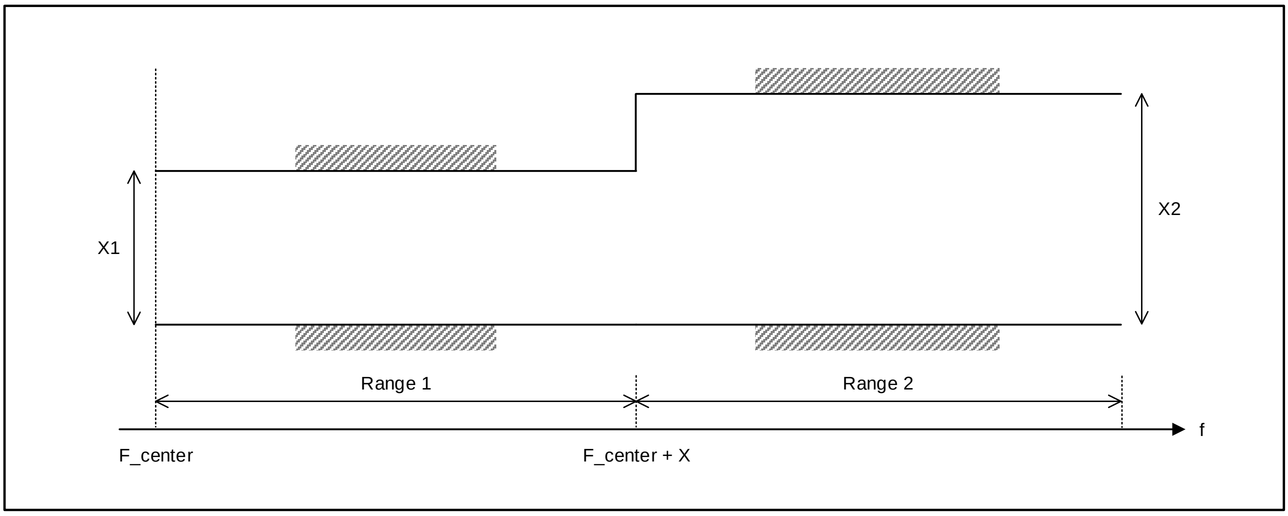

Figure 6.4.2.5.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. F_center denotes the center frequency of the allocated block of PRBs. X, in MHz, is equal to 25 % of the bandwidth of the PRB allocation.

For pi/2 BPSK modulation the UE shall be allowed to employ spectral shaping and the shaping filter shall be restricted so that the impulse response of the shaping filter itself shall meet

$$\left| \tilde{a}_t(t,0) \right| \geq \left| \tilde{a}_t(t,\tau) \right| \quad \forall \tau \neq 0$$

$20log_{10}\left|\tilde{a}_t(t,\tau)\right| < -15$ dB $1 < \tau < M - 1$,

where, $\left|\tilde{a}_t(t, \tau)\right| = IDFT\{\left|\tilde{a}_t(t,f)\right| e^{j\varphi\,(t,f)}\}$, f is the frequency of the M allocated subcarriers, $\tilde{a}(t,f)$ and $\varphi(t,f)$ are the amplitude and phase response.

0dB reference is defined as $20log_{10}\left|\tilde{a}_t(t,0)\right|$.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4.2.4.1.

6.4.2.5.4 Test description

6.4.2.5.4.1 Initial condition

Same initial conditions as in clause 6.4.2.4.4.1 with following exceptions:

- Instead of Table 6.4.2.4.4.1-1 → use Table 6.4.2.5.4.1-1

Table 6.4.2.5.4.1-1: Test Configuration

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range (NOTE 3)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1[4]		DFT-s-OFDM Pi/2 BPSK	Outer Full
2[5]		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies. NOTE 4: UEs indicating support for UE capability *powerBoosting-pi2BPSK*. NOTE 5: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*..			

6.4.2.5.4.2 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 6.4.2.5.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

6.4.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exception:

Table 6.4.2.5.4.3-1: ServingCellConfig (Test ID 1 in Table 6.4.2.5.4.1-1)

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
uplinkConfig SEQUENCE {			
initialUplinkBWP	BWP-UplinkDedicated		
uplinkBWP-ToReleaseList	Not present		
uplinkBWP-ToAddModList	Not present		
firstActiveUplinkBWP-Id	BWP-Id		
pusch-ServingCellConfig CHOICE {			
setup	PUSCH-ServingCellConfig		
}			
carrierSwitching	Not present		
powerBoostPi2BPSK	enabled		
}			

Table 6.4.2.5.4.3-2: DMRS-UplinkConfig (Test ID 2 in Table 6.4.2.5.4.1-1)

Derivation Path: TS 38.508-1 [5], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
nPUSCH-Identity	Not present		
sequenceGroupHopping	Not present		
sequenceHopping	Not present		
dmrs-UplinkTransformPrecoding-r16 SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			

6.4.2.5.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1 The derived results shall not exceed the values in Figure 6.4.2.5.5-1:

Table 6.4.2.5.5-1: Mask for EVM equalizer coefficients for Pi/2 BPSK, normal conditions

Frequency range	Parameter	Maximum ripple (dB)
$\lvert F_{UL\_Meas}$ – F_center$\rvert$ ≤ X MHz (Range 1)	X1	6 + TT (p-p)
$\lvert F_{UL\_Meas}$ – F_center$\rvert$ > X MHz (Range 2)	X2	14 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_center refers to the center frequency of an allocated block of PRBs NOTE 3: X, in MHz, is equal to 25% of the bandwidth of the PRB allocation NOTE 4: See Figure 6.4.2.5.5-1 for description of X1, X2 NOTE 5: Test tolerance TT = 1.4 dB.		

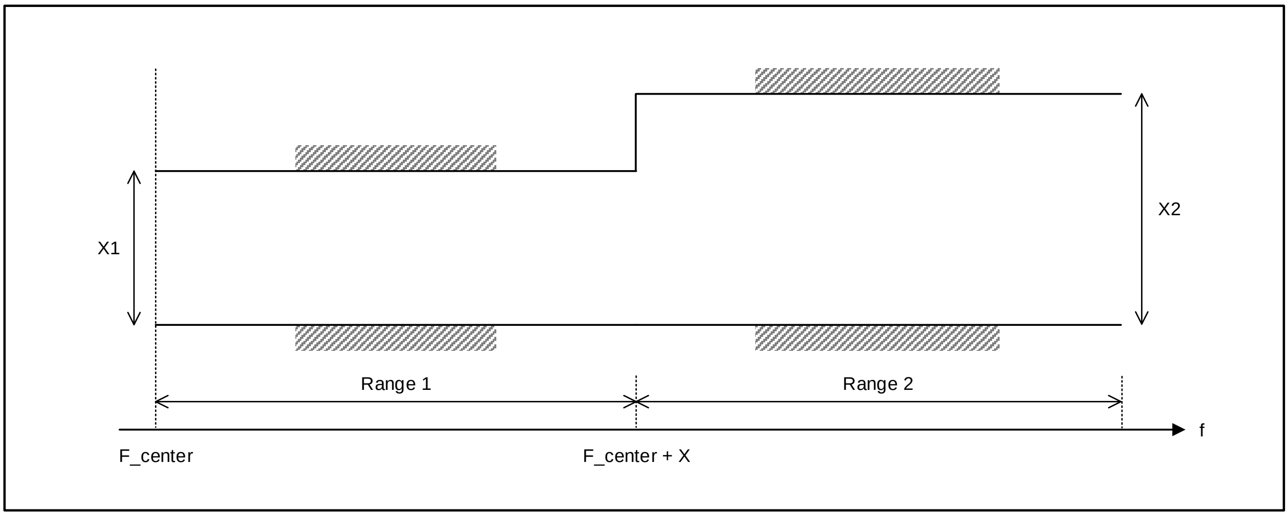

Figure 6.4.2.5.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. F_center denotes the center frequency of the allocated block of PRBs. X, in MHz, is equal to 25 % of the bandwidth of the PRB allocation.

Each of the *n* spectrum flatness functions shall derive an impulse response of the spectral shaping filter in Annex E.4.4.2. The derived results shall fulfill:

$$|\tilde{a}(0)| \geq |\tilde{a}(\tau)| \quad \forall \tau \neq 0$$

$$20\log_{10}|\tilde{a}(\tau)| < -15\text{dB} + \text{TT} \quad 1 < \tau < M-1,$$

where TT = 1.4 dB.

6.4A Transmit signal quality for CA

6.4A.1 Frequency error for CA

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

- Extending the coverage of the TCs with intra-band CA scenarios is FFS

6.4A.1.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the minimum conformance requirements specified in subclause 6.4.1.3 shall apply on each component carrier with all component carriers active.

6.4A.1.1 Frequency error for CA (2UL CA)

6.4A.1.1.1 Test purpose

This test verifies the ability of both, the receiver and the transmitter, to process frequency for 2UL CA correctly.

Receiver: to extract the correct frequency from the stimulus signal, offered by the System simulator, under ideal propagation conditions and low level.

Transmitter: to derive the correct modulated carrier frequency from the results, gained by the receiver.

6.4A.1.1.2 Test applicability

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

6.4A.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.1.0.

6.4A.1.1.4 Test description

6.4A.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 configuration, and are shown in Table 6.4A.1.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4A.1.1.4.1-1: Inter band CA Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Mid range for PCC and SCC (NOTE 3)		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Highest N_{RB_agg} for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1		Lowest		
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**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 belongs to inter-band CA combination. NOTE 3: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure 3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The DL and UL Reference Measurement channels are set according to Table 6.4A.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 [5] clause 4.5. Message contents are defined in clause 6.4A.1.1.4.3

6.4A.1.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.4A.1.1.4.3
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4A.1.1.4.1-1 on both PCC and SCC. 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 6.4A.1.1.4.1-1 on both PCC and SCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level to the appropriate REFSENS value defined in subclauses 7.3A.1.5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE so that the UE transmits at P_{UMAX} level for the duration of the test. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

7. Measure the Frequency Error on PCC and SCC using Global In-Channel Tx-Test (Annex E) respectively. For TDD slots with transient periods are not under test.

8. For UEs supporting DSS, repeat steps 1~7 on the applicable bands as specified in Section 5.4.2.1 with message contents being according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-61 and Table 4.6.3-62 with condition DSS.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.4A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.4A.1.1.4.3-1 FrequencyInfoUL-SIB for inter-band CA

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		

6.4A.1.1.5 Test requirement

The 10 frequency error Δf results must fulfil the test requirement:

$|\Delta f| \leq (0.1 \text{ PPM} + \text{TT})$ for each test point

where PPM refers to each CC UL frequency.

Table 6.4A.1.1.5-1: Test Tolerance for frequency error

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	15Hz	15Hz
40MHz < BW ≤ 100MHz	15Hz	15Hz

6.4A.2 Transmit modulation quality for CA

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

- Extending the coverage of the TCs with intra-band CA scenarios is FFS

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

6.4A.2.1 Error Vector Magnitude for CA

6.4A.2.1.0 Minimum conformance requirements

For Inter-band carrier aggregation, EVM measurements are evaluated for each component carrier, and for the different modulations schemes, the EVM requirements shall not exceed the values specified in Table 6.4.2.1.3-1 for the parameters defined in Table 6.4.2.1.3-2, if CA is configured in uplink.

For the intra-band non-contiguous carrier aggregation, EVM measurements are evaluated for each component carrier,

and for the different modulations schemes, the EVM requirements shall not exceed the values specified in Table

6.4A.2.1.0-1, if CA is configured in uplink.

For the intra-band contiguous carrier aggregation, EVM measurements are evaluated for each component carrier, and for the different modulations schemes, the EVM requirements shall not exceed the values specified in Table 6.4A.2.1.0-1, if CA is configured in uplink.

When a single component carrier is configured Table 6.4.2.1.3-1 apply.

The EVM requirements are according to Table 6.4A.2.1.0-1 if CA is configured in uplink with the parameters defined in Table 6.4.2.1.3-2.

Table 6.4A.2.1.0-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level per CC
Pi/2-BPSK	**%**	**30**
QPSK	%	17.5
16 QAM	%	12.5
64 QAM	%	8
256 QAM	%	3.5

The normative reference for this requirement is TS 38.101 [2] clause 6.4A.2.1

6.4A.2.1.1 Error Vector Magnitude for CA (2UL CA)

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

- The minimum requirements for intra-band contiguous CA and intra-band non-contiguous CA have not been defined.

6.4A.2.1.1.1 Test Purpose

For 2UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in clause 6.4.2.1.

6.4A.2.1.1.2 Test applicability

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

6.4A.2.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0.

6.4A.2.1.1.4 Test description

6.4A.2.1.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in Table 6.4A.2.1.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4A.2.1.1.4.1-1: Inter band CA Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg} for both PCC and SCC Highest N_{RB_agg} for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1		Smallest and biggest supported SCS per Channel Bandwidth		
Test Parameters				
Test ID	**Downlink Configuration**	**Uplink Configuration**		
		Modulation (NOTE 3)	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1[3]	N/A	DFT-s-OFDM PI/2 BPSK	Inner Full	0
2[3]		DFT-s-OFDM PI/2 BPSK	Outer Full	0
3		DFT-s-OFDM QPSK	Inner Full	0
4		DFT-s-OFDM QPSK	Outer Full	0
5		DFT-s-OFDM 16 QAM	Inner Full	0
6		DFT-s-OFDM 16 QAM	Outer Full	0
7		DFT-s-OFDM 64 QAM	Outer Full	0
8		DFT-s-OFDM 256 QAM	Outer Full	0
9		CP-OFDM QPSK	Inner Full	0
10		CP-OFDM QPSK	Outer Full	0
11		CP-OFDM 16 QAM	Inner Full	0
12		CP-OFDM 16 QAM	Outer Full	0
13		CP-OFDM 64 QAM	Outer Full	0
14		CP-OFDM 256 QAM	Outer Full	0
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 4: The frequencies of PCC and SCC shall be switched and tested in each configuration.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4A.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 [5] clause 4.5. Message contents are defined in clause 6.4A.2.1.1.4.3

6.4A.2.1.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.4A.2.1.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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 6.4A.2.1.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

5. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at $P_{UMAX\ level,}$ allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

6. Measure the EVM and $\overline{EVM}_{DMRS}$ on PCC using Global In-Channel Tx-Test (Annex E).

7. For modulations except 256QAM, send uplink power control commands to the UE using 1dB power step size 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 Pmin, where:

   - Pmin is the minimum output power according to Table 6.3.1.3-1.

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

   For 256 QAM, send uplink power control commands to the UE using 1dB power step size 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 Pmin + 10 dB, where Pmin, MU and Uplink power control window size are defined above.

8. Measure the EVM and $\overline{EVM}_{DMRS}$ on PCC using Global In-Channel Tx-Test (Annex E).

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

6.4A.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4A.2.1.1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.1.5-1.

The PUSCH $\overline{EVM}_{DMRS}$,derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.1.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.1.5-1: Test requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	30+TT
QPSK	%	17.5+TT
16QAM	%	12.5+TT
64QAM	%	8+TT
256 QAM	%	3.8+TT for 15 dBm< P_{UL} 4.3+TT for -25 dBm< P_{UL}≤ 15 dBm 4.6+TT for -40dBm ≤ P_{UL}≤ -25dBm

Table 6.4A.2.1.1.5-2: Test Tolerance for Error Vector Magnitude

Parameter	f ≤ 6.0GHz, BW ≤ 100MHz		
	15dBm < PUL	**-25dBm < P_{UL} ≤ 15dBm**	**-40dBm ≤ P_{UL} ≤ -25dBm**
Pi/2-BPSK	0%	0%	0%
QPSK	0%	0%	0%
16QAM	0%	0%	0%
64QAM	0%	0%	0%
256 QAM	0.3%	0.8%	1.1%

6.4A.2.2 Carrier leakage for CA

6.4A.2.2.0 Minimum conformance requirements

6.4A.2.2.0.1 Minimum conformance requirements for intra-band contiguous CA

FFS

6.4A.2.2.0.2 Minimum conformance requirements for intra-band non-contiguous CA

FFS

6.4A.2.2.0.3 Minimum conformance requirements for inter-band CA

For inter-band carrier aggregation, the carrier leakage shall not exceed the values specified in Table 6.4A.2.2.0.3-1.

In the case that uplink sharing, the carrier leakage may have 7.5 kHz shift with the carrier frequency.

Table 6.4A.2.2.0.3-1: Requirements for carrier leakage

Parameter description	Unit	Limit		Applicable Frequencies
Carrier leakage	dBc	-28	Output power > 10 dBm	Carrier leakage frequency (NOTES 1, 2)
		-25	0 dBm ≤ Output power ≤10 dBm	
		-20	-30 dBm ≤ Output power ≤ 0 dBm	
		-10	-40 dBm ≤ Output power < -30 dBm	

NOTE 1:	The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
NOTE 2:	The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.

The normative reference for this requirement is TS 38.101-1 [2] clauses 6.4A.2.3.

6.4A.2.2.1 Carrier leakage for CA (2UL CA)

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

- The minimum requirements for intra-band contiguous CA and intra-band non-contiguous CA have not been defined.

6.4A.2.2.1.1 Test purpose

Carrier leakage is an additive sinusoid waveform that is confined within the aggregated transmission bandwidth configuration. The carrier leakage requirement for 2UL CA is defined for each component carrier and is measured on the component carrier with PRBs allocated.

6.4A.2.2.1.2 Test applicability

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

6.4A.2.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.1.4 Test description

6.4A.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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in Table 6.4A.2.2.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4A.2.2.1.4.1-1: Inter band CA Test Configuration Table

<table>
<tr><th colspan="6">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="4">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1</td><td colspan="4">Low range for PCC and SCC
High range for PCC and SCC</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Mid N_{RB_agg} for both PCC and SCC</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.5A.3-1</td><td colspan="4">Smallest supported SCS per Channel Bandwidth</td></tr>
<tr><th colspan="6">Test Parameters</th></tr>
<tr><th rowspan="3">Test ID</th><th rowspan="3">Downlink Configuration</th><th colspan="4">Uplink Configuration</th></tr>
<tr><th rowspan="2">Modulation</th><th colspan="3">RB allocation (NOTE 1, 3)</th></tr>
<tr><th>PCC</th><th colspan="2">SCC</th></tr>
<tr><td>1</td><td>N/A</td><td>DFT-s-OFDM QPSK</td><td>Inner_1RB_Left</td><td colspan="2">0</td></tr>
<tr><td colspan="6">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1.
NOTE 3: When the signalled DC carrier position is at Inner_1RB_Left, use Inner_1RB_Right for UL RB allocation.
NOTE 4: The frequencies of PCC and SCC shall be switched and tested in each configuration.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure 3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause4.4.3.

3. Downlink signals for PCC are initially set up according to AnnexC.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4A.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 [5] clause 4.5. Message contents are defined in clause 6.4A.2.2.1.4.3.

6.4A.2.2.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.4A.2.2.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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 6.4A.2.2.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Send uplink power control commands to the UE using 1dB power step size 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 10 dBm, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS

38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

6. Measure carrier leakage using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.
7. Send uplink power control commands to the UE using 1dB power step size 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 0 dBm, where MU and Uplink power control window size are defined above.
8. Measure carrier leakage on PCC using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.
9. Send uplink power control commands to the UE using 1dB power step size 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 -30 dBm, where MU and Uplink power control window size are defined above.
10. Measure carrier leakage on PCC using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.
11. Send uplink power control commands to the UE using 1dB power step size 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 Pmin, where MU and Uplink power control window size are defined above, and Pmin is the minimum output power according to Table 6.3.1.3-1.
12. Measure carrier leakage on PCC using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Table 6.4A.2.2.1.4.2-1: Void

Table 6.4A.2.2.1.4.2-2: Void

6.4A.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4A.2.2.1.5 Test requirement

Each of the [20] carrier leakage results, derived in Annex E.3.1, shall not exceed the values in table 6.4A.2.2.1.5-1. Allocated RBs are not under test.

Table 6.4A.2.2.1.5-1: Test requirements for Carrier Leakage

LO Leakage	Parameters UE output power	Relative limit (dBc)
	10 + MU to 10 + (MU + Uplink power control window size) dBm	-28+TT
	0 + MU to 0 + (MU + Uplink power control window size) dBm	-25+TT
	-30 + MU to -30 + (MU + Uplink power control window size) dBm	-20+TT

	Pmin + MU to Pmin + (MU + Uplink power control window size) dBm	-10+TT
NOTE 1: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs. NOTE 2: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB. NOTE 3: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3). NOTE 4: Void NOTE 5: MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW. NOTE 6: Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1. NOTE 7: Pmin is the minimum output power according to Table 6.3.1.3-1.		

Table 6.4A.2.2.1.5-2: Test Tolerance for Carrier Leakage

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	0.8dB	0.8dB
40MHz < BW ≤ 100MHz	0.8dB	0.8dB

6.4A.2.3 In-band emissions for CA

6.4A.2.3.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the requirements shall apply on each component carrier as defined in clause 6.4.2 with all component carriers active.

The requirements in Table 6.4A.2.3.0-1 apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

Table 6.4A.2.3.0-1: Inter band CA Requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General	dB	$\max\{ -25-10\cdot\log_{10}(N_{RB}/L_{CRB}),\ 20\cdot\log_{10} EVM -3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},\ -57\,dBm+10\log_{10}(SCS/15kHz)-P_{RB} \}$		Any non-allocated (NOTE 2)
IQ Image	dB	-28	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25	Image frequencies when output power ≤ 10 dBm	
Carrier leakage	dBc	-28	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25	0 dBm ≤ Output power ≤10 dBm	
		-20	-30 dBm ≤ Output power ≤ 0 dBm	

		-10	-40 dBm≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10.

NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.

NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.

NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.

NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.

NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3).

NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).

NOTE 8: EVM is the limit specified in Table 6.4A.2.3.1.3-1 for the modulation format used in the allocated RBs.

NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB} = 1$ or $\Delta_{RB} = -1$ for the first adjacent RB outside of the allocated bandwidth.

NOTE 10: P_{RB} is the transmitted power normalized by the number of allocated RBs, measured in dBm.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4A.2.3.

6.4A.2.3.1 In-band emissions for CA (2UL CA)

6.4A.2.3.1.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks.

For an allocated component carrier, the in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non–allocated RB to the UE output power in an allocated RB. The basic in-band emissions measurement interval is defined over one slot in the time domain, however, the minimum requirement applies when the in-band emission measurement is averaged over 10 sub-frames. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one or more symbols, accordingly.

For a non allocated component carrier a spectral measurement is specified.

6.4A.2.3.1.2 Test applicability

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

6.4A.2.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.1.4 Test description

6.4A.2.3.1.4.1 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 configuration, and are shown in Table 6.4A.2.3.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4A.2.3.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg} for both PCC and SCC Highest N_{RB_agg} for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1		Smallest supported SCS per Channel Bandwidth		
Test Parameters				
Test ID	**Downlink Configuration**	**Uplink Configuration**		
		Modulation	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A	DFT-s-OFDM QPSK	Inner_1RB_Left	0
2		DFT-s-OFDM QPSK	Inner_1RB_Right	0
3		CP-OFDM QPSK	Inner_1RB_Left	0
4		CP-OFDM QPSK	Inner_1RB_Right	0
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.5A3-1. NOTE 3: The frequencies of PCC and SCC shall be switched and tested in each configuration.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.4A.2.3.1.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.4A.2.3.1.4.3.

6.4A.2.3.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.4A.2.3.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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 6.4A.2.3.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Send uplink power control commands to the UE using 1dB power step size 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 10 dBm, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

6. Measure In-band emission on PCC using Global In-Channel Tx-Test (Annex E). Measure power spectral density on the SCC. For TDD slots with transient periods are not under test.
7. Send uplink power control commands to the UE using 1dB power step size 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 0 dBm, where MU and Uplink power control window size are defined above.
8. Measure In-band emission on PCC using Global In-Channel Tx-Test (Annex E). Measure power spectral density on the SCC. For TDD slots with transient periods are not under test.
9. Send uplink power control commands to the UE using 1dB power step size 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 -30 dBm, where MU and Uplink power control window size are defined above.
10. Measure In-band emission on PCC using Global In-Channel Tx-Test (Annex E). Measure power spectral density on the SCC. For TDD slots with transient periods are not under test.
11. Send uplink power control commands to the UE using 1dB power step size 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 Pmin, where MU and Uplink power control window size are defined above, and Pmin is the minimum output power according to Table 6.3.1.3-1.
12. Measure In-band emission on PCC using Global In-Channel Tx-Test (Annex E). Measure power spectral density on the SCC. For TDD slots with transient periods are not under test.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

Table 6.4A.2.3.1.4.2-1: Void

Table 6.4A.2.3.1.4.2-2: Void

6.4A.2.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4A.2.3.1.5 Test requirement

The averaged In-band emission result, derived in Annex E.4.3, shall not exceed the corresponding values in Table 6.4A.2.3.1.5-1. n is 10 for 15kHz SCS, 20 for 30kHz SCS and 40 for 60kHz SCS..

Table 6.4A.2.3.1.5-1: Test requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General	dB	$\max\{ -25-10\cdot\log_{10}(N_{RB}/L_{CRB}),\ 20\cdot\log_{10} EVM -3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},\ -57\,dBm+10\log_{10}(SCS/15kHz)-P_{RB}\}$ + TT		Any non-allocated (NOTE 2)
IQ Image	dB	-28+TT	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25+TT	Image frequencies when output power ≤ 10 dBm	
Carrier leakage	dBc	-28+TT	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25+TT	0 dBm ≤ Output power ≤10 dBm	
		-20+TT	-30 dBm ≤ Output power ≤ 0 dBm	
		-10+TT	-40 dBm≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. $P_{RB}$is defined in NOTE 10.

NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.

NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.

NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.

NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.

NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3).

NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).

NOTE 8: EVM is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.

NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.

NOTE 10: P_{RB} is the transmitted power normalized by the number of allocated RBs, measured in dBm.

Table 6.4A.2.3.1.5-2: Test Tolerance for In-band emission

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	0.8dB	0.8dB
40MHz < BW ≤ 100MHz	0.8dB	0.8dB

6.4B Transmit signal quality for NR-DC

For inter-band NR-DC with one uplink carrier assigned per NR band, the transmit signal quality for the corresponding inter-band CA configuration as specified in clause 6.4A applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.

6.4B.1 Frequency error for NR-DC

For inter-band dual connectivity, the frequency error for the corresponding inter-band CA configuration as specified in clause 6.4A.1 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.1.

6.4B.2 Transmit modulation quality for NR-DC

For inter-band dual connectivity, the transmit modulation quality for the corresponding inter-band CA configuration as specified in clause 6.4A.2 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.2.

6.4B.2.1 Error Vector Magnitude for NR-DC

For inter-band dual connectivity, the Error Vector Magnitude for the corresponding inter-band CA configuration as specified in clause 6.4A.2.1 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.2.1.

6.4B.2.2 Carrier leakage for NR-DC

For inter-band dual connectivity, the carrier leakage for the corresponding inter-band CA configuration as specified in clause 6.4A.2.2 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.2.2.

6.4B.2.3 In-band emissions for NR-DC

For inter-band dual connectivity, the in-band emissions for the corresponding inter-band CA configuration as specified in clause 6.4A.2.3 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.4A.2.3.

6.4C Transmit signal quality for SUL

6.4C.1 Frequency error for SUL

6.4C.1.1 Test purpose

Same test purpose as in clause 6.4.1.1

6.4C.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.4C.1.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3and 6.4.1.

6.4C.1.4 Test description

Same test description as specified in clause 6.4.1.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.4.1.4-1 → use Table 6.4C.1.4-1

Table 6.4C.1.4-1: Test Configuration Table

<table>
<tr><th colspan="7">Initial Conditions</th></tr>
<tr><td colspan="3">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="4">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="3">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Mid range for both SUL carrier and Non-SUL carrier</td></tr>
<tr><td colspan="3">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="3">Test SCS as specified in Table 5.3.5-1</td><td colspan="4">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="7">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th colspan="2">Downlink Configuration</th><th>UL Configuration</th><th colspan="3">SUL Configuration</th></tr>
<tr><td></td><td>Modulation</td><td>RB allocation</td><td rowspan="2">N/A</td><td>Modulation</td><td colspan="2">RB allocation</td></tr>
<tr><td>1</td><td>CP-OFDM QPSK</td><td>Full RB (NOTE 1)</td><td>DFT-s-OFDM QPSK</td><td colspan="2">SUL REFSENS (NOTE 2)</td></tr>
<tr><td colspan="7">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: SUL REFSENS refers to Table 7.3C.2.4.1-1a which defines SUL RB configuration and start RB location for each SCS, channel BW and NR band.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.4C.1.4-1: Void

6.4C.1.5 Test requirement

The 10 frequency error Δf results measured on the SUL carrier must fulfil the test requirement:

$|\Delta f| \le (0.1 \text{ PPM} + 15 \text{ Hz})$

6.4C.2 Transmit modulation quality for SUL

6.4C.2.1 Error Vector Magnitude for SUL

6.4C.2.1.1 Test purpose

Same test purpose as in clause 6.4.2.1

6.4C.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.4C.2.1.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3and 6.4.2.1.

6.4C.2.1.4 Test description

Same test description as specified in clause 6.4.2.1.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.4.2.1.4-1, table 6.4.2.1.4-2, table 6.4.2.1.4-3 → use Table 6.4C.2.1.4-1, table 6.4C.2.1.4-2, table 6.4C.2.1.4-3

Table 6.4C.2.1.4-1: Test Configuration Table for PUSCH

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Low, Mid, High range for SUL carrier Mid range for Non-SUL carrier			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Highest for SUL carrier Lowest for Non-SUL carrier			
Test SCS as specified in Table 5.3.5-1	15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier			
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
	N/A	N/A	Modulation	RB allocation (NOTE 2)
1[3]			DFT-s-OFDM PI/2 BPSK	Inner Full
2[3]			DFT-s-OFDM PI/2 BPSK	Outer Full
3			DFT-s-OFDM QPSK	Inner Full
4			DFT-s-OFDM QPSK	Outer Full
5			DFT-s-OFDM 16 QAM	Inner Full
6			DFT-s-OFDM 16 QAM	Outer Full
7			DFT-s-OFDM 64 QAM	Outer Full
8			DFT-s-OFDM 256 QAM	Outer Full
9			CP-OFDM QPSK	Inner Full
10			CP-OFDM QPSK	Outer Full
11			CP-OFDM 16 QAM	Inner Full
12			CP-OFDM 16 QAM	Outer Full
13			CP-OFDM 64 QAM	Outer Full
14			CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.				

Table 6.4C.2.1.4-2: Test Configuration Table for PUCCH

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	See Table 6.4C.2.1.4.1-1					
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4C.2.1.4.1-1					
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4C.2.1.4.1-1					
Test SCS as specified in Table 5.3.5-1	See Table 6.4C.2.1.4.1-1					
Test Parameters						
ID	**Downlink Configuration**		**Uplink Configuration**	**SUL Configuration**		
	Modulation	RB allocation	N/A	Waveform	PUCCH format	RB index

1	CP-OFDM QPSK	Full RB (Note 1)		CP-OFDM	PUCCH format = Format 1 Length in OFDM symbols = 14	0
2	CP-OFDM QPSK	Full RB (Note 1)		CP-OFDM	PUCCH format = Format 1 Length in OFDM symbols = 14	N_{RB}-1
3	CP-OFDM QPSK	Full RB (Note 1)		DFT-s-OFDM	PUCCH format = Format 3 Length in OFDM symbols = 14	0
4	CP-OFDM QPSK	Full RB (Note 1)		DFT-s-OFDM	PUCCH format = Format 3 Length in OFDM symbols = 14	N_{RB}-1
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: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.						

Table 6.4C.2.1.4-3: Test Configuration Table for PRACH

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4C.2.1.4.1-1
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	See Table 6.4C.2.1.4.1-1
Test SCS as specified in Table 5.3.5-1	See Table 6.4C.2.1.4.1-1
PRACH preamble format	
	SUL
PRACH Configuration Index	17
RS EPRE setting for test point 1 (dBm/15kHz)	-71
RS EPRE setting for test point 2 (dBm/15kHz)	-86

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL. Additionally the following exceptions shown in Table 6.4C.2.1.4-2 is considered.

Table 6.4C.2.1.4-1: Void

Table 6.4C.2.1.4-2: *BWP-UplinkCommon:* PRACH measurement

Derivation Path: TS 38.508-1 [5], Table 4.6.3-14			
Information Element	**Value/remark**	**Comment**	**Condition**
BWP-UplinkCommon ::= SEQUENCE {			
rach-ConfigCommon CHOICE {			SUL_SUL AND RF
setup	RACH-ConfigCommon		
}			
}			

6.4C.2.1.5 Test requirement

Same test requirement for EVM measured on the SUL carrier as specified in 6.4.2.1.5.

6.4C.2.2 Carrier leakage for SUL

6.4C.2.2.1 Test purpose

Same test purpose as in clause 6.4.2.2.1.

6.4C.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.4C.2.2.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3and 6.4.2.2.

6.4C.2.2.4 Test description

Same test description as specified in clause 6.4.2.2.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.4.2.2.4-1 → use Table 6.4C.2.2.4-1

Table 6.4C.2.2.4-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low, Mid, High range for SUL carrier Mid range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Mid for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1		15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
	N/A	N/A	Modulation	RB allocation (NOTE 1)
1			DFT-s-OFDM QPSK	Inner_1RB_Left
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 3: When the signalled DC carrier position is at Inner_1RB_Left, use Inner_1RB_Right for UL RB allocation..				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.

- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.

- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND

(RF OR RRM), Table 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_ON_SUL.

Table 6.4C.2.2.4-1: Void

6.4C.2.2.5 Test requirement

Same test requirement for carrier leakage measured on the SUL carrier as specified in 6.4.2.2.5.

6.4C.2.3 In-band emissions for SUL

6.4C.2.3.1 Test purpose

Same test purpose as in clause 6.4.2.3.1.

6.4C.2.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.4C.2.3.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3and 6.4.2.3.

6.4C.2.3.4 Test description

Same test description as specified in clause 6.4.2.3.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.4.2.3.4-1 → use Table 6.4C.2.3.4-1

Table 6.4C.2.3.4-1: Test Configuration Table for PUSCH

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range for SUL carrier Mid range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1		15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
	N/A	N/A	Modulation	RB allocation (NOTE 1)
1			DFT-s-OFDM QPSK	Inner_1RB_Left
2			DFT-s-OFDM QPSK	Inner_1RB_Right
3			CP-OFDM QPSK	Inner_1RB_Left
4			CP-OFDM QPSK	Inner_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.				

Table 6.4.2.3.4.1-2: Test Configuration Table for PUCCH

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			See Table 6.4C.2.3.4.1-1			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4C.2.3.4.1-1			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			See Table 6.4C.2.3.4.1-1			
Test SCS as specified in Table 5.3.5-1			See Table 6.4C.2.3.4.1-1			
Test Parameters						
ID	**Downlink Configuration**		**Uplink Configuration**	**SUL Configuration**		
	Modulation	RB allocation	N/A	Waveform	PUCCH format	RB index
1	CP-OFDM QPSK	Full RB (Note 1)		DFT-s-OFDM	PUCCH format = Format 3 Length in OFDM symbols = 14	0
2	CP-OFDM QPSK	Full RB (Note 1)		DFT-s-OFDM	PUCCH format = Format 3 Length in OFDM symbols = 14	N_{RB}-1
3	CP-OFDM QPSK	Full RB (Note 1)		CP-OFDM	PUCCH format = Format 1 Length in OFDM symbols = 14	0
4	CP-OFDM QPSK	Full RB (Note 1)		CP-OFDM	PUCCH format = Format 1 Length in OFDM symbols = 14	N_{RB}-1
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: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.						

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.4C.2.3.4-1: Void

6.4C.2.3.5 Test requirement

Same test requirement for carrier leakage measured on the SUL carrier as specified in 6.4.2.3.5.

6.4C.2.4 EVM equalizer spectrum flatness for SUL

6.4C.2.4.1 Test purpose

Same test purpose as in clause 6.4.2.4.1.

6.4C.2.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.4C.2.4.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.4.2.4.

6.4C.2.4.4 Test description

Same test description as specified in clause 6.4.2.4.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1.

Instead of table 6.4.2.4.4-1 → use Table 6.4C.2.4.4-1

Table 6.4C.2.4.4-1: Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Low range, Mid range, High range for SUL carrier
Mid range for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Lowest, Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.5C-1</td><td colspan="3">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="5">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th>UL Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td></td><td rowspan="3">N/A</td><td rowspan="3">N/A</td><td>Modulation</td><td>RB allocation (NOTE 1)</td></tr>
<tr><td>1</td><td>DFT-s-OFDM QPSK</td><td>Outer Full</td></tr>
<tr><td>2</td><td>CP-OFDM QPSK</td><td>Outer Full</td></tr>
<tr><td colspan="5">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Table 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

Table 6.4C.2.4.4-1: Void

6.4C.2.4.5 Test requirement

Same test requirement for EVM equalizer spectrum flatness measured on the SUL carrier as specified in 6.4.2.4.5.

6.4C.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK for SUL

6.4C.2.5.1 Test purpose

Same test purpose as in clause 6.4.2.5.1.

6.4C.2.5.2 Test applicability

This test applies to all types of NR UE release 16 and forward that support SUL operating on the SUL bands and indicate support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

6.4C.2.5.3 Minimum conformance requirements

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clauses 4.3 and 6.4.2.4.1.

6.4C.2.5.4 Test description

6.4C.2.5.4.1 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 operating bands specified in Table 5.5C-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 6.4C.2.5.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4C.2.5.4.1-1: Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Low range, Mid range, High range for SUL carrier
Mid range for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Lowest, Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.5C-1</td><td colspan="3">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="5">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th>UL Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td></td><td rowspan="2">N/A</td><td rowspan="2">N/A</td><td>Modulation</td><td>RB allocation (NOTE 1)</td></tr>
<tr><td>1</td><td>DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS</td><td>Outer Full</td></tr>
<tr><td colspan="5">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.4C.2.5.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.4C.2.5.4.3.

6.4C.2.5.4.2 Test procedure

Same as in 6.4.2.5.4.2.

6.4C.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), Table 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL with the following exception:

Table 6.4C.2.5.4.3-1: DMRS-UplinkConfig

Derivation Path: TS 38.508-1 [5], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			

6.4C.2.5.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1 The derived results shall not exceed the values in Figure 6.4C.2.5.5-1:

Table 6.4C.2.5.5-1: Mask for EVM equalizer coefficients for Pi/2 BPSK, normal conditions

Frequency range	Parameter	Maximum ripple (dB)
$\lvert F_{UL\_Meas} – F\_center \rvert \le X$ MHz (Range 1)	X1	6 + TT (p-p)
$\lvert F_{UL\_Meas} – F\_center \rvert > X$ MHz (Range 2)	X2	14 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_center refers to the center frequency of an allocated block of PRBs NOTE 3: X, in MHz, is equal to 25% of the bandwidth of the PRB allocation NOTE 4: See Figure 6.4C.2.5.5-1 for description of X1, X2 NOTE 5: Test tolerance TT = 1.4 dB.		

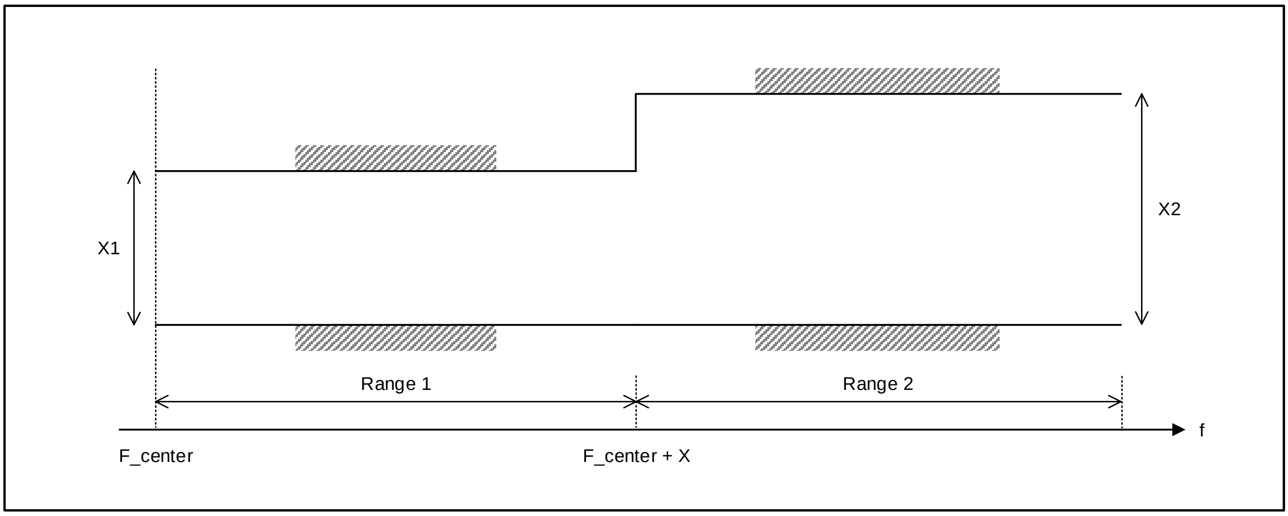

Figure 6.4C.2.5.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. F_center denotes the center frequency of the allocated block of PRBs. X, in MHz, is equal to 25 % of the bandwidth of the PRB allocation.

Each of the *n* spectrum flatness functions shall derive an impulse response of the spectral shaping filter in Annex E.4.4.2. The derived results shall fulfill:

$$|\tilde{a}(0)| \geq |\tilde{a}(\tau)| \quad \forall \tau \neq 0$$

$$20\log_{10}|\tilde{a}(\tau)| < -15\mathrm{dB} + \mathrm{TT} \quad 1 < \tau < M - 1,$$

where TT = 1.4 dB.6.4D Transmit signal quality for UL MIMO.

6.4D Transmit signal quality for UL MIMO

6.4D.1 Frequency error for UL MIMO

6.4D.1.1 Test purpose

This test verifies the ability of both, the receiver and the transmitter for UL MIMO, to process frequency correctly.

Receiver: to extract the correct frequency from the stimulus signal, offered by the System simulator, under ideal propagation conditions and low level.

Transmitter: to derive the correct modulated carrier frequency for each antenna connector from the results, gained by the receiver.

6.4D.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.1.3 Minimum conformance requirements

For UE(s) supporting UL MIMO, the basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency received from the NR Node B.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.1.

6.4D.1.4 Test description

6.4D.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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.4D.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest	
Test SCS as specified in Table 5.3.5-1			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	CP-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.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.2.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Table 6.4D.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 [5] clause 4.5. Message contents are defined in clause 6.4D.1.4.3.

6.4D.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4D.1.4.1-1. 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 6.4D.1.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2

3. Set the Downlink signal level to the appropriate REFSENS value defined in 7.3D.2.5. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE

transmits at P_{UMAX} level for the duration of the test. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

4. Measure the Frequency Error using Global In-Channel Tx-Test (Annex E) at each transmit antenna connector of the UE. For TDD, only slots consisting of only UL symbols are under test.
5. For UEs supporting DSS, repeat steps 1~4 on the applicable bands as specified in Section 5.4.2.1 with message contents being according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-61 and Table 4.6.3-62 with condition DSS.

6.4D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.4D.1.5 Test requirement

The requirements apply to each transmit antenna connector.

The 10 frequency error Δf results must fulfil the test requirement:

$|\Delta f| \leq (0.1PPM+15\ Hz)$

6.4D.2 Transmit modulation quality for UL MIMO

For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna connector.

If UE is configured for transmission on single-antenna port, the requirements specified for single carrier apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

6.4D.2.1 Error Vector Magnitude for UL MIMO

6.4D.2.1.1 Test purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clause 6.4D.2.4.3. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is the duration of PUSCH channel, or one hop, if frequency hopping is enabled for PUSCH in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient as defined in subclause 6.3D.3.3.

6.4D.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.1.3 Minimum conformance requirements

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.4.2.1.3-1 which is defined in subclause 6.4.2.1.3 apply at each transmit antenna connector. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.3-2

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.2.1.

6.4D.2.1.4 Test description

6.4D.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 operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4D.2.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		All	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Inner Full
2		CP-OFDM QPSK	Outer Full
3		CP-OFDM 16 QAM	Inner Full
4		CP-OFDM 16 QAM	Outer Full
5		CP-OFDM 64 QAM	Outer Full
6		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.4D.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 [5] clause 4.5. Message contents are defined in clause 6.4D.2.1.4.3.

6.4D.2.1.4.2 Test procedure

Test procedure for PUSCH:

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 6.4D.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. The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2

1.2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at $P_{UMAX\ level}$, allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

1.3. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) for each of transmit antenna of the UE. For TDD, only slots consisting of only UL symbols are under test.

1.4. For modulations except 256QAM, send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 Pmin, where:

- Pmin is the minimum output power according to Table 6.3.1.3-1.
- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

For 256 QAM, send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 Pmin + 10 dB, where MU and Uplink power control window size are defined above. Pmin is the minimum output power according to Table 6.3D.1.3-1.

1.5. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

NOTE1: Void.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power at each antenna connector under measurement is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

NOTE3: For the UE which the output power at each antenna connector can reach the Uplink power control window at the same time, execute measurement for each of antenna connectors. For the UE which the output power at each antenna connector cannot reach the Uplink power control window at the same time, execute measurement for the one antenna connector which the output power is within Uplink power control window. And then ensure output power of the other antenna connector is within Uplink power control window and execute measurement for this antenna connector.

Table 6.4D.2.1.4.2-1: Void

6.4D.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the condition 2TX_UL_MIMO.

6.4D.2.1.5 Test requirement

The requirements apply to each transmit antenna connector.

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4D.2.1.5-1.

The PUSCH $\overline{EVM}_{DMRS}$, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4D.2.1.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4D.2.1.5-1: Test requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	30 + TT
QPSK	%	17.5 + TT
16 QAM	%	12.5 + TT
64 QAM	%	8 + TT
256 QAM	%	3.5 + TT
Note 1: TT is defined in Table 6.4D.2.1.5-2.		

Table 6.4D.2.1.5-2: Test Tolerance

Parameter	Unit	Average EVM Level
Pi/2-BPSK	%	0
QPSK	%	0
16 QAM	%	0
64 QAM	%	0
256 QAM	%	0.3 for 15 dBm < P_{UL} 0.8 for -25 dBm < P_{UL}≤ 15 dBm 1.1 for -40dBm ≤ P_{UL} ≤ -25dBm

6.4D.2.2 Carrier leakage for UL MIMO

6.4D.2.2.1 Test purpose

The purpose of this test is to exercise the UE transmitter for UL MIMO to verify its modulation quality in terms of carrier leakage.

6.4D.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.2.3 Minimum conformance requirements

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.4.2.2.3-1 which is defined in subclause 6.4.2.2.3 apply at each transmit antenna connector. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.3-2

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.2.2.

6.4D.2.2.4 Test description

6.4D.2.2.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.4D.2.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.2.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Mid	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1, 3)**
1		CP-OFDM QPSK	Inner_1RB_Left
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. NOTE 3: When the signalled DC carrier position is at Inner_1RB_Left, use Inner_1RB_Right for UL RB allocation.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.4D.2.2.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.4D.2.2.4.3.

6.4D.2.2.4.2 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 6.4D.2.2.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 10 dBm, where:
   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.
3. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for each of transmit antenna of the UE. For TDD, only slots consisting of only UL symbols are under test.
4. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 0 dBm, where MU and Uplink power control window size are defined above.

5. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for each of transmit antenna of the UE. For TDD, only slots consisting of only UL symbols are under test.
6. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 -30 dBm, where MU and Uplink power control window size are defined above.
7. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for each of transmit antenna of the UE. For TDD, only slots consisting of only UL symbols are under test.
8. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 Pmin, where MU and Uplink power control window size are defined above. Pmin is the minimum output power according to Table 6.3D.1.3-1..
9. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for each of transmit antenna of the UE. For TDD, only slots consisting of only UL symbols are under test.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power at each antenna connector under measurement is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

NOTE2: For the UE which the output power at each antenna connector can reach the Uplink power control window at the same time, execute measurement for each of antenna connectors. For the UE which the output power at each antenna connector cannot reach the Uplink power control window at the same time, execute measurement for the one antenna connector which the output power is within Uplink power control window. And then ensure output power of the other antenna connector is within Uplink power control window and execute measurement for this antenna connector.

Table 6.4D.2.2.4.2-1: Void

Table 6.4D.2.1.4.2-2: Void

6.4D.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the condition 2TX_UL_MIMO.

6.4D.2.2.5 Test requirement

The requirements apply to each transmit antenna connector.

Each of the n carrier leakage results, derived in Annex E.3.1, shall not exceed the values in table 6.4D.2.2.5-1. Allocated RBs are not under test. n is 10 for 15kHz SCS, 20 for 30kHz SCS and 30 for 60kHz SCS.

Table 6.4D.2.2.5-1: Test requirements for Relative Carrier Leakage Power

LO Leakage	Parameters UE output power	Relative limit (dBc)
	10 + MU to 10 + (MU + Uplink power control window size) dBm	-28 + TT
	0 + MU to 0 + (MU + Uplink power control window size) dBm	-25 + TT
	-30 + MU to -30 + (MU + Uplink power control window size) dBm	-20 + TT
	-40 + MU to -40 + (MU + Uplink power control window size) dBm	-10 + TT

NOTE 1:	The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
NOTE 2:	The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.
NOTE 3:	N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).
NOTE 4:	Void
NOTE 5:	MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.
NOTE 6:	Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.
NOTE 7:	Test tolerance TT = 0.8 dB.

Table 6.4D.2.2.5-2: Void

6.4D.2.3 In-band emissions for UL MIMO

6.4D.2.3.1 Test purpose

The purpose of this test is to exercise the UE transmitter for UL MIMO to verify its modulation quality in terms of in-band emissions.

6.4D.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.3.3 Minimum conformance requirements

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.4.2.3.3-1 which is defined in subclause 6.4.2.3.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2D.1.3-2.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.2.3.

6.4D.2.3.4 Test description

6.4D.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, 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.4D.2.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.3.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Inner_1RB_Left
2		CP-OFDM QPSK	Inner_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Table 6.4D.2.3.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.4D.2.3.4.3.

6.4D.2.3.4.2 Test procedure

Test procedure for PUSCH:

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 6.4D.2.3.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

1.2. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 10 dBm, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW.

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

1.3. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

1.4. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 0 dBm, where MU and Uplink power control window size are defined above.

1.5. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

1.6. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 -30 dBm, where MU and Uplink power control window size are defined above.

1.7. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

1.8. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power at each antenna connector under measurement 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 Pmin, where MU and Uplink power control window size are defined above. Pmin is the minimum output power according to Table 6.3D.1.3-1.

1.9. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

NOTE1: Void.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power at each antenna connector under measurement is no less than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.2.

NOTE3: For the UE which the output power at each antenna connector can reach the Uplink power control window at the same time, execute measurement for each of antenna connectors. For the UE which the output power at each antenna connector cannot reach the Uplink power control window at the same time, execute measurement for the one antenna connector which the output power is within Uplink power control window. And then ensure output power of the other antenna connector is within Uplink power control window and execute measurement for this antenna connector.

Table 6.4D.2.3.4.2-1: Void

Table 6.4D.2.3.4.2-2: Void

6.4D.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the condition 2TX_UL_MIMO.

6.4D.2.3.5 Test requirement

The requirements apply to each transmit antenna connector.

The averaged In-band emissions result, derived in Annex E.4.3, shall not exceed the corresponding values in Tables 6.4D.2.3.5-1. n is 10 for 15kHz SCS, 20 for 30kHz SCS and 40 for 60kHz SCS.

Table 6.4D.2.3.5-1: Test requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General	dB	$\max\{ -25-10\cdot\log_{10}(N_{RB}/L_{CRB}),\ 20\cdot\log_{10} EVM -3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},\ -57\,dBm+10\log_{10}(SCS/15kHz)-P_{RB}\}$ + TT		Any non-allocated (NOTE 2)
IQ Image	dB	-28 + TT	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25 + TT	Image frequencies when output power ≤ 10 dBm	
Carrier leakage	dBc	-28 + TT	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25 + TT	0 dBm ≤ Output power ≤10 dBm	
		-20 + TT	-30 dBm ≤ Output power ≤ 0 dBm	
		-10 + TT	-40 dBm ≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10.
NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.
NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RB containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.
NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3).
NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3).
NOTE 8: EVM is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.
NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.
NOTE 10: P_{RB} is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.
NOTE 11: Test tolerance TT = 0.8 dB.

Table 6.4D.2.3.5-2: Void

6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO

6.4D.2.4.1 Test purpose

The purpose of this test is to verify the zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) meets a spectrum flatness requirement for the EVM measurement to be valid.

6.4D.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.4.3 Minimum conformance requirements

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.4.2.4.3-1 and Table 6.4.2.4.3-2 which are defined in subclause 6.4.2.4.3 apply at each transmit antenna connector. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.3-2

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.2.4.

6.4D.2.4.4 Test description

6.4D.2.4.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.4D.2.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**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. NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.2.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.4D.2.4.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.4D.2.4.4.3.

6.4D.2.4.4.2 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 6.4D.2.4.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E) for each of transmit antennas of the UE. For TDD, only slots consisting of only UL symbols are under test.

6.4D.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the condition 2TX_UL_MIMO.

6.4D.2.4.5 Test requirement

The requirements apply to each transmit antenna connector.

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1. The derived results shall not exceed the values in Figure 6.4D.2.4.5-1:

For shaped Pi/2-BPSK modulated waveforms, the test requirements are TBD.

For normal conditions and unshaped modulated waveforms, the maximum ripple in Range 1 and Range 2 shall not exceed the values specified in Table 6.4D.2.4.5-1 and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4D.2.4.5-1).

For normal conditions and for unshaped modulated waveforms, the peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4D.2.4.5-1. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4D.2.4.5-1).

For extreme conditions, the EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4D.2.4.5-2. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 7.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 11.4 dB (see Figure 6.4D.2.4.5-1).

Table 6.4D.2.4.5-1: Requirements for EVM equalizer spectrum flatness for unshaped modulations (normal conditions)

Frequency range	Maximum ripple [dB]
$F_{UL\_Meas} – F_{UL\_Low} \geq 3$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 3$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 3$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 3$ MHz (Range 2)	8 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

Table 6.4D.2.4.5-2: Minimum requirements for EVM equalizer spectrum flatness for unshaped modulations (extreme conditions)

Frequency range	Maximum Ripple [dB]
$F_{UL\_Meas} - F_{UL\_Low} \geq 5$ MHz and $F_{UL\_High} - F_{UL\_Meas} \geq 5$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} - F_{UL\_Low} < 5$ MHz or $F_{UL\_High} - F_{UL\_Meas} < 5$ MHz (Range 2)	12 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

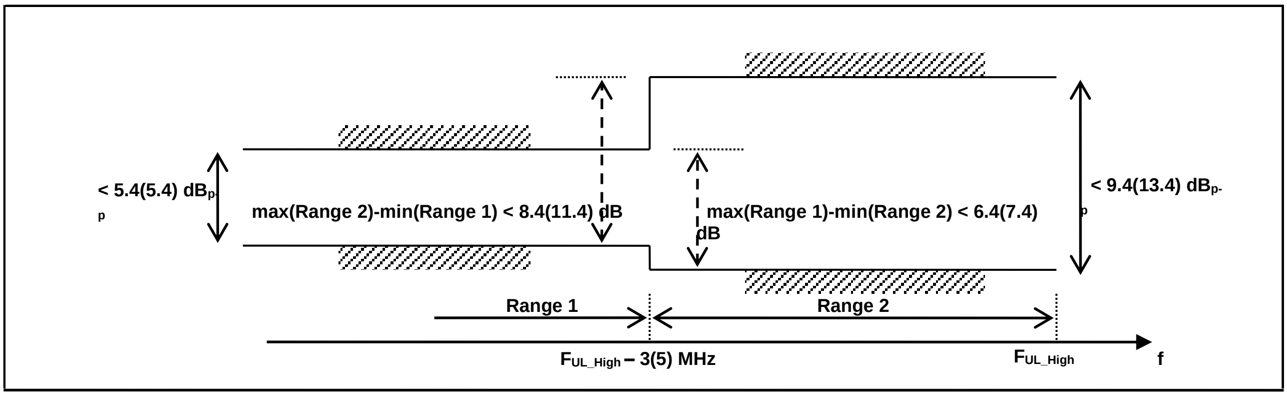

Figure 6.4D.2.4.5-1: The test requirements for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated for unshaped modulations (the ETC test requirements are within brackets)

6.4D.3 Time alignment error for UL MIMO

6.4D.3.1 Test purpose

To verify that the error of time alignment in UL MIMO does not exceed the range prescribed by the specified UL MIMO Time Alignment Error (TAE) and tolerance.

An excess time alignment error has the possibility to interfere to other channels or other systems and decrease UL MIMO performance because of the timing unsynchronization.

6.4D.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.3.3 Minimum conformance requirements

For UE(s) with multiple transmit antenna connectors supporting UL MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.3.

6.4D.3.4 Test description

6.4D.3.4.1 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 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 6.4D.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 6.4D.3.4.1-1: Test Configuration Table

<table>
<tr><th colspan="4">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="2">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Mid range</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Lowest, Mid, Highest</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">Lowest, Highest</td></tr>
<tr><th colspan="4">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><td></td><td rowspan="2">N/A for Time alignment error for UL MIMO test case</td><th>Modulation</th><th>RB allocation (NOTE 1)</th></tr>
<tr><td>1</td><td>CP-OFDM QPSK</td><td>Outer Full</td></tr>
<tr><td colspan="4">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.4D.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 [5] clause 4.5. Message contents are defined in clause 6.4D.3.4.3.

6.4D.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 6.4D.3.4.1-1. Since the UE 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 the condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. Measure the timing of one sub-frame at each antenna connector.

6.4D.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.4D.3.5 Test requirement

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 + TT ns.

Table 6.4D.3.5-1: Test Tolerance (Time alignment error for UL MIMO)

Test Tolerance
25ns

6.4D.4 Requirements for coherent UL MIMO

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

- Test config table is still FFS.

- Scheduling pattern within 20ms measurement window is FFS

- The test procedure is FFS.

- MU and TT value are still FFS

6.4D.4.1 Test purpose

To verify that the difference of relative phase error and the difference of relative power error between antenna ports in coherent UL MIMO do not exceed the range prescribed by the specified requirements for coherent UL MIMO and tolerance.

An excess relative phase error or excess relative power error has the possibility to interfere to other channels and decrease UL MIMO performance because of the timing unsynchronization.

6.4D.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support coherent UL MIMO.

6.4D.4.3 Minimum conformance requirements

For coherent UL MIMO, Table 6.4D.4.3-1 lists the maximum allowable difference between the measured relative power and phase errors between different antenna ports in any slot within the specified time window from the last transmitted SRS on the same antenna ports, for the purpose of uplink transmission (codebook or non-codebook usage) and those measured at that last SRS. The requirements in Table 6.4D.4.3-1 apply when the UL transmission power at each antenna port is larger than 0 dBm for SRS transmission and for the duration of time window.

Table 6.4D.4.3-1: Maximum allowable difference of relative phase and power errors in a given slot compared to those measured at last SRS transmitted

Difference of relative phase error	Difference of relative power error	Time window
40 degrees	4 dB	20 msec

The above requirements when all the following conditions are met within the specified time window:

- UE is not signaled with a change in number of SRS ports in SRS-config, or a change in PUSCH-config

- UE remains in DRX active time (UE does not enter DRX OFF time)

- No measurement gap occurs

- No instance of SRS transmission with the usage antenna switching occurs

- Active BWP remains the same

- EN-DC and CA configuration is not changed for the UE (UE is not configured or de-configured with PScell or SCell(s))

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4D.4

6.4D.4.4 Test description

6.4D.4.4.1 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 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 6.4D.4.4.1-1. 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 6.4D.4.4.1-1: Test Configuration Table

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.4D.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 [5] clause 4.5. Message contents are defined in clause 6.4D.4.4.3

6.4D.4.4.2 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 6.4D.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE reaches the Pumax level of the test point.
3. Measure the mean power of the UE on each antenna port on SRS symbol in the SRS channel bandwidth according to the test configuration from table 6.4D.4.4.1-1. Calculate the power difference between antenna ports and save this value as ‘Power_ref’.
4. On the slots within 20ms following the SRS symbol, measure the mean power of the UE on each antenna port in the channel bandwidth according to the test configuration from table 6.2.4.4.1-1. The period of measurement shall be at least the continuous duration of one active slot and in the uplink symbols. For TDD slots with transient periods are not under test. Calculate the power difference between antenna ports and save this value as ‘Power_meas’.

6.4D.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 ensuring Table 4.6.3-182 with the condition 2TX_UL_MIMO.

6.4D.4.5 Test requirement

Maximum allowable difference of 'power_ref' measured in step 3 and 'power_meas' measured in step 4 shall not exceed the described relative power error in Table 6.4D.4.5-1.

Table 6.4D.4.5-1: Maximum allowable difference of relative phase and power errors in a given slot compared to those measured at last SRS transmitted

Difference of relative phase error	Difference of relative power error	Time window
40+TT degrees	4+TT[1] dB	20 msec
NOTE 1: TT for relative power for each frequency and channel bandwidth is specified in Table 6.4D.4.5-2.		

Table 6.4D.4.5-2: Test Tolerance

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	FFS	FFS
40MHz < BW ≤ 100MHz	FFS	FFS

6.4E Transmit signal quality for V2X

6.4E.1 Frequency error for V2X

6.4E.2 Transmit modulation quality for V2X

6.4E.2.1 General

The transmit modulation quality requirements in this clause apply to V2X sidelink transmissions.

For NR V2X UE supporting SL MIMO, the transmit modulation quality requirements for single carrier shall apply to each transmit antenna connector.

If V2X UE transmits on one-antenna connector at a time, the requirements specified for single carrier apply to the active antenna connector.

6.4E.2.2 Error Vector Magnitude for V2X

6.4E.2.2.1 Error Vector Magnitude for V2X / non-concurrent operation

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Test configuration is TBD

- Target power level is TBD

6.4E.2.2.1.1 Test purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clause 6.4E.2.5.1.3. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

6.4E.2.2.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication.

6.4E.2.2.1.3 Minimum conformance requirements

For V2X sidelink physical channels PSCCH and PSSCH, the Error Vector Magnitude requirements shall be as specified for PUSCH in Table 6.4.2.1-1 except pi/2-BPSK for NR V2X operating bands in Table 5.2E.1-1. When sidelink transmissions are shortened due to transmission gap of 1 symbol at the end of the slot, the EVM measurement interval is reduced by one symbol, accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.2.

6.4E.2.2.1.4 Test description

6.4E.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 operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.2.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annex A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.4E.2.2.1.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.4E.2.2.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.2.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.4E.2.2.1.4.2 Test procedure

1. The UE starts to perform the V2X sidelink communication according to [SL-V2X-Preconfiguration]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the V2X RMC.
2. Configure the UE to transmit at $P_{UMAX\ level}$.
3. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E). The measurement period is [15] subframes. When V2X transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.
4. Modify SL-V2X-Preconfiguration to ensure the UE to transmit at a relative low power, according to Table [TBD].
5. Ensure the UE is in State [TBD] in Transmit Mode according to TS 38.508-1 [5] clause [TBD] using the new UL power control setting.

6. The UE starts to perform the V2X sidelink communication according to [SL-V2X-Preconfiguration]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the V2X RMC.

7. Measure EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E). The measurement period is [15] subframes. When V2X transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.

6.4E.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.2.1.5 Test requirement

FFS

6.4E.2.2.1D Error Vector Magnitude for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- No test points are defined since there is no configuration satisfying MPR=0dB requirements in RAN4.

- The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.4E.2.2.1D.1 Test purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clause 6.4E.2.5.1D.3. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

6.4E.2.2.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.2.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier described in clause 6.4E.2.2.1.3 shall apply to each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.2.

6.4E.2.2.1D.4 Test description

6.4E.2.2.1D.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 operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.2.1D.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.4E.2.2.1D.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

NOTE: No test points are defined since there is no configuration satisfying MPR=0dB requirements in RAN4.

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure [TBD] for TE diagram and section [TBD] for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause [TBD]. Message content exceptions are defined in clause 6.4E.2.2.1D.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.2.1D.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table [TBD]. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state [TBD].

6.4E.2.2.1D.4.2 Test procedure

1. The UE starts to perform the V2X sidelink communication according to [SL-V2X-Preconfiguration]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the V2X RMC.
2. Configure the UE to transmit at $P_{UMAX\ level}$.
3. Measure the EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) for each of transmit antenna. The measurement period is [15] subframes. When V2X transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.
4. Modify SL-V2X-Preconfiguration to ensure the UE to transmit at a relative low power, according to Table [TBD].
5. Ensure the UE is in State [TBD] in Transmit Mode according to TS 38.508-1 [5] clause [TBD] using the new UL power control setting.
6. The UE starts to perform the V2X sidelink communication according to [SL-V2X-Preconfiguration]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the V2X RMC.
7. Measure EVM and $\overline{EVM}_{DMRS}$ using Global In-Channel Tx-Test (Annex E) for each of transmit antenna. The measurement period is [15] subframes. When V2X transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.

6.4E.2.2.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.2.1D.5 Test requirement

FFS

6.4E.2.4 In-band emissions for V2X

6.4E.2.4.1 In-band emissions for V2X / non-concurrent operation

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Test configuration is TBD

- Target power level is TBD

6.4E.2.4.1.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks, this is to verify that the in-band emissions of V2X sidelink non-concurrent operation satisfy the minimum requirements.

6.4E.2.4.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.4E.2.4.1.3 Minimum conformance requirements

For V2X sidelink physical channels PSCCH, PSSCH and PSBCH, the In-band emissions requirements shall be as specified for PUSCH in subclause 6.4.2.3 for the corresponding modulation and transmission bandwidth. When V2X transmissions are shortened due to transmission gap of one symbol at the end of the subframe, the In-band emissions measurement interval is reduced by one symbol, accordingly.

Consequently, the relative in-band emission of each sidelink physical channel shall not exceed the values specified in Table 6.4E.2.4.1.3-1.

Table 6.4E.2.4.1.3-1: Minimum requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General	dB	$\max\{ -25-10\cdot\log_{10}(N_{RB}/L_{CRB}),$ $20\cdot\log_{10} EVM -3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},$ $-57\,dBm+10\log_{10}(SCS/15kHz)-\overline{P_{RB}}\}$		Any non-allocated (NOTE 2)
IQ Image	dB	-28	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25	Image frequencies when output power ≤ 10 dBm	
Carrier leakage	dBc	-28	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25	0 dBm ≤ Output power ≤ 10 dBm	
		-20	-30 dBm ≤ Output power < 0 dBm	
		-10	-40 dBm ≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of $\overline{P_{RB}}$ - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. $\overline{P_{RB}}$ is defined in NOTE 10.
NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.
NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.
NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RB containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.
NOTE 6: L_{CRB} is the Transmission Bandwidth (see clause 5.3).
NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see clause 5.3).
NOTE 8: *EVM* is the limit specified in Table 6.4.2.1-1 for the modulation format used in the allocated RBs.
NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. Δ_{RB} = 1 or Δ_{RB} = -1 for the first adjacent RB outside of the allocated bandwidth.
NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.
NOTE 11: For almost contiguous allocations defined in clause 6.2.2, $L_{CRB} = N_{RB\_alloc} + N_{RB\_gap}$ with no in-gap emission requirement.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.4.

6.4E.2.4.1.4 Test description

6.4E.2.4.1.4.1 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 operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.4.1.4.1-1 and 6.4E.2.4.1.4.1-2. The details of the V2X reference measurement channels (RMCs) are specified in Annex A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.4E.2.4.1.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

Table 6.4E.2.4.1.4.1-2: Test Configuration Table for PSBCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.4E.2.4.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.4.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.4E.2.4.1.4.2 Test procedure

Test procedure for PSCCH+PSSCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].
2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.1.4.1-1.
3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD]
4. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

[TP2: V2X UE output power within (0 -30) dBm]

Repeat the above steps 1~4 with the exception that making sure V2X UE transmission power to be -25.5dBm+/-4.5dB for carrier frequency f > 5GHz in step3.

Test procedure for PSBCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].
2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.1.4.1-2.
3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD]
4. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

[TP2: V2X UE output power within (0 -30) dBm]

Repeat the above steps 1~4 with the exception that making sure V2X UE transmission power to be -25.5dBm+/-4.5 dB for carrier frequency f > 5GHz in step3.

6.4E.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.4.1.5 Test requirement

FFS

6.4E.2.4.1D In-band emissions for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.4E.2.4.1D.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks, this is to verify that the in-band emissions of V2X sidelink non-concurrent operation satisfy the minimum requirements.

6.4E.2.4.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.4.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier described in clause 6.4E.2.4.1.3 shall apply to each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.4.

6.4E.2.4.1D.4 Test description

6.4E.2.4.1D.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 operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.4.1D.4.1-1 and 6.4E.2.4.1D.4.1-2. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.4E.2.4.1D.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

Table 6.4E.2.4.1D.4.1-2: Test Configuration Table for PSBCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure [TBD] for TE diagram and section [TBD] for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause [TBD]. Message content exceptions are defined in clause 6.4E.2.4.1D.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.4.1D.4.1-1.

4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table [TBD]. Geographical area #1 is also pre-configured in the UE.

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

6. Ensure the UE is in state [TBD].

6.4E.2.4.1D.4.2 Test procedure

Test procedure for PSCCH+PSSCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].

2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.1D.4.1-1.

3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD].

4. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antenna.

Test procedure for PSBCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].

2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.1D.4.1-2.

3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD].

4. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antenna.

6.4E.2.4.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.4.1D.5 Test requirement

FFS

6.4E.2.4.2 In-band emissions for V2X / con-current operation

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.4E.2.4.2.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks, this is to verify that the in-band emissions of V2X sidelink con-current operation satisfy the minimum requirements.

6.4E.2.4.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with con-current operation.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.4.2.3 Minimum conformance requirements

For V2X sidelink physical channels PSCCH, PSSCH and PSBCH, the In-band emissions requirements shall be as specified for PUSCH in subclause 6.4.2.3 for the corresponding modulation and transmission bandwidth. When V2X transmissions are shortened due to transmission gap of one symbol at the end of the subframe, the In-band emissions measurement interval is reduced by one symbol, accordingly.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.4.

6.4E.2.4.2.4 Test description

6.4E.2.4.2.4.1 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 operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.4.2.4.1-1 and 6.4E.2.4.2.4.1-2. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.4E.2.4.2.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

Table 6.4E.2.4.2.4.1-2: Test Configuration Table for PSBCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure [TBD] for TE diagram and section [TBD] for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause [TBD]. Message content exceptions are defined in clause 6.4E.2.4.2.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.4.2.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table [TBD]. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state [TBD].

6.4E.2.4.2.4.2 Test procedure

Test procedure for PSCCH+PSSCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].
2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.2.4.1-1.
3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD].
4. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antenna.

Test procedure for PSBCH:

1. Set the V2X sidelink communication parameters for both the V2X sidelink capable UE (hereinafter referred to as V2X UE) and SS according to *SL-PreconfigurationNR* in [TBD].

2. V2X UE schedules the V2X RMC according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.4.2.4.1-2.
3. Measure the V2X UE output power to make sure V2X UE transmission power to be [TBD].
4. Measure In-band emission using Global In-Channel Tx-Test (Annex E) for each of transmit antenna.

6.4E.2.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.4.2.5 Test requirement

FFS

6.4E.2.5 EVM equalizer spectrum flatness for V2X

6.4E.2.5.1 EVM equalizer spectrum flatness for V2X / non-concurrent operation

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Test configuration is TBD

- Target power level is TBD

6.4E.2.5.1.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectrum flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the V2X sidelink allocated block variation in dB of the equalizer coefficients generated by the EVM measurement process. The EVM equalizer spectrum flatness requirement does not limit the correction applied to the signal in the EVM measurement process but for the EVM result to be valid, the equalizer correction that was applied must meet the EVM equalizer spectrum flatness minimum requirements. The basic measurement interval is the same as for EVM.

6.4E.2.5.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.5.1.3 Minimum conformance requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the V2X sidelink allocation shall not exceed the maximum ripple. The EVM equalizer spectrum flatness shall not exceed the values specified in Table 6.4E.2.5.1.3-1 for normal conditions. For V2X sidelink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.4E.2.5.1.3-1).

The EVM equalizer spectrum flatness shall not exceed the values specified in Table 6.4E.2.5.1.3-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.4E.2.5.1.3-1).

For V2X sidelink physical channels PSCCH, PSSCH and PSBCH, the EVM equalizer spectrum flatness requirements shall be as specified for PUSCH in clause 6.4.2.4 for the corresponding modulation and transmission bandwidth.

Table 6.4E.2.5.1.3-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

Frequency range	Maximum ripple (dB)
$F_{UL\_Meas} – F_{UL\_Low} \geq 3$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 3$ MHz (Range 1)	4 (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 3$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 3$ MHz (Range 2)	8 (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each NR frequency band specified in Table 5.2-1	

Table 6.4E.2.5.1.3-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple (dB)
$F_{UL\_Meas} – F_{UL\_Low} \geq 5$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 5$ MHz (Range 1)	4 (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 5$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 5$ MHz (Range 2)	12 (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each NR frequency band specified in Table 5.2-1	

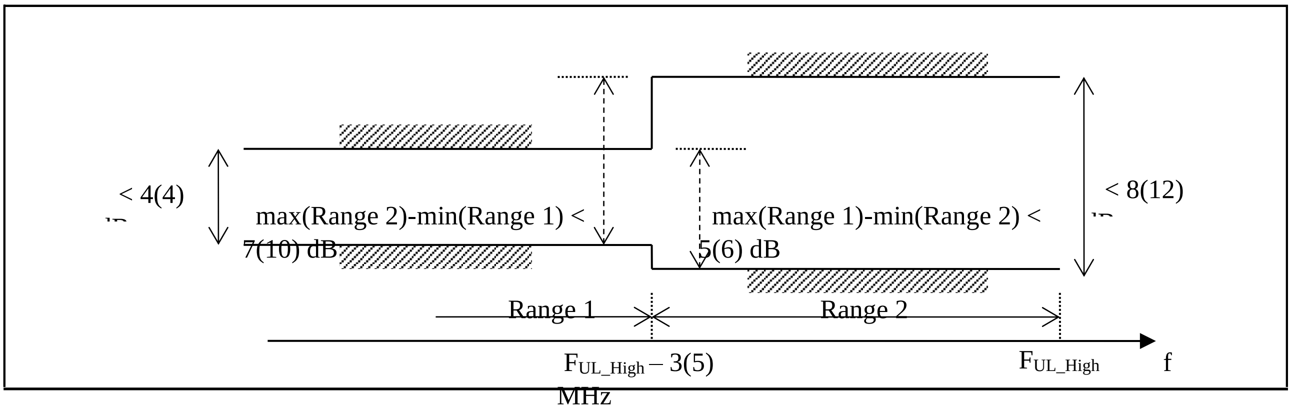

Figure 6.4E.2.5.1.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement are within brackets).

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.5.

6.4E.2.5.1.4 Test description

6.4E.2.5.1.4.1 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 operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.5.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annex A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.4E.2.5.1.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.4E.2.5.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.5.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.4E.2.5.1.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.5.1.4.1-1;
2. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.

6.4E.2.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.5.1.5 Test requirement

FFS

6.4E.2.5.1D EVM equalizer spectrum flatness for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.4E.2.5.1D.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectrum flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the V2X sidelink allocated block variation in dB of the equalizer coefficients generated by the EVM measurement process. The EVM equalizer spectrum flatness requirement does not limit the correction applied to the signal in the EVM measurement process but for the EVM result to be valid, the equalizer correction that was applied must meet the EVM equalizer spectrum flatness minimum requirements. The basic measurement interval is the same as for EVM.

6.4E.2.5.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.5.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier described in clause 6.4E.2.5.1.3 shall apply to each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.5.

6.4E.2.5.1D.4 Test description

6.4E.2.5.1D.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 operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.5.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.4E.2.5.1D.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure [TBD] for TE diagram and section [TBD] for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause [TBD]. Message content exceptions are defined in clause 6.4E.2.5.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.5.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table [TBD]. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state [TBD].

6.4E.2.5.1D.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.5.1D.4.1-1;
2. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.

6.4E.2.5.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.5.1D.5 Test requirement

FFS

6.4E.2.5.2 EVM equalizer spectrum flatness for V2X / con-current operation

Editor's Note:

- The test case is not completed due to the following aspects are not yet determined:

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.4E.2.5.2.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectrum flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the V2X sidelink allocated block variation in dB of the equalizer coefficients generated by the EVM measurement process. The EVM equalizer spectrum flatness requirement does not limit the correction applied to the signal in the EVM measurement process but for the EVM result to be valid, the equalizer correction that was applied must meet the EVM equalizer spectrum flatness minimum requirements. The basic measurement interval is the same as for EVM.

6.4E.2.5.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with con-current operation.

NOTE: This test case can't be performed due to lack of appropriate test points.

6.4E.2.5.2.3 Minimum conformance requirements

For V2X sidelink physical channels PSCCH, PSSCH and PSBCH, the EVM equalizer spectrum flatness requirements shall be as specified for PUSCH in clause 6.4.2.4 for the corresponding modulation and transmission bandwidth.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4E.2.5.

6.4E.2.5.2.4 Test description

6.4E.2.5.2.4.1 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 operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.4E.2.5.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.4E.2.5.2.4.1-1: Test Configuration Table for PSSCH and PSCCH

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure [TBD] for TE diagram and section [TBD] for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause [TBD]. Message content exceptions are defined in clause 6.4E.2.5.2.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.4E.2.5.2.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS38.508-1 [5] Table [TBD]. Geographical area #1 is also pre-configured in the UE.

5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state [TBD].

6.4E.2.5.2.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.4E.2.5.2.4.1-1;
2. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD slots with transient periods are not under test.

6.4E.2.5.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.4E.2.5.2.5 Test requirement

FFS

6.4F Transmit signal quality for shared spectrum channel access

6.4F.1 Frequency error

Editor's Note: This test is incomplete. The following aspects are not yet determined:

- Test configuration table is FFS
- Test state and generic procedure are TBD in 38.508-1

6.4F.1.1 Test purpose

This test verifies the ability of both, the receiver and the transmitter, to process frequency correctly.

Receiver: to extract the correct frequency from the stimulus signal, offered by the System simulator, under ideal propagation conditions and low level.

Transmitter: to derive the correct modulated carrier frequency from the results, gained by the receiver.

6.4F.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.4F.1.3 Minimum conformance requirements

The requirements for frequency error requirements in clause 6.4.1 apply.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4F.1

6.4F.1.4 Test description

6.4F.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 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 6.4F.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4F.1.4.1-1: Test Configuration Table

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The DL and UL Reference Measurement channels are set according to Table 6.4F.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 [5] clause 4.5. Message contents are defined in clause 6.4F.1.4.3

6.4F.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4F.1.4.1-1. 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 6.4F.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.
3. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.2.5-1. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at P_{UMAX} level for the duration of the test. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
4. Measure the Frequency Error using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.
5. For UEs supporting DSS, repeat steps 1~4 on the applicable bands as specified in Section 5.4.2.1 with message contents being according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-61 and Table 4.6.3-62 with condition DSS.

6.4F.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.4F.1.5 Test requirement

The 10 frequency error Δf results must fulfil the test requirement:

$|\Delta f| \leq (0.1 \text{ PPM} + 15 \text{ Hz})$

6.4G Transmit signal quality for Tx Diversity

In this clause a multitude of results are derived, all using one common algorithm returning these results: Global In-Channels TX-Test Annex E. Each sub clause of this clause contains a procedure and test requirements described for a specific measurement. If all relevant test parameters in different sub clauses are the same, then the results, returned by the Global In-Channel TX-Test, may be used across the applicable sub clauses.

6.4G.1 Frequency error for Tx Diversity

Editor’s Note: The following aspects are either missing or not yet determined:

- Tests for Power Class 3 are FFS.

6.4G.1.1 Test purpose

Same test purpose as in 6.4.1.1.

6.4G.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.4G.1.3 Minimum conformance requirements

For UE(s) supporting Tx diversity, the basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency received from the NR Node B.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4G.1

6.4G.1.4 Test description

Same test description as in clause 6.4.1.4 with the measurement performed at each transmit antenna connector.

6.4G.1.5 Test requirement

For each transmit antenna connector, the 10 frequency error Δf results must fulfil the test requirement:

$|\Delta f| \leq (0.1\ \text{PPM} + 15\ \text{Hz})$6.4G.2 Transmit modulation quality for Tx Diversity

For UE supporting Tx diversity, the transmit modulation quality requirements are specified at each transmit antenna connector.The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE (as defined in TS 38.331 [6]), carrier leakage measurement requirement in clause 6.4G.2.2 and 6.4G.2.3 shall be waived, and the RF correction with regard to the carrier leakage and IQ image shall be omitted during the calculation of transmit modulation quality.

6.4G.2.1 Error Vector Magnitude for Tx Diversity

FFS

6.4G.2.2 Carrier leakage for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.4G.2.2.1 Test purpose

Same test purpose as in 6.4.2.2.1.

6.4G.2.2.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.4G.2.2.3 Minimum conformance requirements

For UE supporting Tx diversity, the Relative Carrier Leakage Power requirements specified in Table 6.4.2.2.3-1 which is defined in clause 6.4.2.2.3 apply at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4G.2.2.

6.4G.2.2.4 Test description

Same test description as in clause 6.4.2.2.4 with the measurement performed at each transmit antenna connector.

6.4G.2.2.5 Test requirement

For each transmit antenna connector, each of the *n* carrier leakage results, derived in Annex E.3.1, shall not exceed the values in Table 6.4G.2.2.5-1. Allocated RBs are not under test. n is 10 for 15kHz SCS, 20 for 30kHz SCS and 30 for 60kHz SCS.

Table 6.4G.2.2.5-1: Test requirements for Relative Carrier Leakage Power

Parameters UE output power	Relative limit (dBc)
10 + MU to 10 + (MU + Uplink power control window size) dBm	-28 + TT
0 + MU to 0 + (MU + Uplink power control window size) dBm	-25 + TT
-30 + MU to -30 + (MU + Uplink power control window size) dBm	-20 + TT
Pmin + MU to Pmin + (MU + Uplink power control window size) dBm	-10 + TT
NOTE 1: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs. NOTE 2: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB. NOTE 3: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3). NOTE 4: MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency f and the channel bandwidth BW. NOTE 5: Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1. NOTE 6: Test tolerance TT = 0.8 dB. NOTE 7: Pmin is the minimum output power according to Table 6.3.1.3-1.	

6.4G.2.3 In-band emissions for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.4G.2.3.1 Test purpose

Same test purpose as in 6.4.2.3.1.

6.4G.2.3.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.4G.2.3.3 Minimum conformance requirements

For UE supporting Tx diversity, the In-band Emission requirements specified in Table 6.4.2.3.3-1 which is defined in clause 6.4.2.3.3 apply at each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4G.2.3.

6.4G.2.3.4 Test description

Same test description as in clause 6.4.2.3.4 with the measurement performed at each transmit antenna connector.

6.4G.2.3.5 Test requirement

For each transmit antenna connector, the averaged In-band emission result, derived in Annex E.4.3 shall not exceed the corresponding values in Table 6.4G.2.3.5-1.

Table 6.4G.2.3.5-1: Test requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies
General (NOTE 12)	dB	$\max\{-25-10\cdot\log_{10}(N_{RB}/L_{CRB}),$ $20\cdot\log_{10}EVM-3-5\cdot(\lvert\Delta_{RB}\rvert-1)/L_{CRB},$ $-57\,dBm+10\log_{10}(SCS/15kHz)-\overline{P_{RB}}\}$ + TT		Any non-allocated (NOTE 2)
IQ Image (NOTE 12)	dB	-28 + TT	Image frequencies when output power > 10 dBm	Image frequencies (NOTES 2, 3)
		-25 + TT	Image frequencies when output power ≤ 10 dBm	
Carrier leakage (NOTE 12)	dBc	-28 + TT	Output power > 10 dBm	Carrier leakage frequency (NOTES 4, 5)
		-25 + TT	0 dBm ≤ Output power ≤ 10 dBm	
		-20 + TT	-30 dBm ≤ Output power < 0 dBm	
		-10 + TT	-40 dBm ≤ Output power < -30 dBm	

NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10. NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs. NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs. NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency, but excluding any allocated RB. NOTE 6: L_{CRB} is the Transmission Bandwidth (see Section 5.3). NOTE 7: N_{RB} is the Transmission Bandwidth Configuration (see Section 5.3). NOTE 8: EVM is the limit specified in Table 6.4G.2.1.3-1 for the modulation format used in the allocated RBs. NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB} = 1$ or $\Delta_{RB} = -1$ for the first adjacent RB outside of the allocated bandwidth. NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm. NOTE 11: Test tolerance TT = 0.8 dB. NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies.

6.4G.2.4 EVM equalizer spectrum flatness for Tx Diversity

Editor's Note: The test case is not completed. The following aspects are either missing or not yet determined:

- Tests for Power Class 3 are FFS.

- Update to Annex E is FFS.

6.4G.2.4.1 Test purpose

Same test purpose as in 6.4.2.4.1.

6.4G.2.4.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.4G.2.4.3 Minimum conformance requirements

For UE supporting Tx diversity, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.4.2.4.3-1 and Table 6.4.2.4.3-2 which are defined in clause 6.4.2.4.3. The composite EVM equalizer equalizer *EC(f)* is defined as

$$EC(f) = \frac{P_1 \cdot |EC_1(f)| + P_2 \cdot |EC_2(f)|}{P_1 + P_2}$$

where

$EC_n(f)$ represents equalizer coefficient for each antenna connector, $f \in F$, f is the allocated subcarriers within the transmission bandwidth (($|F|$=12* L_{CRBs});

P_1 and P_2 denote the linear power measured at each antenna connector respectively.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.4G.2.4.

6.4G.2.4.4 Test description

Same test description as specified in clause 6.4.2.4.4 with following exceptions:

Step 3 of Test procedure as in 6.4.2.4.4.2 is replaced by:

3. Measure spectrum flatness for each antenna connector using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

4. Measure the mean power at each antenna connector in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

5. Calculate the composite EVM using the values measured in step 3 and step 4 as in Annex TBD.

6.4G.2.4.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1. The derived results shall not exceed the values in Figure 6.4G.2.4.5-1:

For normal conditions, the peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4G.2.4.5-1. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4G.2.4.5-1).

For extreme conditions, the EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4G.2.4.5-2. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 7.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 11.4 dB (see Figure 6.4G.2.4.5-1).

Table 6.4G.2.4.5-1: Requirements for EVM equalizer spectrum flatness (normal conditions)

Frequency range	Maximum ripple [dB]
$F_{UL\_Meas} – F_{UL\_Low} \geq 3$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 3$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 3$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 3$ MHz (Range 2)	8 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

Table 6.4G.2.4.5-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple [dB]
$F_{UL\_Meas} – F_{UL\_Low} \geq 5$ MHz and $F_{UL\_High} – F_{UL\_Meas} \geq 5$ MHz (Range 1)	4 + TT (p-p)
$F_{UL\_Meas} – F_{UL\_Low} < 5$ MHz or $F_{UL\_High} – F_{UL\_Meas} < 5$ MHz (Range 2)	12 + TT (p-p)
NOTE 1: F_{UL_Meas} refers to the sub-carrier frequency for which the equalizer coefficient is evaluated NOTE 2: F_{UL_Low} and F_{UL_High} refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 3: Test tolerance TT = 1.4 dB.	

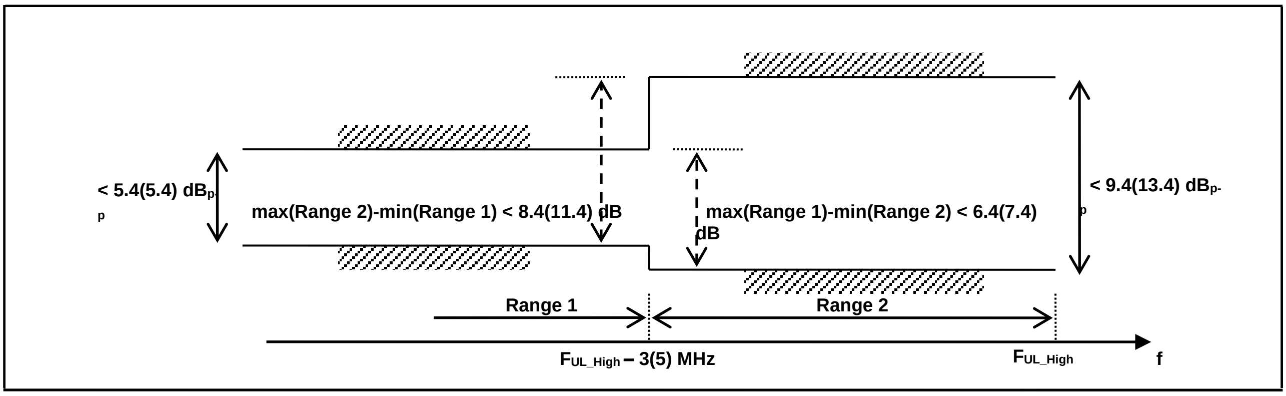

Figure 6.4G.2.4.5-1: The test requirements for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated for unshaped modulations (the ETC test requirements are within brackets)

6.5 Output RF spectrum emissions

6.5.0 General

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.329-10 and the Radio Regulations [22].

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.

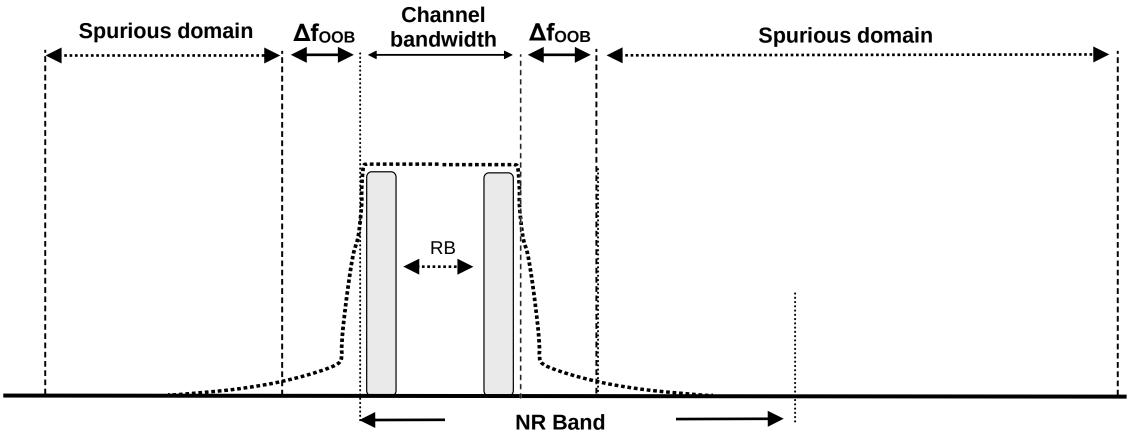

Figure 6.5.0-1: Transmitter RF spectrum

6.5.1 Occupied bandwidth

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.

Table 6.5.1.3-1: Occupied channel bandwidth

	NR channel bandwidth													
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	45 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Occupied channel bandwidth (MHz)	5	10	15	20	25	30	40	45	50	60	70	80	90	100

The normative reference for this requirement is TS 38.101-1 [2] 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, 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 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

<table>
<tr><th colspan="4">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="2">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Mid range by default, exceptions listed in Table 6.5.1.4.1-2</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">All</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">Lowest</td></tr>
<tr><th colspan="4">Test Parameters</th></tr>
<tr><th rowspan="2">Test ID</th><th rowspan="2">Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><th>Modulation</th><th>RB allocation (NOTE 1)</th></tr>
<tr><td>1</td><td>N/A for occupied bandwidth test case</td><td>CP-OFDM QPSK</td><td>Outer_full</td></tr>
<tr><td colspan="4">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.</td></tr>
</table>

Table 6.5.1.4.1-2: Test frequency exceptions for Occupied Bandwidth

5G NR Band	Test Frequency
n77	Low Range, Mid Range, High Range
n78	Low Range, Mid Range, High Range
n79	Low Range, Mid Range, High Range
n28	Low Range for 30MHz channel bandwidth

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
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 [5] 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. Send continuously power control “up” commands to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.
3. Measure the power spectrum distribution within two times or more 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). Other methods to measure the power spectrum distribution are allowed. The measuring duration is at least 1ms over consecutive active uplink slots.
4. Calculate the total power within the range of all frequencies measured in step 3 and save this value as “Total power”.

5. Identify the measurement window whose centre is aligned on the centre of the channel for which the sum of the power measured is 99% of the "Total power".
6. The "Occupied Bandwidth" is the width of the measurement window obtained in step 5.

6.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

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

	NR channel bandwidth													
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Occupied channel bandwidth (MHz)	5	10	15	20	25	30	40	45	50	60	70	80	90	100

6.5.2 Out of band emission

6.5.2.1 General

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.

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 Spectrum emission mask

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

- PC1 requirements for NR operating bands other than Band n14 are not defined in RAN4 Rel-15 and Rel-16 specifications.

6.5.2.2.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level 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.

6.5.2.2.3 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 Δf_{OOB}, the spurious requirements in subclause 6.5.3 are applicable.

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 power of any UE emission shall not exceed the levels specified in Table 6.5.2.2.3-1 for the specified channel bandwidth.

Table 6.5.2.2.3-1: General NR spectrum emission mask

Δf_{OOB} (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)			Measurement bandwidth
	5	10, 15, 20, 25, 30, 40, 45	50, 60, 70, 80, 90, 100	
± 0-1	-13	-13		1 % of channel BW
± 0-1			-24	30 kHz
± 1-5	-10	-10		1 MHz
± 5-6	-13			
± 6-10	-25			
± 5-$BW_{Channel}$		-13		
± $BW_{Channel}$-($BW_{Channel}$+5)		-25		

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.2

6.5.2.2.4 Test description

6.5.2.2.4.1 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 6.5.2.2.4.1-1, 6.5.2.2.4.1-2, 6.5.2.2.4.1-2a and Table 6.5.2.2.4.1-3. 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 6.5.2.2.4.1-1: Test Configuration Table for power class 3 (contiguous allocation)

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1				Low range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1				Lowest, Highest		
Test SCS as specified in Table 5.3.5-1				Lowest, Highest		
Test Parameters for Channel Bandwidths						
Test ID	Freq	ChBw	SCS	Downlink Configuration	Uplink Configuration	
		Default	Default	N/A for Spectrum Emission Mask test case	Modulation (NOTE 2)	RB allocation (NOTE 1)
1[3]	Low				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left
2[3]	High				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right
3[3]	Default				DFT-s-OFDM PI/2 BPSK	Outer_Full
4[4]	Low				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left
5[4]	High				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right
6[4]	Default				DFT-s-OFDM PI/2 BPSK	Outer_Full
7	Low				DFT-s-OFDM QPSK	Edger_1RB_Left
8	High				DFT-s-OFDM QPSK	Edge_1RB_Right
9	Default				DFT-s-OFDM QPSK	Outer_Full
10	Low				DFT-s-OFDM 16 QAM	Edge_1RB_Left
11	High				DFT-s-OFDM 16 QAM	Edge_1RB_Right
12	Default				DFT-s-OFDM 16 QAM	Outer_Full
13	Low				DFT-s-OFDM 64 QAM	Edge_1RB_Left
14	High				DFT-s-OFDM 64 QAM	Edge_1RB_Right
15	Default				DFT-s-OFDM 64 QAM	Outer_Full
16	Low				DFT-s-OFDM 256 QAM	Edge_1RB_Left
17	High				DFT-s-OFDM 256 QAM	Edge_1RB_Right
18	Default				DFT-s-OFDM 256 QAM	Outer_Full
19	Low				CP-OFDM QPSK	Edge_1RB_Left
20	High				CP-OFDM QPSK	Edge_1RB_Right
21	Default				CP-OFDM QPSK	Outer_Full
22	Low				CP-OFDM 16 QAM	Edge_1RB_Left
23	High				CP-OFDM 16 QAM	Edge_1RB_Right

24	Default				CP-OFDM 16 QAM	Outer_Full
25	Low				CP-OFDM 64 QAM	Edge_1RB_Left
26	High				CP-OFDM 64 QAM	Edge_1RB_Right
27	Default				CP-OFDM 64 QAM	Outer_Full
28	Low				CP-OFDM 256 QAM	Edge_1RB_Left
29	High				CP-OFDM 256 QAM	Edge_1RB_Right
30	Default				CP-OFDM 256 QAM	Outer_Full
31[5,6]	Low				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
32[5,6]	High				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
33[5,6]	Default				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full

NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and the IE *powerBoostPi2BPSK* is set to 1 for bands n40, n41, n77, n78 and n79.
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n41, n77, n78 and n79.
NOTE 5: For Power Class 3 testing, UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n77, n78 and n79.
NOTE 6: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

Table 6.5.2.2.4.1-2: Test Configuration Table for power class 2 (contiguous allocation)

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
2	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
3	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
4	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
5	High		DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default		DFT-s-OFDM QPSK	Outer Full
7	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default		DFT-s-OFDM 16 QAM	Outer Full
10	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 64 QAM	Outer Full
13	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 256 QAM	Outer Full
16	Low		CP-OFDM QPSK	Edge_1RB_Left
17	High		CP-OFDM QPSK	Edge_1RB_Right
18	Default		CP-OFDM QPSK	Outer Full
19	Low		CP-OFDM 16 QAM	Edge_1RB_Left
20	High		CP-OFDM 16 QAM	Edge_1RB_Right
21	Default		CP-OFDM 16 QAM	Outer Full
22	Low		CP-OFDM 64 QAM	Edge_1RB_Left
23	High		CP-OFDM 64 QAM	Edge_1RB_Right
24	Default		CP-OFDM 64 QAM	Outer Full
25	Low		CP-OFDM 256 QAM	Edge_1RB_Left
26	High		CP-OFDM 256 QAM	Edge_1RB_Right
27	Default		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: It is essential that all test points in this table also exist in table 6.2.2.4.1-2.				

Table 6.5.2.2.4.1-2a: Test Configuration Table for power class 1 for Band n14 (contiguous allocation)

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A for Spectrum Emission Mask test case	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1	Default		DFT-s-OFDM Pi/2 BPSK	Inner Full
2	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
3	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
4	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
5	Default		DFT-s-OFDM QPSK	Inner Full
6	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
7	High		DFT-s-OFDM QPSK	Edge_1RB_Right
8	Default		DFT-s-OFDM QPSK	Outer Full
9	Default		DFT-s-OFDM 16 QAM	Inner Full
10	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 16 QAM	Outer Full
13	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 64 QAM	Outer Full
16	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
17	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
18	Default		DFT-s-OFDM 256 QAM	Outer Full
19	Default		CP-OFDM QPSK	Inner Full
20	Low		CP-OFDM QPSK	Edge_1RB_Left
21	High		CP-OFDM QPSK	Edge_1RB_Right
22	Default		CP-OFDM QPSK	Outer Full
23	Default		CP-OFDM 16 QAM	Inner Full
24	Low		CP-OFDM 16 QAM	Edge_1RB_Left
25	High		CP-OFDM 16 QAM	Edge_1RB_Right
26	Default		CP-OFDM 16 QAM	Outer Full
27	Low		CP-OFDM 64 QAM	Edge_1RB_Left
28	High		CP-OFDM 64 QAM	Edge_1RB_Right
29	Default		CP-OFDM 64 QAM	Outer Full
30	Low		CP-OFDM 256 QAM	Edge_1RB_Left
31	High		CP-OFDM 256 QAM	Edge_1RB_Right
32	Default		CP-OFDM 256 QAM	Outer Full
33[3]	Low		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
34[3]	High		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
35[3]	Default		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*. NOTE 4: It is essential that all test points in this table also exist in table 6.2.2.4.1-2.				

Table 6.5.2.2.4.1-3: Test Configuration Table for power class 2&3 (almost contiguous allocation)

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A	**Modulation**	**RB allocation (NOTE 1)**
1	Default		CP-OFDM QPSK	Inner Full
2	Default		CP-OFDM QPSK	Outer Full
3	Default		CP-OFDM 16 QAM	Inner Full
4	Default		CP-OFDM 16 QAM	Outer Full
5	Default		CP-OFDM 64 QAM	Outer Full
6	Default		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.5.2.2.4.1-4. NOTE 2: It is essential that all test points in this table also exist in table 6.2.2.4.1-3. NOTE 3: Test applies only for UEs which support almost contiguous UL CP-OFDM transmissions. For PC2 UE which support almost contiguous UL CP-OFDM transmissions, test is only applicable for Release 16 and forward.				

Table 6.5.2.2.4.1-4: Uplink configuration for almost contiguous allocation

Channel Bandwidth（MHz）	SCS(kHz)	OFDM	Outer Full		Inner Full	
			Cluster1 RB allocations (L_{CRB} @ RB_{start})	Cluster2 RB allocations (L_{CRB} @ RB_{start})	Cluster1 RB allocations (L_{CRB} @ RB_{start})	Cluster2 RB allocations (L_{CRB} @ RB_{start})
25	15	CP	48@0	53@80	N/A	N/A
	30	CP	24@0	25@40	N/A	N/A
	60	CP	12@0	13@18	N/A	N/A
30	15	CP	64@0	64@96	N/A	N/A
	30	CP	32@0	30@48	N/A	N/A
	60	CP	16@0	14@24	N/A	N/A
40	15	CP	80@0	88@128	N/A	N/A
	30	CP	40@0	42@64	N/A	N/A
	60	CP	20@0	19@32	12@12	8@28
50	15	CP	96@0	110@160	48@64	48@144
	30	CP	48@0	53@80	24@32	24@72
	60	CP	24@0	25@40	12@16	12@36
60	15	CP	N/A	N/A	N/A	N/A
	30	CP	64@0	66@96	32@32	16@80
	60	CP	32@0	31@48	16@16	8@40
70	15	CP	N/A	N/A	N/A	N/A
	30	CP	80@0	77@112	32@32	16@80
	60	CP	40@0	37@56	16@16	8@40
80	15	CP	N/A	N/A	N/A	N/A
	30	CP	80@0	89@128	32@32	16@80
	60	CP	40@0	43@64	16@16	8@40
90	15	CP	N/A	N/A	N/A	N/A
	30	CP	96@0	101@144	32@32	16@80
	60	CP	48@0	49@72	16@16	8@40
100	15	CP	N/A	N/A	N/A	N/A
	30	CP	112@0	97@176	48@64	48@144
	60	CP	48@0	55@80	24@32	24@72

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5.2.2.4.1-1.
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 [5] clause 4.5. Message contents are defined in clause 6.5.2.2.4.3.

6.5.2.2.4.2 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 6.5.2.2.4.1-1, Table 6.5.2.2.4.1-2, Table 6.5.2.2.4.1-2a and Table 6.5.2.2.4.1-3. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously power control “up” commands to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.2.2.5-1 to 6.2.2.5-9. The period of the measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots. For TDD, only slots consisting of only UL symbols are under test.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 6.5.2.2.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, table 6.5.2.2.4.1-2, and table 6.5.2.2.4.1-2a, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.5.2.2.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

Table 6.5.2.2.4.3-2: DMRS-UplinkConfig (Test ID 28 – 30 in Table 6.5.2.2.4.1-1)

Derivation Path: TS 38.508-1 [5], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			

6.5.2.2.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Tables 6.2.2.5-1 to 6.2.2.5-9 as appropriate, and the power of any UE emission shall fulfil requirements in Table 6.5.2.2.5-1.

Table 6.5.2.2.5-1: General NR spectrum emission mask

<table>
<tr><th rowspan="2">Δf_{OOB}
(MHz)</th><th colspan="3">Channel bandwidth (MHz) / Spectrum emission limit (dBm)</th><th rowspan="2">Measurement bandwidth</th></tr>
<tr><th>5</th><th>10, 15, 20, 25, 30, 40, 45</th><th>50, 60, 70, 80, 90, 100</th></tr>
<tr><td>± 0-1</td><td>-13 + TT</td><td>-13 + TT</td><td></td><td>1 % of channel BW</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td>-24 + TT</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10 + TT</td><td colspan="2">-10 + TT</td><td rowspan="5">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13 + TT</td><td colspan="2"></td></tr>
<tr><td>± 6-10</td><td>-25 + TT</td><td colspan="2"></td></tr>
<tr><td>± 5-$BW_{Channel}$</td><td></td><td colspan="2">-13 + TT</td></tr>
<tr><td>± $BW_{Channel}$-($BW_{Channel}$+5)</td><td></td><td colspan="2">-25 + TT</td></tr>
<tr><td colspan="5">Note 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0.015 MHz and 0.985 MHz.
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.
Note 4: TT for each frequency and channel bandwidth is specified in Table 6.5.2.2.5-2.</td></tr>
</table>

Table 6.5.2.2.5-2: Test Tolerance (Spectrum Emission Mask)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 6.0GHz
BW ≤ 100MHz	1.5 dB	1.8 dB	1.8 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.

6.5.2.3 Additional spectrum emission mask

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

- NS_07 test requirements is not complete.

6.5.2.3.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth under the deployment scenarios where additional requirements are specified.

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

6.5.2.3.3.1 Minimum requirement for "NS_35"

Additional spectrum 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.

When " NS_35" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.2.3.3.1-1.

Table 6.5.2.2.3.3.1-1: Additional requirements for "NS_35"

Spectrum emission limit (dBm) / Channel bandwidth					
Δf_OOB (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth (unless otherwise stated)
± 0-0.1	-15	-18	-20	-21	30 kHz
± 0.1-6	-13	-13	-13	-13	100 kHz
± 6-10	-25[1]	-13	-13	-13	100 kHz
± 10-15		-25[1]	-13	-13	100 kHz
± 15-20			-25[1]	-13	100 kHz
± 20-25				-25	1 MHz
NOTE 1: The measurement bandwidth shall be 1 MHz					

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.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.3.1.

6.5.2.3.3.2 Requirements for network signalling value "NS_04"

Additional spectrum 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.

The n41 SEM transition point from -13 dBm/MHz to -25 dBm/MHz is based on the emission bandwidth. The emission bandwidth is defined as the width of the signal between two points, one below the carrier centre frequency and one above the carrier c frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Since the 26-dB emission bandwidth is implementation dependent, the maximum transmission bandwidths in MHz (N_{RB} * SCS * 12 / 1,000,000) is used for the SEM.

Table 6.5.2.3.3.2-1: n41 maximum transmission bandwidths (MHz) for CP-OFDM

SCS (kHz)	Channel bandwidths (MHz)										
	10	15	20	30	40	50	60	70	80	90	100
15	9.36	14.22	19.08	28.80	38.88	48.6	N/A	N/A	N/A	N/A	N/A
30	8.64	13.68	18.36	28.08	38.16	47.88	58.32	68.04	78.12	88.02	98.28
60	7.92	12.96	17.28	27.36	36.72	46.8	56.88	66.96	77.04	87.12	97.20

Table 6.5.2.3.3.2-2: n41 maximum transmission bandwidths (MHz) for DFT-S-OFDM

SCS (kHz)	Channel bandwidths (MHz)										
	10	15	20	30	40	50	60	70	80	90	100
15	9.00	13.50	18.00	28.80	38.88	48.60	N/A	N/A	N/A	N/A	N/A
30	8.64	12.96	18.00	27.00	36.00	46.08	58.32	64.80	77.76	87.48	97.20
60	7.20	12.96	17.28	25.92	36.00	46.08	54.00	64.80	72.00	86.40	97.20

When "NS_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.2-3.

Table 6.5.2.3.3.2-3: n41 SEM with “NS_04”

Δf_{OOB} MHz	Spectrum emission limit (dBm) / measurement bandwidth for each channel bandwidth (MHz)											Measurement bandwidth
	10	**15**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	
± 0 - 1	-10	-10	-10	-10	-10							2 % channel bandwidth
						-10						1 MHz
± 1 - 5	-10											1 MHz
± 5 - X	-13											
± X - ($BW_{Channel}$ + 5 MHz)	-25											
NOTE: X is defined in Table 6.5.2.3.3.2-1 for CP-OFDM and 6.5.2.3.3.2-2 for DFT-S-OFDM												

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.3.2.

6.5.2.3.3.3 Requirements for network signalling value "NS_03", "NS_03U" and "NS_21"

Additional spectrum 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.

When "NS_03" or "NS_03U", or "NS_21", is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.3-1.

Table 6.5.2.3.3.3-1: Additional requirements for "NS_03", "NS_03U" and "NS_21"

Δf_{OOB} MHz	Channel bandwidth (MHz) / Spectrum emission limit (dBm)							Measurement bandwidth
	5	10	15	20	25	30	40	
± 0-1	-13	-13	-13	-13	-13	-13	-13	1 % of channel BW
± 1-6	-13	-13	-13	-13	-13	-13	-13	1 MHz
± 6-10	-25	-13	-13	-13	-13	-13	-13	1 MHz
± 10-15		-25	-13	-13	-13	-13	-13	1 MHz
± 15-20			-25	-13	-13	-13	-13	1 MHz
± 20-25				-25	-13	-13	-13	1 MHz
± 25-30					-25	-13	-13	1 MHz
± 30-35						-25	-13	1 MHz
± 35-40							-13	1 MHz
± 40-45							-25	1 MHz

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.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.3.3.

6.5.2.3.3.4 Requirements for network signalling value "NS_06"

Additional spectrum 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.

When "NS_06" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.4-1.

Table 6.5.2.3.3.4-1: Additional requirements for "NS_06"

<table>
<tr><th colspan="5">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>Δf_{OOB} (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0 – 0.1</td><td>-15</td><td>-18</td><td>-20</td><td>30 kHz</td></tr>
<tr><td>± 0.1 – 1</td><td>-13</td><td>-13</td><td>-13</td><td>100 kHz</td></tr>
<tr><td>± 1 – 6</td><td>-13</td><td rowspan="2">-13</td><td rowspan="3">-13</td><td rowspan="4">1 MHz</td></tr>
<tr><td>± 6 – 10</td><td>-25</td></tr>
<tr><td>± 10 – 15</td><td></td><td>-25</td></tr>
<tr><td>± 15 – 20</td><td></td><td></td><td>-25</td></tr>
</table>

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.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.3.4.

6.5.2.3.3.5 Void

6.5.2.3.3.6 Void

6.5.2.3.3.7 Void

6.5.2.3.3.8 Requirements for network signalling value "NS_27"

Additional spectrum 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.

When "NS_27" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.8-1.

Table 6.5.2.3.3.8-1: Additional requirements for "NS_27"

<table>
<tr><th rowspan="2">Δf_{OOB} MHz</th><th colspan="6">Channel bandwidth (MHz) / Spectrum emission limit (dBm)</th><th rowspan="2">Measurement bandwidth</th></tr>
<tr><th>5</th><th>10</th><th>15</th><th>20</th><th>30</th><th>40</th></tr>
<tr><td>± 0 - 1</td><td colspan="6">-13</td><td>1 % channel bandwidth</td></tr>
<tr><td>± 1 - X</td><td colspan="6">-13</td><td rowspan="2">1 MHz</td></tr>
<tr><td>< – X or > X</td><td colspan="6">-25</td></tr>
<tr><td colspan="8">NOTE 1: X is occupied channel bandwidth as defined in Table 6.5.1.3-1.
NOTE 2: The requirements apply only at the frequency range from 3540 MHz to 3710 MHz.</td></tr>
</table>

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.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.3.8.

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, 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 test channel bandwidth and sub-carrier spacing, and are shown in clause 6.2.3.4.1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 and uplink signals according Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to the applicable test configuration table in clause 6.2.3.4.1.

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 [5] 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 the applicable test configuration table in clause 6.2.3.4.1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in applicable table from Table 6.2.3.5-1 to Table 6.2.3.5-35. The period of measurement shall be at least the continuous duration one sub-frame (1ms). For TDD slots with transient periods are not under test.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to applicable test configuration tables in subclause 6.5.2.3.5. The centre frequency of the filter shall be stepped in continuous steps according to the applicable test requirement table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.2.3.4.1-1 through 6.2.3.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions for each network signalling value.

6.5.2.3.4.3.1 Message contents exceptions (network signalling value "NS_35")

For "NS_35" see A-MPR test case in table 6.2.3.4.3.2-1.

6.5.2.3.4.3.2 Message contents exceptions (network signalling value "NS_04")

For "NS_04" see A-MPR test case in table 6.2.3.4.3.4-1.

6.5.2.3.4.3.3 Message contents exceptions (network signalling value "NS_03")

For "NS_03" see A-MPR test case in table 6.2.3.4.3.1-1.

6.5.2.3.4.3.4 Message contents exceptions (network signalling value "NS_03U")

For "NS_03U" see A-MPR test case in table 6.2.3.4.3.3-1.

6.5.2.3.4.3.5 Message contents exceptions (network signalling value "NS_06")

For "NS_06" see A-MPR test case in table 6.2.3.4.3.7-1.

6.5.2.3.4.3.6 Message contents exceptions (network signalling value "NS_21")

For "NS_21" see A-MPR test case in table 6.2.3.4.3.20-1.

6.5.2.3.4.3.7 Message contents exceptions (network signalling value "NS_27")

For "NS_27" see A-MPR test case in table 6.2.3.4.3.22-1.

6.5.2.3.5 Test requirement

Table 6.5.2.3.5-1: Test Tolerance (Additional spectrum emission mask)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 6.0GHz
BW ≤ 100MHz	1.5 dB	1.8 dB	1.8 dB

6.5.2.3.5.1 Test requirements (network signalling value "NS_35")

When "NS_35" is indicated in the cell:

- the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in table 6.2.3.5-1 as appropriate for a NR UE.

and

- the power of any UE emission shall fulfil requirements in table 6.5.2.3.5.1-1, as applicable.

Table 6.5.2.3.5.1-1: Additional test requirements "NS_35"

Spectrum emission limit (dBm) / Channel bandwidth					
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth (unless otherwise stated)
± 0-0.1	-15.0 + TT	-18.0 + TT	-20.0 + TT	-21.0 + TT	30 kHz
± 0.1-6	-13.0 + TT-	-13.0 + TT	-13.0 + TT	-13.0 + TT	100 kHz
± 6-10	-25 [1] + TT	-13.0 + TT	-13.0 + TT	-13.0 + TT	100 kHz
± 10-15		-25[1] 0 + TT	-13.0 + TT	-13.0 + TT	100 kHz
± 15-20			-25 [1]0 + TT	-13.0 + TT	100 kHz
± 20-25				-25 + TT	1 MHz
NOTE 1: The measurement bandwidth shall be 1 MHz. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.					

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.

6.5.2.3.5.2 Test requirements (network signalling value "NS_04")

When "NS_04" is indicated in the cell:

- the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-2 for UE power class 2 or Table 6.2.3.5-3 UE power class 3.

and

- the power of any UE emission shall fulfil requirements in table 6.5.2.3.5.2-1.

Table 6.5.2.3.5.2-1: Additional test requirements for "NS_04"

Δf_{OOB} MHz	Spectrum emission limit (dBm) / measurement bandwidth for each channel bandwidth (MHz)											Measurement bandwidth
	10	15	20	30	40	50	60	70	80	90	100	
± 0 - 1	-10+TT	-10+TT	-10+TT	-10+TT	-10+TT							2 % channel bandwidth
						-10						1 MHz
± 1 - 5	-10 + TT											1 MHz
± 5 - X	-13 + TT											
± X - ($BW_{Channel}$ + 5 MHz)	-25 + TT											
NOTE 1: X is defined in Table 6.5.2.3.3.2-1 for CP-OFDM and 6.5.2.3.3.2-2 for DFT-S-OFDM.												
NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.												

6.5.2.3.5.3 Test requirements (network signalling value "NS_03", "NS_03U" and "NS_21")

When "NS_03" or "NS_03U" or “NS_21” is indicated in the cell:

- the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in table 6.2.3.5-4 or 6.2.3.5-5 as appropriate for a NR UE.

and

- the power of any UE emission shall fulfil requirements in table 6.5.2.3.5.3-1, as applicable.

Table 6.5.2.3.5.3-1: Additional requirements for "NS_03", "NS_03U" and "NS_21"

Δf_{OOB} MHz	Channel bandwidth (MHz) / Spectrum emission limit (dBm)							Measurement bandwidth
	5	10	15	20	25	30	40	
± 0-1	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 % of channel BW
± 1-6	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 6-10	-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 10-15		-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 15-20			-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 20-25				-25 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 25-30					-25 + TT	-13 + TT	-13 + TT	1 MHz
± 30-35						-25 + TT	-13 + TT	1 MHz
± 35-40							-13 + TT	1 MHz
± 40-45							-25 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.								

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.

6.5.2.3.5.4 Test requirements (network signalling value "NS_06")

When "NS_06" is indicated in the cell:

- the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in table 6.2.3.5-34 as appropriate for a NR UE

and

- the power of any UE emission shall fulfil requirements in table 6.5.2.3.5.4-1, as applicable.

Table 6.5.2.3.5.4-1: Additional requirements for "NS_06"

Spectrum emission limit (dBm) / Channel bandwidth				
Δf_{OOB} (MHz)	**5 MHz**	**10 MHz**	**15 MHz**	**Measurement bandwidth**
± 0 – 0.1	-15 + TT	-18 + TT	-20 + TT	30 kHz
± 0.1 – 1	-13 + TT	-13 + TT	-13 + TT	100 kHz
± 1 – 6	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 6 – 10	-25 + TT	-13 + TT	-13 + TT	1 MHz
± 10 – 15		-25 + TT	-13 + TT	1 MHz
± 15 – 20			-25 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.				

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.

6.5.2.4 Adjacent channel leakage ratio

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.

6.5.2.4.1 NR ACLR

6.5.2.4.1.1 Test purpose

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

6.5.2.4.1.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 15 and forward and NR Power Class 1 UE release 15 and forward in NR Band n14.

This test case applies to all types of NR Power Class 2 UE not supporting txDiversity-r16 release 15 and forward.

6.5.2.4.1.3 Minimum conformance requirements

NR adjacent channel leakage power ratio (NR_{ACLR}) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent NR 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 6.5.2.4.1.3-1.

If the measured adjacent channel power is greater than –50dBm then the NR_{ACLR} shall be higher than the value specified in Table 6.5.2.4.1.3-2.

Table 6.5.2.4.1.3-1: NR ACLR measurement bandwidth

Channel bandwidth	(MHz)	5,10,15,20,25,30,35,40,45,50	60,70,80,90,100
REF_SCS	(kHz)	15	30
NR ACLR measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000	

Table 6.5.2.4.1.3-2: NR ACLR requirement

	Power class 1[1]	**Power class 1.5**	**Power class 2**	**Power class 3**
NR ACLR	37 dB[1]	31 dB	31 dB	30 dB
NOTE 1: Applicable for power class 1 UE operating in Band n14.				

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.4.1.

6.5.2.4.1.4 Test description

6.5.2.4.1.4.1 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 sub-carrier spacing, are shown in the test configuration tables in clause 6.2.2.4.1. 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 6.5.2.4.1.4.1-1: Void

Table 6.5.2.4.1.4.1-2: Void

Table 6.5.2.4.1.4.1-2a: Void

Table 6.5.2.4.1.4.1-3: Void

Table 6.5.2.4.1.4.1-4: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2.2.4.1.
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 [5] clause 4.5. Message contents are defined in clause 6.5.2.4.1.4.3.

6.5.2.4.1.4.2 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 the test configuration tables in clause 6.2.2.4.1T. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3of 6.2.2.4.2, which shall meet the requirements described in clause 6.2.2.5 as appropriate.
4. Measure the rectangular filtered mean power for the assigned NR channel.
5. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR, respectively.
7. For UEs supporting Power Class 1 in Band n14 and Power Class 2, repeat steps 1~6 for Test ID 22 and 36 in Table 6.2.2.4.1-1 on the applicable bands with message exception of P-Max defined in Table 6.5.2.4.1.4.3-1.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2.2.4.1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

Table 6.5.2.4.1.4.3-1: *P-Max* (Step 7)

Derivation Path: TS 38.508-1 [5], Table 4.6.3-89			
Information Element	**Value/remark**	**Comment**	**Condition**
P-Max	23		PC2 UE or PC1 UE

Table 6.5.2.4.1.4.3-1a: Void

Table 6.5.2.4.1.4.3-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

Table 6.5.2.4.1.4.3-3: DMRS-UplinkConfig (Test ID 37 – 39 in Table 6.2.2.4.1-1)

Derivation Path: TS 38.508-1 [5], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 {			
Setup SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			
}			

Table 6.5.2.4.1.4.3-4: ServingCellConfig

Derivation Path: TS 38.508-1 [5] Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
powerBoostPi2BPSK	1		Test IDs where NOTE 3 in Table 6.2.2.4.1-1 applies.
	0		Test IDs where NOTE 4 in Table 6.2.2.4.1-1 applies.
}			
}			

6.5.2.4.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in clause 6.2.2.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6, shall be higher than the limits in Table 6.5.2.4.1.5-2.

The measured UE mean power in the channel bandwidth, derived in step 7, shall fulfil power class 3 requirements in Tables 6.2.2.5-1 and 6.2.2.5-3 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 7, shall be higher than the power class 3 limits in Table 6.5.2.4.1.5-2.

Table 6.5.2.4.1.5-1: NR ACLR measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth														
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**45 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
NR ACLR measurement bandwidth (MHz)	4.515	9.375	14.235	19.095	23.955	28.815	38.895	43.575	48.615	58.35	68.07	78.15	88.23	98.31

Table 6.5.2.4.1.5-2: NR ACLR requirement

	Power class 1[2]	**Power class 1.5**	**Power class 2**	**Power class 3**
NR ACLR	37 - TT dB[2]	31 - TT dB	31 - TT dB	30 - TT dB
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.4.1.5-3. NOTE 2: Applicable for power class 1 UE operating in Band n14.				

Table 6.5.2.4.1.5-3: Test Tolerance (NR ACLR)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 6.0GHz
BW ≤ 100MHz	0.8 dB	0.8 dB	0.8 dB

6.5.2.4.2 UTRA ACLR

6.5.2.4.2.1 Test purpose

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

6.5.2.4.2.2 Test applicability

This test case applies for network signalling values NS_03U, NS_05U, NS_43U, and NS_100 to all types of NR Power Class 3 UE release 15 and forward.

6.5.2.4.2.3 Minimum conformance requirements

UTRA adjacent channel leakage power ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

$UTRA_{ACLR}$ is specified for the first adjacent UTRA channel ($UTRA_{ACLR1}$) which centre frequency is ± 2.5 MHz from NR channel edge and for the 2^{nd} adjacent UTRA channel ($UTRA_{ACLR2}$) which centre frequency is ± 7.5 MHz from NR channel edge.

The UTRA channel power is measured with an RRC filter with roll-off factor α =0.22 and bandwidth of 3.84 MHz. The assigned NR channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.5.2.4.1.3-1.

If the measured adjacent channel power is greater than - 50dBm then the $UTRA_{ACLR1}$ and $UTRA_{ACLR2}$ shall be higher than the value specified in Table 6.5.2.4.2.3-1.

$UTRA_{ACLR}$ is not applicable to the power class 3 UE operating in Band n12, n14, n17, and n30.

$UTRA_{ACLR}$ is not applicable to the power class 1 UE operating in Band n14.

Table 6.5.2.4.2.3-1: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB
$UTRA_{ACLR2}$	36 dB

UTRA ACLR requirement is applicable when signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission*.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.2.4.2.

6.5.2.4.2.4 Test description

6.5.2.4.2.4.1 Initial conditions

Same as in subclause 6.2.3.4.1 with the following exception;

- Only network signalling values NS_03U, NS_05U, NS_43U, and NS_100 with the corresponding band defined in Table 6.2.3.3.1-1 need to perform UTRA ACLR test.
- Message contents in step 6 are defined in clause 6.5.2.4.2.4.3.

6.5.2.4.2.4.2 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 the applicable test configuration table in clause 6.2.3.4.1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2.3.5 as appropriate. The period of the measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD slots with transient periods are not under test.

4. Measure the rectangular filtered mean power for the assigned NR channel.

5. Measure the RRC filtered mean power of the first and the second UTRA adjacent channel on both lower and upper side of the NR channel, respectively.

6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper UTRA ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in 6.2.3.4.1 as appropriate, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

Table 6.5.2.4.2.4.3-1: AdditionalSpectrumEmission

Derivation Path: 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 AdditionalSpectrumEmission			
Information Element	**Value/remark**	**Comment**	**Condition**
AdditionalSpectrumEmission	3 (NS_03U) 3 (NS_05U) 3 (NS_43U) 1 (NS_100)	for band n2, n25, n66, n86 for band n1, n84 for band n8, n81 for band n1, n2, n3, n5, n8, n25, n66 (NOTE1)	
NOTE 1: This NS can be signalled for NR bands that have UTRA services deployed			

6.5.2.4.2.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements described in 6.2.3.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured UTRA ACLR, derived in step 6, shall be higher than the limits in table 6.5.2.4.2.5-2.

Table 6.5.2.4.2.5-1: Void

Table 6.5.2.4.2.5-2: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB -TT
$UTRA_{ACLR2}$	36 dB - TT
NOTE 1: TT = 0.8 dB	

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 unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with SM.329 [22] and NR operating band requirement to address UE co-existence.

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.

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.

6.5.3.1 General spurious emissions

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

This clause specifies the requirements for the specified NR band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5.3.1.3-2.

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 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5.3.1.3-2 apply for all transmitter band configurations (N_{RB}) 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 6.5.3.1.3-1: Boundary between NR out of band and general spurious emission domain

Channel bandwidth	OOB boundary F_{OOB} (MHz)
$BW_{Channel}$	$BW_{Channel}$ + 5

Table 6.5.3.1.3-2: Requirement for general spurious emissions limits

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	4
	-25 dBm	1 MHz	3
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band for which the upper frequency edge of the UL Band is greater than 2.55 GHz and less than or equal to 5.2 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz NOTE 3: Applies for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in sub-clause 5.2B of [4] when NS_04 is signalled. NOTE 4: Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in subclause 5.2B of TS 38.101-3 [4] when NS_04 is signalled.			

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.1

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, 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 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 [5] subclause 4.1.		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.		Low range, Mid range, High range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1.		Lowest, Mid, Highest	
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	N/A for Spurious Emissions testing	CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration. NOTE 2: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
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 [5] clause 4.5. Message contents are defined in clause 6.5.3.1.4.3 with no exceptions.

6.5.3.1.4.2 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 6.5.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
4. For UE operating on Band n41, redo the test for frequency range 1 GHz ≤ f < 12.75 GHz with the message content in step 6 of initial conditions with exceptions defined in clause 6.5.3.1.4.3.

6.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

Exception for step 4 in test procedure:

Table 6.5.3.1.4.3-1: Message contents

Derivation Path: TS 38.508-1 [5], Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_04)		

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.

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 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5.3.1.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5.3.1.5-1.

Table 6.5.3.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	4
	-25 dBm	1 MHz	3
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band for which the upper frequency edge of the UL Band is greater than 2.55 GHz and less than or equal to 5.2 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz NOTE 3: Applies for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in sub-clause 5.2B of 38.101-3 [4] when NS_04 is signalled. NOTE 4: Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in subclause 5.2B of TS 38.101-3 [4] when NS_04 is signalled.			

6.5.3.2 Spurious emissions for UE co-existence

6.5.3.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements 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 coexistence with protected bands as indicated in Tables 6.5.3.2.3-1 to 6.5.3.2.3-3.

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.

Table 6.5.3.2.3-1: Requirements for spurious emissions for UE co-existence Rel-15

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n1, n84	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR Band n78, n79	F_{DL_low}	--	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	15
	Frequency range	1880	-	1895	-40	1	15, 27
	Frequency range	1895	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
n2	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43	F_{DL_low}	-	F_{DL_high}	-50	1	2
n3, n80	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 41, 43, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73,74, 75, 76 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 22, 42, 52 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n5	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 24, 25, 26, 28, 29, 30, 31, 34, 38, 40, 42, 43, 45, 48, 50, 51, 65, 66, 70, 71, 73, 74, 85 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 52, 53 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
n8, n81	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	

	E-UTRA band 3, 7, 22, 41, 42, 43, 52, NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA 8	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n12	E-UTRA Band 2, 5, 13, 14, 17, 24, 25, 26, 27, 30, 41, 50, 53, 70, 71, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 48, 51, 66	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 12, 85	F_{DL_low}	-	F_{DL_high}	-50	1	15
n20, n82	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 50, 51, 65, 67, 68, 72, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 38, 42, 52, 69 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	788	-50	1	
n25	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 53, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43	F_{DL_low}	-	F_{DL_high}	-50	1	2
n28, n83	E-UTRA Band 1, 4, 22, 32, 42, 43, 50, 51, 65, 66, 74, 75, 76 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	19, 25
	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, 25, 26, 27, 31, 34, 38, 40, 41, 52, 72, 73 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	19, 24
	Frequency range	470	-	694	-42	8	15, 35
	Frequency range	470	-	710	-26.2	6	34
	Frequency range	662	-	694	-26.2	6	15
	Frequency range	758	-	773	-32	1	15
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 19
n34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 28, 31, 32, 33, 38, 39, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 69, 72, 74, 75, 76 NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	5
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n38	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85,	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22
n39	E-UTRA Band 1, 8, 22, 26, 34, 40, 41, 42, 44, 45, 50, 51, 52, 74 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50		
	NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2

	Frequency range	1805	-	1855	-40	1	33
	Frequency range	1855	-	1880	-15.5	5	15, 26, 33
n40	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 74, 75, 76 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5		1915.7	-41	0.3	8
n41	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 24, 25, 26, 27, 28, 29, 30, 34, 39, 42, 44, 45, 48, 50, 51, 52, 65, 66, 70, 71, 73, 74, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5		1915.7	-41	0.3	8
n50	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
n51	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 65, 66, 67, 68	F_{DL_low}	-	F_{DL_high}	-50	1	
n66, n86	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 27, 28, 29, 30, 38, 41, 43, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 42, 48	F_{DL_low}	-	F_{DL_high}	-50	1	2
n70	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	2
n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 30, 48, 53, 66, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 70	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	15
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	15
n74	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 18, 19, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	1400	-	1427	-32	27	15, 41
	Frequency range	1475	-	1488	-50	1	42
	Frequency range	1475	-	1488	-28	1	15, 42
	Frequency range	1475	-	1488	-50	1	15, 45
	Frequency range	1475.9	-	1510.9	-35	1	15, 46
n77	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 74	F_{DL_low}	--	F_{DL_high}	-50	1	
	Frequency range	1884.5	--	1915.7	-41	0.3	8
n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 32, 34, 39, 40, 41, 65, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	

	Frequency range	1884.5	-	1915.7	-41	0.3	8
n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 28, 34, 39, 40, 41, 42, 65, 74	F_{DL_low}	--	F_{DL_high}	-50	1	
	Frequency range	1884.5	--	1915.7	-41	0.3	

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2-1 for NR band, Table 5.2-1 in TS 36.521-1 [21] for E-UTRA band.
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1.3-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x RBSizekHz), where N is 2, 3, 4, [5] for the 2nd, 3rd, 4th [or 5th] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3: 15 kHz SCS is assumed when RB is mentioned in the note when channel bandwidth is less than or equal to 50MHz, lowest SCS is assumed when channel bandwidth is larger than 50MHz. The transmission bandwidth in terms of RB position and range is not limited to 15 kHz SCS and shall scale with SCS accordingly.
NOTE 4: Void
NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band.
NOTE 6: N/A
NOTE 7: Void.
NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.
NOTE 9: Void
NOTE 10: Void
NOTE 11: Void
NOTE 12: Void
NOTE 13: Void.
NOTE 14: Void
NOTE 15: These requirements also apply 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.
NOTE 16: Void
NOTE 17: Void
NOTE 18: Void
NOTE 19: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 20: Void
NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 22: This requirement is applicable for power class 3 UE for any channel bandwidths within the range 2570 - 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 - 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For power class 2 UE for any channel bandwidths within the range 2570 - 2615 MHz, NS_44 shall apply. For power class 2 or 3 UE for carriers with channel bandwidth overlapping the frequency range 2615 - 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE P-Max.
NOTE 23: Void.
NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 27: This requirement is applicable for any channel bandwidths within the range 1920 - 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within

the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 - 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 28: Void NOTE 29: Void NOTE 30: Void NOTE 31: Void NOTE 32: Void NOTE 33: This requirement is only applicable for carriers with bandwidth up to 20MHz and confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz. NOTE 34: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RB_{start} > 1 and RB_{start} < 48. NOTE 35: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies. NOTE 36: Void NOTE 37: Void NOTE 38: Void NOTE 39: Void. NOTE 40: Void NOTE 41: Applicable for cases when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1427 MHz + the channel BW assigned for 5 and 10 MHz bandwidth, and when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1440 MHz for 15 and 20 MHz bandwidth. This requirement shall be verified with UE transmission power of 15 dBm. NOTE 42: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is more than 1460MHz and more than 1460MHz and less than or equal to 1470MHz for 5 MHz bandwidth, and when the upper edge of the assigned NR UL channel bandwidth frequency is less than or equal to 1465 MHz for10 MHz bandwidth. NOTE 43: Void NOTE 44: Void NOTE 45: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is equal to or less than 1460MHz. NOTE 46: Applicable for 5MHz bandwidth and when the NR carrier is within 1447.9 – 1462.9 MHz.

NOTE: To simplify Table 6.5.3.2.3-1, E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation or both E-UTRA and NR operation. NR band numbers are listed for bands which are specified only for NR operation.

Table 6.5.3.2.3-2 Requirements for spurious emissions for UE co-existence Rel-16 specifies the requirements for NR bands for coexistence with protected bands.

Table 6.5.3.2.3-2: Requirements for spurious emissions for UE co-existence Rel-16

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n1, n84	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR Band n78, n79	F_{DL_low}	--	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	15
	Frequency range	1880	-	1895	-40	1	15, 27
	Frequency range	1895	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
n2	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n3, n80	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 41, 43, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73,74, 75, 76 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	13
	E-UTRA Band 22, 42,52 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	13
n5, n89	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 24, 25, 26, 28, 29, 30, 31, 34, 38, 40, 42, 43, 45, 48, 50, 51, 65, 66, 70, 71, 73, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 52, 53 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	39
	Frequency range	1884.5	-	1915.7	-41	0.3	8,39
n7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
n8, n81	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	

	E-UTRA band 3, 7, 22, 41, 42, 43, 52, NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA 8	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n12	E-UTRA Band 2, 5, 13, 14, 17, 24, 25, 26, 27, 30, 41, 50, 53, 70, 71, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 48, 51, 66 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 12, 85	F_{DL_low}	-	F_{DL_high}	-50	1	15
n14	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 30, 41, 48, 53, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	769	-	775	-35	0.00625	12, 15
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
n18	E-UTRA Band 1, 3, 11, 21, 34, 40, 42, 65 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
n20, n82	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 50, 51, 65, 67, 68, 72, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 38, 42, 69 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	788	-50	1	
n25	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 53, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n26	E-UTRA Band 1, 2, 3, 4, 5, 11, 12, 13, 14, 17, 18,19, 21, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 48, 50, 51, 65, 66, 70, 71, 73,74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 53 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	703	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8

n28, n83	E-UTRA Band 1, 4, 22, 32, 42, 43, 50, 51, 65, 66, 74, 75, 76 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	19, 25
	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, 25, 26, 27, 31, 34, 38, 39, 40, 41, 52, 72, 73 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	19, 24
	Frequency range	470	-	694	-42	8	15, 35
	Frequency range	470	-	710	-26.2	6	34
	Frequency range	662	-	694	-26.2	6	15
	Frequency range	758	-	773	-32	1	15
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 19
n30	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 24, 25, 26, 27, 29, 30, 38, 41, 48, 53, 66, 70, 71, 85, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	
n34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 28, 31, 32, 33, 38,39, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 69, 72, 74, 75, 76 NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	5
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n38	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85,	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78	FDL_low	-	FDL_high	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22
n39	E-UTRA Band 1, 8, 22, 26, 28, 34, 40, 41, 42, 44, 45, 50, 51, 52, 74 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50		
	NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	33
	Frequency range	1855	-	1880	-15.5	5	15, 26, 33
n40	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 74, 75, 76 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5		1915.7	-41	0.3	8
n41	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 24, 25, 26, 27, 28, 29, 30, 34, 39, 42, 44, 45, 48, 50, 51, 52, 65, 66, 70, 71, 73, 74, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 9, 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	30

	Frequency range	1884.5		1915.7	-41	0.3	8, 30
n47	E-UTRA Band 1, 3, 5, 7, 8, 22, 26, 28, 34, 39, 40, 41, 42, 44, 45, 65, 68, 72, 73	FDL_low	-	FDL_high	-50	1	
	NR Band n71, n77, n78, n79	FDL_low	-	FDL_high	-50	1	
n48	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
n50	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 65, 66, 67, 68	F_{DL_low}	-	F_{DL_high}	-50	1	
n51	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
n53	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 48, 66, 70, 71, 85, NR Band n77	FDL_low	-	FDL_high	-50	1	
n65	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 50, 51, 65, 68, 69, 72, 74, 75, 76, NR Band n78, n79	FDL_low	-	FDL_high	-50	1	
	NR Band n77	FDL_low	-	FDL_high	-50	1	2
	E-UTRA Band 34	FDL_low	-	FDL_high	-50	1	43
	Frequency range	1900	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
n66, n86	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 27, 28, 29, 30, 38, 41, 43, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 42, 48 NR Band n47, n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n70	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	2
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 30, 48, 53, 66, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 70 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	15
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	15
n74	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 18, 19, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	1400	-	1427	-32	27	15, 41
	Frequency range	1475	-	1488	-28	1	15, 42
	Frequency range	1475	-	1488	-50	1	15, 45
	Frequency range	1475.9	-	1510.9	-35	1	15, 46
	Frequency range	1488	-	1518	-50	1	15

n77	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 11, 12, 13, 14, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 41, 53, 65, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 28, 34, 39, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n95	E-UTRA Band 1, 3, 5, 8, 28, 39, 40, 41 NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	5
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2-1 for NR band, Table 5.2-1 in TS 36.521-1 [21] for E-UTRA band.
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1.3-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L_{CRB} x RB_{Size} kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3: 15 kHz SCS is assumed when RB is mentioned in the note when channel bandwidth is less than or equal to 50MHz, lowest SCS is assumed when channel bandwidth is larger than 50MHz. The transmission bandwidth in terms of RB position and range is not limited to 15 kHz SCS and shall scale with SCS accordingly.
NOTE 4: Void
NOTE 5: For non-synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band.
NOTE 6: N/A
NOTE 7: Void.
NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.
NOTE 9: Void
NOTE 10: Void
NOTE 11: Void
NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB
NOTE 13: Void.
NOTE 14: Void
NOTE 15: These requirements also apply 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.
NOTE 16: Void
NOTE 17: Void
NOTE 18: Void
NOTE 19: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 20: Void
NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 22: This requirement is applicable for power class 3 UE for any channel bandwidths up to 20 MHz. For channel bandwidth within the range 2570 - 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 - 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers overlapping the frequency range 2615 - 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE P-Max.
NOTE 23: Void.
NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 27: This requirement is applicable for channel bandwidths up to 20MHz within the range 1920 - 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when the carrier centre

frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when the carrier centre frequency is within the range 1930 - 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 28: Void

NOTE 29: Void

NOTE 30: Void

NOTE 31: Void

NOTE 32: Void

NOTE 33: This requirement is only applicable for carriers with bandwidth up to 20MHz and confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz.

NOTE 34: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718-728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with $RB_{start} > 1$ and $RB_{start} < 48$.

NOTE 35: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.

NOTE 36: Void

NOTE 37: Void

NOTE 38: Void

NOTE 39: Void.

NOTE 40: Void

NOTE 41: Applicable for cases when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1427 MHz + the channel BW assigned for 5 and 10 MHz bandwidth, and when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1440 MHz for 15 and 20 MHz bandwidth. This requirement shall be verified with UE transmission power of 15 dBm.

NOTE 42: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is more than 1460MHz and more than 1460MHz and less than or equal to 1470MHz for 5 MHz bandwidth, and when the upper edge of the assigned NR UL channel bandwidth frequency is less than or equal to 1465 MHz for 10 MHz bandwidth.

NOTE 43: This requirement is applicable for NR channel bandwidth allocated within 1920-1980 MHz.

NOTE 44: As exceptions, for 90 and 100 MHz channel bandwidth, -40 dBm/MHz is applicable in the frequency range of 2496 – 2505 MHz

NOTE 45: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is equal to or less than 1460MHz.

NOTE 46: Applicable for 5MHz bandwidth and when the NR carrier is within 1447.9 – 1462.9 MHz.

Table 6.5.3.2.3-3: Requirements for spurious emissions for UE co-existence Rel-17

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n1, n84	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76, NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	15
	Frequency range	1880	-	1895	-40	1	15, 27
	Frequency range	1895	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
n2	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n3, n80	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 41, 43, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73,74, 75, 76. NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 22, 42, 52, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n5, n89	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 24, 25, 26, 28, 29, 30, 31, 34, 38, 40, 42, 43, 45, 48, 50, 51, 65, 66, 70, 71, 73, 74, 85 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 52, 53 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
n8, n81	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	

NR Band	Spurious emission for UE co-existence						
	Protected band	**Frequency range (MHz)**			**Maximum Level (dBm)**	**MBW (MHz)**	**NOTE**
	E-UTRA band 3, 7, 22, 41, 42, 43, 52, NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA 8	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n12	E-UTRA Band 2, 5, 13, 14, 17, 24, 25, 26, 27, 30, 41, 50, 53, 70, 71, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 48, 51, 66 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 12, 85	F_{DL_low}	-	F_{DL_high}	-50	1	15
n13	E-UTRA Band 2, 4, 5,12, 13, 17, 25, 26, 27, 29, 41, 48, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 14	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 24, 30 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	-	805	-35	0.00625	11, 15
n14	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 30, 41, 48, 53, 66, 70, 71, 85	FD_{L_low}	-	FD_{L_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	769	-	775	-35	0.00625	12, 15
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
n18	E-UTRA Band 1, 3, 11, 21, 34, 40, 42, 65 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
n20, n82	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 50, 51, 65, 67, 68, 72, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 38, 42, 52, 69, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	788	-50	1	
n24, n99	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n25	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 48, 53, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n26	E-UTRA Band 1, 2, 3, 4, 5, 11, 12, 13, 14, 17, 18,19, 21, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 48, 50, 51, 65, 66, 70, 71, 73,74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 53 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	703	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n28, n83	E-UTRA Band 1, 4, 22, 32, 42, 43, 50, 51, 65, 66, 74, 75, 76, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	19, 25
	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, 25, 26, 27, 31, 34, 38, 39, 40, 41, 52, 72, 73 NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	19, 24
	Frequency range	470	-	694	-42	8	15, 35
	Frequency range	470	-	710	-26.2	6	34
	Frequency range	662	-	694	-26.2	6	15
	Frequency range	758	-	773	-32	1	15
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 19
n30	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 24, 25, 26, 27, 29, 30, 38, 41, 48, 53, 66, 70, 71, 85, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	
n34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 28, 31, 32, 33, 38,39, 40, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 69, 72, 74, 75, 76, NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	5
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n38	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	FDL_low	-	FDL_high	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n39, n98	E-UTRA Band 1, 8, 22, 26, 28, 34, 40, 41, 42, 44, 45, 50, 51, 52, 74, NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	33
	Frequency range	1855	-	1880	-15.5	5	15, 26, 33
n40, n97	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 74, 75, 76, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	44
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n41	E-UTRA Band 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 24, 25, 26, 27, 28, 29, 30, 34, 39, 42, 44, 45, 48, 50, 51, 52, 65, 66, 70, 71, 73, 74, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5		1915.7	-41	0.3	8
n47	E-UTRA Band 1, 3, 5, 7, 8, 22, 26, 28, 34, 39, 40, 41, 42, 44, 45, 65, 68, 72, 73	FDL_low	-	FDL_high	-50	1	
	NR Band n71, n77, n78, n79	FDL_low	-	FDL_high	-50	1	
n48	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
n50	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 65, 66, 67, 68	F_{DL_low}	-	F_{DL_high}	-50	1	
n51	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
n53	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 48, 66, 70, 71, 85, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	
n65	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 50, 51, 65, 68, 69, 72, 74, 75, 76, NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	43
	Frequency range	1900	-	1915	-15.5	5	15, 26, 27

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
n66, n86	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 27, 28, 29, 30, 38, 41, 43, 50, 51, 53, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 42, 48, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n70	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n47, n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 30, 48, 53, 66, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 70, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	15
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	15
n74	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 18, 19, 20, 26, 28, 29, 31, 34, 38, 39, 40, 41, 42, 43, 48, 52, 65, 66, 67, 68, 85 NR Band n77, n78, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	1400	-	1427	-32	27	15, 41
	Frequency range	1475	-	1488	-28	1	15, 42
	Frequency range	1475	-	1488	-50	1	15, 45
	Frequency range	1475.9	-	1510.9	-35	1	15, 46
	Frequency range	1488	-	1518	-50	1	15
n77	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 11, 12, 13, 14, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 41, 53, 65, 66, 70, 71, 74, 85, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 28, 34, 39, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
n85	E-UTRA Band 2, 5, 13, 14, 17, 24, 25, 26, 27, 30, 41, 53, 70, 71, 74, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 48, 51, 66 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 12, 85	F_{DL_low}	-	F_{DL_high}	-50	1	15
n95	E-UTRA Band 1, 3 , 5, 8, 28, 39, 40, 41, NR Band n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	5
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n101	E-UTRA Band 1, 3, 8, 20, 22, 28, 31, 32, 33, 34, 38, 40, 43, 50, 51, 52, 65, 67, 68, 69, 72, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 7, 41, 42 NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	758	-	788	-50	1	

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2-1 in TS 38.101-1 [2] or Table 5.5-1 in TS 36.101 NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2 MHz + N x L_{CRB} x RB_{size} kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval. NOTE 3: 15 kHz SCS is assumed when RB is mentioned in the note when channel bandwidth is less than or equal to 50 MHz, lowest SCS is assumed when channel bandwidth is larger than 50 MHz. The transmission bandwidth in terms of RB position and range is not limited to 15 kHz SCS and shall scale with SCS accordingly. NOTE 4: Void NOTE 5: For non-synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band NOTE 6: N/A NOTE 7: Void NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz. NOTE 9: Void NOTE 10: Void NOTE 11: Void NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB NOTE 13: Void NOTE 14: Void NOTE 15: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth. NOTE 16: Void NOTE 17: Void NOTE 18: Void NOTE 19: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. NOTE 20: Void NOTE 21: This requirement is applicable for any channel bandwidths up to 20MHz within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 22: This requirement is applicable for power class 3 UE for any channel bandwidths up to 20 MHz. For channel bandwidth within the range 2570 - 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when the carrier centre frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when the carrier centre frequency is within the range 2597 - 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers overlapping the frequency range 2615 - 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE P-Max. NOTE 23: Void NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band. NOTE 27: This requirement is applicable for channel bandwidths up to 20 MHz within the range 1920 - 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when the carrier centre

NR Band	Spurious emission for UE co-existence				
	Protected band	**Frequency range (MHz)**	**Maximum Level (dBm)**	**MBW (MHz)**	**NOTE**

frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when the carrier centre frequency is within the range 1930 - 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 28: Void

NOTE 29: Void

NOTE 30: Void

NOTE 31: Void

NOTE 32: Void

NOTE 33: This requirement is only applicable for carriers with bandwidth up to 20MHz and confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 - 1903 MHz.

NOTE 34: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718-728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RB_{start} > 1 and RB_{start} < 48.

NOTE 35: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.

NOTE 36: Void

NOTE 37: Void

NOTE 38: Void

NOTE 39: Void

NOTE 40: Void

NOTE 41: Applicable for cases and when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1427 MHz + the channel BW assigned for 5 and 10 MHz bandwidth, and when the lower edge of the assigned NR UL channel bandwidth frequency is greater than or equal to 1440 MHz for 15 and 20 MHz bandwidth. This requirement shall be verified with UE transmission power of 15 dBm.

NOTE 42: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is more than 1460MHz and more than 1460MHz and less than or equal to 1470MHz for 5 MHz bandwidth, and when the upper edge of the assigned NR UL channel bandwidth frequency is less than or equal to 1465 MHz for 10 MHz bandwidth.

NOTE 43: This requirement is applicable for NR channel bandwidth allocated within 1920-1980 MHz.

NOTE 44: As exceptions, for 90 and 100 MHz channel bandwidth, -40 dBm/MHz is applicable in the frequency range of 2496 – 2505 MHz.

NOTE 45: Applicable when upper edge of the assigned NR UL channel bandwidth frequency is equal to or less than 1460MHz.

NOTE 46: Applicable for 5MHz bandwidth and when the NR carrier is within 1447.9 – 1462.9 MHz.

NOTE: To simplify Table 6.5.3.2.3-2 and 6.5.3.2.3-3, E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation or both E-UTRA and NR operation. NR band numbers are listed for bands which are specified only for NR operation.

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.2. This test use minimum requirements from many releases of TS 38.101-1 [2] due to release independence defined in TS 38.307 [23].

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, 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 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 [5] subclause 4.1.		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.		Low range, Mid range, High range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_Full
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration. NOTE 2: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

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 [5] clause 4.5. Message contents are defined in clause 6.5.3.2.4.3.

6.5.3.2.4.2 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 6.5.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Tables 6.5.3.2.3-1 to 6.5.3.2.3-3. The centre frequency of the filter shall be stepped in contiguous steps according to Tables 6.5.3.2.3-1 to 6.5.3.2.3-3. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.5.3.2.5 Test requirement

Test requirements for Spurious Emissions UE Co-existence are the same as the minimum requirements and are not repeated in this section.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Tables 6.5.3.1.3-1 from the edge of the channel bandwidth. The spurious emission limits in Tables 6.5.3.2.3-1 to 6.5.3.2.3-3 apply for all transmitter band configurations (NRB) and channel bandwidths.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5.3.2.3-1 to 6.5.3.2.3-3 for difference releases.

The requirements for the UE are release specific and can be found in Tables 6.5.3.2.3-1 to 6.5.3.2.3-3. If the UE support a band, which is not defined in the table corresponding UE's release, the requirements for this band are taken from the table of earliest release where requirements for this band are defined. This has been described in following Table 6.5.3.2.5-1.

Table 6.5.3.2.5-1: UE Requirements according to UE NR release and supported E-UTRA and NR band

UE Requirements per release			
NR Band	**Rel-15**	**Rel-16**	**R17**
n1	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n2	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n3	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n5	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n7	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n8	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n12	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n14	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n18	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n20	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n24	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3
n25	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n26	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n28	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n30	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n34	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n38	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n39	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n40	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n41	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n48	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n50	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n51	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n53	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n65	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n66	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n70	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n71	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n74	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n77, n78	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n79	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
NOTE 1: The frequency range applicable with network signalling values of NS_04, NS_17, NS_18, NS_05, NS_43, NS_37, NS_38, NS_39, NS_40, NS_41, NS_42, NS_45 and NS_56 are covered in subclause 6.5.3.3 Additional Spurious Emissions NOTE 2: The restriction on the maximum uplink transmission to 54 RB in Notes 21 and 22 of Tables 6.5.3.2.3-1 to 6.5.3.2.3-3 is intended for conformance testing and may be applied to network operation to facilitate coexistence when the aggressor and victim bands are deployed in the same geographical area. The applicable spurious emission requirement of -15.5 dBm/5MHz is a least restrictive technical condition for FDD/TDD coexistence and may have to be revised in the future.			

6.5.3.3 Additional spurious emissions

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

Initial conditions for NS_37, NS_38, NS_39, NS_40, NS_41, NS_42, NS_45 and NS_50 are incomplete.

The requirements of this test case for NS_44, NS_46, NS_47, NS_48, and NS_49 apply to all types of NR UE release 16 forward, and release 15 if the corresponding channel bandwidths are supported.

6.5.3.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions under the deployment scenarios where additional requirements are specified.

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

These requirements are specified in terms of an additional spectrum emission requirement. 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.

6.5.3.3.3.1 Minimum conformance requirements (network signalling value "NS_04")

When "NS 04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.1-1. 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.

Table 6.5.3.3.3.1-1: Additional requirements for “NS_04”

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100	
2495 ≤ f < 2496	-13	1% of Channel BW
2490.5 ≤ f < 2495	-13	1 MHz
0.009 < f < 2490.5	-25	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.1.

6.5.3.3.3.2 Minimum conformance requirements (network signalling value "NS_17")

When “NS_17” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.2-1. 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.

Table 6.5.3.3.3.2-1: Additional requirements for “NS_17”

Frequency band (MHz)	Channel bandwidth (MHz)/ Spectrum emission limit (dBm)	Measurement bandwidth	NOTE
	5, 10		
470 ≤ f ≤ 710	-26.2	6 MHz	1
NOTE 1: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth is 5 or 10 MHz.			

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.2.

6.5.3.3.3.3 Minimum conformance requirements (network signalling value "NS_18")

When “NS_18” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.3-1. 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.

Table 6.5.3.3.3.3-1: Additional requirements for “NS_18”

Frequency band (MHz)	Channel bandwidth (MHz)/ Spectrum emission limit (dBm)	Measurement bandwidth	
	5, 10, 15, 20, 30		
692-698	-26.2	6 MHz	

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.3.

6.5.3.3.3.4 Minimum conformance requirements (network signalling value "NS_05" and "NS_05U")

When "NS_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.4-1. 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.

Table 6.5.3.3.3.4-1: Additional requirements for "NS_05" and "NS_05U"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth	NOTE
	5, 10, 15, 20		
1884.5 ≤ f ≤1915.7	-41	300 kHz	

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.4.

6.5.3.3.3.5 Minimum conformance requirements (network signalling value "NS_43" and "NS_43U")

When "NS_43" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.5-1. 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.

Table 6.5.3.3.3.5-1: Additional requirement for "NS_43" and "NS_43U"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15	
860 ≤ f ≤ 890	-40	1 MHz
NOTE 1: Applicable for 5 MHz and 15 MHz channel BW confined between 900 MHz and 915 MHz and for 10 MHz channel BW confined between 905 MHz and 915 MHz		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.5.

6.5.3.3.3.6 Minimum conformance requirements (network signalling value "NS_37")

When "NS 37" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.6-1. 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.

Table 6.5.3.3.6-1: Additional requirement for "NS_37"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
1475.9 ≤ f ≤ 1510.9	-35	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.6.

6.5.3.3.3.7 Minimum conformance requirements (network signalling value "NS_38")

When "NS 38" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.7-1. 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.

Table 6.5.3.3.7-1: Additional requirements for “NS_38”

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
1400 ≤ f ≤ 1427	-32	27 MHz
NOTE 1: This requirement shall be verified with UE transmission power of 15 dBm.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.7.

6.5.3.3.3.8 Minimum conformance requirements (network signalling value "NS_39")

When “NS 39” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.8-1. 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.

Table 6.5.3.3.8-1: Additional requirements for "NS_39"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
1475 ≤ f ≤ 1488	-28	1MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.8.

6.5.3.3.3.9 Minimum conformance requirements (network signalling value "NS_40")

When "NS_40" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.9-1. 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.

Table 6.5.3.3.3.9-1: Additional requirements for NR channels assigned within 1427-1452MHz for "NS_40"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5	
1400 ≤ f ≤ 1427	-32	27 MHz
NOTE 1: This requirement shall be verified with UE transmission power of 15 dBm.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.9.

6.5.3.3.3.10 Minimum conformance requirements (network signalling value “NS_41”)

When "NS_41" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.10-1. 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.

Table 6.5.3.3.3.10-1: Additional requirements for NR channels assigned within 1432-1517 MHz for "NS_41"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 40, 50, 60	

1400 ≤ f ≤ 1427	-32	27 MHz
NOTE 1: This requirement shall be verified with UE transmission power of 15 dBm.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.10.

6.5.3.3.3.11 Minimum conformance requirements (network signalling value "NS_42")

When "NS_42" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.11-1. 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.

Table 6.5.3.3.3.11-1: Additional requirements for NR channels assigned within 1432-1517MHz for "NS_42"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 40, 50, 60	
1518 ≤ f ≤ 1520	-0.8	1 MHz
1520 < f ≤ 1559	-30	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.11.

6.5.3.3.3.12 Minimum conformance requirements (network signalling value "NS_21")

When "NS_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.12-1. These requirements also apply 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 6.5.3.3.3.12-1: Additional requirements for "NS_21"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10	
2200 ≤ f < 2288	-40	1 MHz
2288 ≤ f < 2292	-37	1 MHz
2292 ≤ f < 2296	-31	1 MHz
2296 ≤ f < 2300	-25	1 MHz
2320 ≤ f < 2324	-25	1 MHz
2324 ≤ f < 2328	-31	1 MHz
2328 ≤ f < 2332	-37	1 MHz
2332 ≤ f ≤ 2395	-40	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.12.

6.5.3.3.3.13 Minimum conformance requirements (network signalling value "NS_24")

When "NS 24" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.13-1. 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.

Table 6.5.3.3.3.13-1: Additional requirements

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
2010 ≤ f ≤ 2025	-50	1 MHz
NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.13.

6.5.3.3.3.14 Minimum conformance requirements (network signalling value "NS_27")

When "NS 27" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.14-1. 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.

Table 6.5.3.3.14-1: Additional requirements for "NS_27"

Frequency range (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 30, 40	
9 kHz – 3530 MHz	-40	1 MHz
3530 MHz – 3540 MHz	-25	
3710 MHz – 3720 MHz	-25	
3720 MHz – 12.75 GHz	-40	

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.14.

6.5.3.3.3.15 Minimum conformance requirements (network signalling value "NS_47")

When "NS_47" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.15-1. 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.

Table 6.5.3.3.3.15-1: Additional requirements for NR channels assigned within 2545 - 2575 MHz for "NS_47"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	30	
2530 ≤ f ≤ 2535	-25	1 MHz
2505 ≤ f ≤ 2530	-30	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.15.

6.5.3.3.3.16 Minimum conformance requirements (network signalling value "NS_50")

When "NS_50" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.16-1. 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.

Table 6.5.3.3.3.16-1: Additional requirements for “NS_50”

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	1805	-	1855	-40	1	1
Frequency range	1855	-	1880	-15.5	5	1, 2, 3
NOTE 1: This requirement is applicable for carriers with aggregated channel bandwidths confined in 1885-1920 MHz for ≤ 30MHz channel BWs and confined in 1880-1920 MHz for 40MHz channel BW. NOTE 2: The 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. NOTE 3: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.16.

6.5.3.3.3.17 Minimum conformance requirements (network signalling value "NS_12")

When "NS_12" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.17-1. 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.

Table 6.5.3.3.3.17-1: Additional requirements for “NS_12”

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz	
806 ≤ f ≤ 813.5	-42	6.25 kHz
NOTE 1: The requirement applies for NR carriers with lower channel edge at or above 814 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.17.

6.5.3.3.3.18 Minimum conformance requirements (network signalling value "NS_13")

When "NS_13" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.18-1. 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.

Table 6.5.3.3.3.18-1: Additional requirements for “NS_13”

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for NR carriers with lower channel edge at or above 817 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.18.

6.5.3.3.3.19 Minimum conformance requirements (network signalling value "NS_14")

When "NS_14" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.19-1. 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.

Table 6.5.3.3.3.19-1: Additional requirements for "NS_14"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz, 15 MHz, 20MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for NR carriers with lower channel edge at or above 824 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.19.

6.5.3.3.3.20 Minimum conformance requirements (network signalling value "NS_15")

When "NS_15" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.20-1. 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.

Table 6.5.3.3.3.20-1: Additional requirements NS_15

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz, 15 MHz, 20 MHz	
851 ≤ f ≤ 859	-53	6.25 kHz
NOTE 1: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.5.3.3.3.21 Minimum conformance requirements (network signalling value "NS_45")

When "NS_45" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.21-1. 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.

Table 6.5.3.3.3.21-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)		Measurement bandwidth
	5 MHz	10 MHz	
0.009 < f ≤ 2473.5	-25	-25	1 MHz
2473.5 < f ≤ 2477.5	-25	-13	1 MHz
2477.5 < f ≤ 2478.5	-13	-13	1 MHz
2478.5< f ≤ 2483.5	-10	-10	1 MHz
2495 ≤ f < 2496	-13	-13	1% of Channel Bandwidth
2496 ≤ f < 2501	-13	-13	1 MHz
2501 < f ≤ 2505	-25	-13	1 MHz
2505 ≤ f ≤ 5th harmonic of the upper frequency edge of the UL operating band	-25	-25	1 MHz

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.21.

6.5.3.3.3.22 Minimum conformance requirements (network signalling value "NS_48" and “NS_51”)

When "NS_48" or “NS_51” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.22-1. 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.

Table 6.5.3.3.3.22-1: Additional requirements for “NS_48”

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34 – NR band n34	F_{DL_low}	-	F_{DL_high}	-50	1	
Frequency range	1900	-	1915	-15.5	5	1
Frequency range	1915	-	1920	+1.6	5	1
NOTE 1: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.22.

6.5.3.3.3.23 Minimum conformance requirements (network signalling value "NS_49")

When "NS_49" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.23-1. 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.

Table 6.5.3.3.3.23-1: Additional requirements for “NS_49”

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34 - NR band n34	F_{DL_low}	-	F_{DL_high}	-50	1	
Frequency range	1880	-	1895	-40	1	
Frequency range	1895		1915	-15.5	5	1
Frequency range	1915	-	1920	1.6	5	1
NOTE 1: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.23.

6.5.3.3.3.24 Minimum conformance requirements (network signalling value "NS_44")

When "NS_44" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.24-1. 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.

Table 6.5.3.3.3.24-1: Additional requirements for “NS_44”

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2620	-	2645	-15.5	5	1, 2
Frequency range	2645	-	2690	-40	1	1
NOTE 1: This requirement is applicable for carriers confined in 2570-2615 MHz. NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.24.

6.5.3.3.3.25 Minimum conformance requirements (network signalling value "NS_46")

When "NS_46" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.25-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.

Table 6.5.3.3.25-1: Additional requirements for "NS_46"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2570	-	2575	+1.6	5	1, 2
Frequency range	2575	-	2595	-15.5	5	1, 2
Frequency range	2595	-	2620	-40	1	1
NOTE 1: This requirement is applicable for all carriers confined in 2500-2570 MHz. Special restrictions apply for channel bandwidths up to 20MHz: For carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB with the minimum supported SCS of 15KHz. NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.25.

6.5.3.3.3.26 Minimum conformance requirements (network signalling value "NS_07")

6.5.3.3.26-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.

Table 6.5.3.3.26-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz	
769 ≤ f ≤ 775	-57	6.25 kHz
NOTE: The emissions measurement shall be sufficiently power averaged to ensure standard standard deviation < 0.5 dB.		

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.26.

6.5.3.3.3.27 Minimum conformance requirements (network signalling value "NS_56")

When "NS_56" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.27-1. 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.

Table 6.5.3.3.27-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit[1] (dBm)	Measurement bandwidth	NOTE
	5 MHz, 10MHz		
1541 ≤ f ≤ 1559	-102	2kHz	Averaged over any 2 millisecond active transmission interval
1559≤ f ≤ 1608	-85	700Hz	
1608≤ f ≤ 1610	-85 +5/2 (f-1608)	700Hz	
1610≤ f ≤ 1625	-80+ 66/15 (f-1610)	700Hz	
1541 ≤ f ≤ 1608	-75	1MHz	Averaged over any 2 millisecond active transmission interval
1608≤ f ≤ 1610	-75 + 5/2 (f-1608)	1MHz	
1610≤ f ≤ 1627.5	-70+ 57/17.5 (f-1610)	1MHz	
1627.5	-37	4kHz	
1638.5 ≤f ≤ 1645.5	-28	4kHz	
1657.5 ≤f ≤ 1660.5	-28	4kHz	
NOTE 1: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna.			

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.3.27.

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, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All these configurations shall be tested with applicable test parameters for each channel bandwidth and sub-carrier spacing, are shown in Tables 6.5.3.3.4.1-1 through Table 6.5.3.3.4.1-27 for different NS values. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.3.4.1-1: Test Configuration Table (network signalling value "NS_04")

Same test configuration as listed in Table 6.2.3.4.1-2 shall be used with the following exceptions:

Test Channel Bandwidths shall be: 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, and 100 MHz.

Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-2: Test Configuration Table (network signalling value "NS_17")

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		5MHz, 10MHz	
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	N/A	CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration			

Table 6.5.3.3.4.1-3: Test Configuration Table (network signalling value "NS_18")

Same test configuration as listed in Table 6.2.3.4.1-11 shall be used with the following exceptions:

Test Channel Bandwidths shall be: 5, 10, 20 and 30 MHz.

Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-4: Test Configuration Table (network signalling value "NS_05" and "NS_05U")

Same test configuration as listed in Table 6.2.3.4.1-4 for NS_05 and Table 6.2.3.4.1-5 for NS_05U shall be used with the following exceptions:

- Test SCS shall be: [Lowest].

Table 6.5.3.3.4.1-5: Test Configuration Table (network signalling value "NS_43" and "NS_43U")

Same test configuration as listed in Table 6.2.3.4.1-6 for NS_43 and Table 6.2.3.4.1-7 for NS_43U shall be used with the following exceptions:

- Test Channel Bandwidths shall be: [5, 10, and 15] MHz
- Test SCS shall be: [Lowest].

Table 6.5.3.3.4.1-6: Test Configuration Table (network signalling value "NS_37")

Same test configuration as listed in Table 6.2.3.4.1-8 shall be used with the following exceptions:

- Test SCS shall be: [Lowest].

Table 6.5.3.3.4.1-7: Test Configuration Table (network signalling value "NS_38")

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		[TBD]	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		[TBD]	
Test SCS as specified in Table 5.3.5-1		[TBD]	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1	N/A for Spurious Emissions testing	FFS	FFS
2		FFS	FFS
3		FFS	FFS
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration			

Table 6.5.3.3.4.1-8: Test Configuration Table (network signalling value "NS_39")

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		[TBD]	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		[TBD]	
Test SCS as specified in Table 5.3.5-1		[TBD]	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1	N/A for Spurious Emissions testing	FFS	FFS
2		FFS	FFS
3		FFS	FFS
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration			

Table 6.5.3.3.4.1-9: Test Configuration Table (network signalling value "NS_40")

TBD

Table 6.5.3.3.4.1-10: Test Configuration Table (network signalling value "NS_41")

TBD

Table 6.5.3.3.4.1-11: Test Configuration Table (network signalling value "NS_42")

TBD

Table 6.5.3.3.4.1-12: Test Configuration Table (network signalling value "NS_45")

Same test configuration as listed in Table 6.2.3.4.1-20 shall be used.

Table 6.5.3.3.4.1-13: Test Configuration Table (network signalling value "NS_24")

Same test configuration as listed in Table 6.2.3.4.1-12 shall be used.

Table 6.5.3.3.4.1-14: Test Configuration Table (network signalling value "NS_27")

Same test configuration as listed in Table 6.2.3.4.1-13 shall be used with the following exceptions:

- Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-15: Test Configuration Table (network signalling value "NS_47")

Same test configuration as listed in Table 6.2.3.4.1-17, Table 6.2.3.4.1-17a and Table 6.2.3.4.1-18 shall be used with the following exceptions:

Test Channel Bandwidths shall be: 30 MHz.

Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-16: Test Configuration Table (network signalling value "NS_50")

Same test configuration as listed in Table [6.2.3.4.1-31] shall be used.

Table 6.5.3.3.4.1-17: Test Configuration Table (network signalling value "NS_12")

Same test configuration as listed in Table 6.2.3.4.1-20 shall be used.

Table 6.5.3.3.4.1-18: Test Configuration Table (network signalling value "NS_13")

Same test configuration as listed in Table 6.2.3.4.1-21 shall be used.

Table 6.5.3.3.4.1-19: Test Configuration Table (network signalling value "NS_14")

Same test configuration as listed in Table 6.2.3.4.1-23 shall be used with the following exceptions:

- Test Frequency shall be: High Range.

Table 6.5.3.3.4.1-20: Test Configuration Table (network signalling value "NS_15")

Same test configuration as listed in Table 6.2.3.4.1-23 shall be used.

Table 6.5.3.3.4.1-21: Test Configuration Table (network signalling value "NS_45")

TBD

Table 6.5.3.3.4.1-22: Test Configuration Table (network signalling value "NS_48")

Same test configuration as listed in Table 6.2.3.4.1-19 shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, 45 and 50 MHz
- Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-23: Test Configuration Table (network signalling value "NS_49")

Same test configuration as listed in Table 6.2.3.4.1-29 shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, and 50 MHz
- Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-24: Test Configuration Table (network signalling value "NS_44")

Same test configuration as listed in Table 6.2.3.4.1-26 shall be used with the following exceptions:

- Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-25: Test Configuration Table (network signalling value "NS_21")

Same test configuration as listed in Table 6.2.3.4.1-27shall be used with the following exceptions:

Test SCS shall be: Lowest.

Table 6.5.3.3.4.1-27: Test Configuration Table (network signalling value "NS_56")

Same test configuration as listed in Table 6.2.3.4.1-30 shall be used.

Table 6.5.3.3.4.1-28: Test Configuration Table (network signalling value "NS_46")

Same test configuration as listed in Table 6.2.3.4.1-25 shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Test Channel Bandwidths shall be: 25 and 50 MHz

1. Connect the SS to the UE to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5.3.3.4.1-1 through Table 6.5.3.3.4.1-27.
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 [5] clause 4.5. Message contents are defined in clause 6.5.3.3.4.3.

6.5.3.3.4.2 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 6.5.3.3.4.1-1 through Table 6.5.3.3.4.1-27. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration in Tables 6.5.3.3.4.1-1 through 6.5.3.3.4.1-27 as appropriate, which shall meet the requirements in clause 6.5.3.3.5 with allowed A-MPR values if specified in Tables 6.2.3.5-1 through 6.2.3.5-27 as appropriate per test condition specified in Tables 6.2.3.4.1-1 through 6.2.3.4.1-30 as appropriate. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to clauses 6.5.3.3.3.1 to 6.5.3.3.3.27 as appropriate. The centre frequency of the filter shall be stepped in contiguous steps according to the same table.

6.5.3.3.4.3 Message contents

6.5.3.3.4.3.1 Message contents exceptions (network signalling value "NS_04")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_04. 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 6.5.3.3.4.3.1-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_04"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_04)		

6.5.3.3.4.3.2 Message contents exceptions (network signalling value "NS_17")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_17. 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 6.5.3.3.4.3.2-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_17"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_17)		

6.5.3.3.4.3.3 Message contents exceptions (network signalling value "NS_18")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_18. 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 6.5.3.3.4.3.3-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_18"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_18)		

6.5.3.3.4.3.4 Message contents exceptions (network signalling value "NS_05")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_05. 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 6.5.3.3.4.3.4-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_05"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_05)		

6.5.3.3.4.3.4a Message contents exceptions (network signalling value "NS_05U")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_05U. 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 6.5.3.3.4.3.4a-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_05U"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	3 (NS_05U)		

6.5.3.3.4.3.5 Message contents exceptions (network signalling value "NS_43")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_43. 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 6.5.3.3.4.3.5-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_43"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_43)		

6.5.3.3.4.3.5a Message contents exceptions (network signalling value "NS_43U")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_43U. 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 6.5.3.3.4.3.5a-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_43U"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	3 (NS_43U)		

6.5.3.3.4.3.6 Message contents exceptions (network signalling value "NS_37")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_37. 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 6.5.3.3.4.3.6-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_37"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_37)		

6.5.3.3.4.3.7 Message contents exceptions (network signalling value "NS_38")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_38. 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 6.5.3.3.4.3.7-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_38"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_38)		

6.5.3.3.4.3.8 Message contents exceptions (network signalling value "NS_39")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_39. 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 6.5.3.3.4.3.8-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_39"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	3 (NS_39)		

6.5.3.3.4.3.9 Message contents exceptions (network signalling value "NS_40")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_40. 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 6.5.3.3.4.3.9-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_40"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_40)		

6.5.3.3.4.3.10 Message contents exceptions (network signalling value "NS_41")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_41. 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 6.5.3.3.4.3.10-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_41"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_41)		

6.5.3.3.4.3.11 Message contents exceptions (network signalling value "NS_42")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_42. 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 6.5.3.3.4.3.11-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_42"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_42)		

6.5.3.3.4.3.12 Message contents exceptions (network signalling value "NS_21")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_21. 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 6.5.3.3.4.3.12-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_21"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_21)		

6.5.3.3.4.3.13 Message contents exceptions (network signalling value "NS_24")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_24. 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 6.5.3.3.4.3.13-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_24"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_24)		

6.5.3.3.4.3.14 Message contents exceptions (network signalling value "NS_27")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_27. 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 6.5.3.3.4.3.14-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_27"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_27)		

6.5.3.3.4.3.15 Message contents exceptions (network signalling value "NS_47")

1. Information element additionalSpectrumEmission is set to NS_47. This can be set in the *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 6.5.3.3.4.3.15-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS_47"

Derivation Path: TS 38.508-1 [5], Table 4.6.3-1			
Information Element	Value/remark	Comment	Condition
additionalSpectrumEmission	2 (NS_47)		

6.5.3.3.4.3.16 Message contents exceptions (network signalling value "NS_50")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_50. 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 6.5.3.3.4.3.16-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_50"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_50)		

6.5.3.3.4.3.17 Message contents exceptions (network signalling value "NS_12")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_12. 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 6.5.3.3.4.3.17-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_12"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_12)		

6.5.3.3.4.3.18 Message contents exceptions (network signalling value "NS_13")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_13. 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 6.5.3.3.4.3.18-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_13"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_13)		

6.5.3.3.4.3.19 Message contents exceptions (network signalling value "NS_14")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_14. 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 6.5.3.3.4.3.19-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_14"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_14)		

6.5.3.3.4.3.20 Message contents exceptions (network signalling value "NS_15")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_15. 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 6.5.3.3.4.3.20-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_15"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_15)		

6.5.3.3.4.3.21 Message contents exceptions (network signalling value "NS_45")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_45. 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 6.5.3.3.4.3.21-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_45"

Derivation Path: TS 38.508-1 [5], Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_45)		

6.5.3.3.4.3.22 Message contents exceptions (network signalling value "NS_48")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_48. 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 6.5.3.3.4.3.22-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_48"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	4 (NS_48)		

6.5.3.3.4.3.23 Message contents exceptions (network signalling value "NS_49")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_49. 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 6.5.3.3.4.3.23-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_49"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	5 (NS_49)		

6.5.3.3.4.3.24 Message contents exceptions (network signalling value "NS_44")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_44. 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 6.5.3.3.4.3.24-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_44"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_44)		

6.5.3.3.4.3.25 Message contents exceptions (network signalling value "NS_46")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_46. 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 6.5.3.3.4.3.25-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_46"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_46)		

6.5.3.3.4.3.26 Message contents exceptions (network signalling value "NS_07")

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6.5.3.3.4.3.27 Message contents exceptions (network signalling value "NS_56")

Message contents are according to TS 38.508-1 [5] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_56. 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 6.5.3.3.4.3.27-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_56"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_56)		

6.5.3.3.5 Test requirement

This clause specifies the requirements for the specified NR band for an additional spectrum emission requirement with protected bands as indicated from Table 6.5.3.3.5.1 to Table 6.5.3.3.5.27 for different NS_values.

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.

6.5.3.3.5.1 Test requirement (network signalling value "NS_04")

When "NS 04" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-2 for power class 2 UE, and Table 6.2.3.5-3 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.1-1. 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.

Table 6.5.3.3.5.1-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 (MHz)	
2495 ≤ f < 2496	-13	1% of Channel BW
2490.5 ≤ f < 2495	-13	1 MHz
0.009 < f < 2490.5	-25	1 MHz

6.5.3.3.5.2 Test requirement (network signalling value "NS_17")

When "NS_17" is indicated in the cell,

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.2-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1.3-1 and Table 6.5.3.1.3-2 from the edge of the channel bandwidth.

Table 6.5.3.3.5.2-1: Additional requirements for "NS_17"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth	NOTE
	5, 10 MHz		
470 ≤ f ≤ 710	-26.2	6 MHz	1
NOTE 1: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.			

6.5.3.3.5.3 Test requirement (network signalling value "NS_18")

When "NS_18" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-8 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.3-1. 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.

Table 6.5.3.3.5.3-1: Additional requirements for "NS_18"

Frequency range (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth	
	5, 10, 15, 20, 30 MHz		
692-698	-26.2	6 MHz	

6.5.3.3.5.4 Test requirement (network signalling value “NS_05” and “NS_05U”)

When "NS 05" or "NS_05U" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-6 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.4-1. 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.

Table 6.5.3.3.5.4-1: Additional requirements for "NS_05" and "NS_05U"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth	
	5, 10, 15, 20 MHz		
1884.5 ≤ f ≤ 1915.7	-41	300 kHz	

6.5.3.3.5.5 Test requirement (network signalling value "NS_43" and "NS_43U")

When "NS_43" or "NS_43U" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-10 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.5-1. 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.

Table 6.5.3.3.5.5-1: Additional requirement for "NS_43" and "NS_43U"

Frequency range (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15 MHz	
860 ≤ f ≤ 890	-40	1 MHz
NOTE 1: Applicable for 5 MHz and 15 MHz channel BW confined between 900 MHz and 915 MHz and for 10 MHz channel BW confined between 905 MHz and 915 MHz		

6.5.3.3.5.6 Test requirement (network signalling value “NS_37”)

When "NS_37" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-14 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.6-1. 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.

Table 6.5.3.3.5.6-1: Additional requirement for "NS_37"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
1475.9 ≤ f ≤ 1510.9	-35	1 MHz

6.5.3.3.5.7 Test requirement (network signalling value "NS_38")

TBD

6.5.3.3.5.8 Test requirement (network signalling value "NS_39")

TBD

6.5.3.3.5.9 Test requirement (network signalling value "NS_40")

TBD

6.5.3.3.5.10 Test requirement (network signalling value "NS_41")

TBD

6.5.3.3.5.11 Test requirement (network signalling value "NS_42")

TBD

6.5.3.3.5.12 Test requirement (network signalling value "NS_21")

When "NS_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.12-1. These requirements also apply 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 6.5.3.3.5.12-1: Additional requirements for "NS_21"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10	
2200 ≤ f < 2288	-40	1 MHz
2288 ≤ f < 2292	-37	1 MHz
2292 ≤ f < 2296	-31	1 MHz
2296 ≤ f < 2300	-25	1 MHz
2320 ≤ f < 2324	-25	1 MHz
2324 ≤ f < 2328	-31	1 MHz
2328 ≤ f < 2332	-37	1 MHz
2332 ≤ f ≤ 2395	-40	1 MHz

6.5.3.3.5.13 Test requirement (network signalling value "NS_24")

When "NS 24" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-17.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.13-1. 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.

Table 6.5.3.3.5.13-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz, 15 MHz, 20 MHz	
2010 ≤ f ≤ 2025	-50	1 MHz
NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.		

6.5.3.3.5.14 Test requirement (network signalling value "NS_27")

When "NS_27" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-18 for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.14-1. 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.

Table 6.5.3.3.5.14-1: Additional requirement for "NS_27"

Frequency range (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 30, 40	
9 kHz – 3530 MHz	-40	1 MHz
3530 MHz – 3540 MHz	-25	
3710 MHz – 3720 MHz	-25	
3720 MHz – 12.75 GHz	-40	

6.5.3.3.5.15 Test requirement (network signalling value "NS_47")

When "NS 47" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.15-1. 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.

Table 6.5.3.3.5.15-1: Additional requirement for "NS_47"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	30	
2530 ≤ f ≤ 2535	-25	1 MHz
2505 ≤ f ≤ 2530	-30	1 MHz

6.5.3.3.5.16 Test requirement (network signalling value "NS_50")

When "NS_50" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.16-1. 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.

Table 6.5.3.3.5.16-1: Additional requirements for "NS_50"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	1805	-	1855	-40	1	1
Frequency range	1855	-	1880	-15.5	5	1, 2, 3
NOTE 1: This requirement is applicable for carriers with aggregated channel bandwidths confined in 1885-1920 MHz for ≤ 30MHz channel BWs and confined in 1880-1920 MHz for 40MHz channel BW. NOTE 2: The 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. NOTE 3: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

6.5.3.3.5.17 Test requirement (network signalling value “NS_12”)

Table 6.5.3.3.5.17-1: Additional requirements for “NS_12”

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz	
806 ≤ f ≤ 813.5	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or above 814 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.5.3.3.5.18 Test requirement (network signalling value “NS_13”)

Table 6.5.3.3.5.18-1: Additional requirements for “NS_13”

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or above 817 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.5.3.3.5.19 Test requirement (network signalling value “NS_14”)

Table 6.5.3.3.5.19-1: Additional requirements for “NS_14”

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz, 15 MHz, 20MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or above 817 MHz. NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.5.3.3.5.20 Test requirement (network signalling value "NS_15")

Table 6.5.3.3.5.20-1: Additional requirements for "NS_15"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz, 15 MHz, 20 MHz	
851 ≤ f ≤ 859	-53	6.25 kHz
NOTE 1: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.5.3.3.5.21 Test requirement (network signalling value "NS_45")

When "NS 45" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-29.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.21-1. 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.

Table 6.5.3.3.5.21-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)		Measurement bandwidth
	5 MHz	10 MHz	
0.009 < f ≤ 2473.5	-25	-25	1 MHz
2473.5 < f ≤ 2477.5	-25	-13	1 MHz
2477.5 < f ≤ 2478.5	-13	-13	1 MHz
2478.5< f ≤ 2483.5	-10	-10	1 MHz
2495 ≤ f < 2496	-13	-13	1% of Channel Bandwidth
2496 ≤ f < 2501	-13	-13	1 MHz
2501 < f ≤ 2505	-25	-13	1 MHz
2505 ≤ f ≤ 5th harmonic of the upper frequency edge of the UL operating band	-25	-25	1 MHz

6.5.3.3.5.22 Test requirement (network signalling value "NS_48")

When "NS 48" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-24.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.22-1. 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.

Table 6.5.3.3.5.22-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34 – NR band n34	F_{DL_low}	-	F_{DL_high}	-50	1	
Frequency range	1900	-	1915	-15.5	5	1
Frequency range	1915	-	1920	+1.6	5	1
NOTE 1: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

6.5.3.3.5.23 Test requirement (network signalling value "NS_49")

When "NS 49" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-33.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.23-1. 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.

Table 6.5.3.3.5.23-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34 - NR band n34	F_{DL_low}	-	F_{DL_high}	-50	1	
Frequency range	1880	-	1895	-40	1	
Frequency range	1895		1915	-15.5	5	1
Frequency range	1915	-	1920	1.6	5	1
NOTE 1: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

6.5.3.3.5.24 Test requirement (network signalling value "NS_44")

When "NS 44" is indicated in the cell,

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-31.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.24-1. 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.

Table 6.5.3.3.5.24-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2620	-	2645	-15.5	5	1, 2
Frequency range	2645	-	2690	-40	1	1
NOTE 1: This requirement is applicable for carriers confined in 2570-2615 MHz. NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

6.5.3.3.5.25 Test requirement (network signalling value "NS_46")

When "NS_46" is indicated in the cell, the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-30. The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.25-1. 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.

Table 6.5.3.3.25-1: Additional requirements for "NS_46"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2570	-	2575	+1.6	5	1, 2
Frequency range	2575	-	2595	-15.5	5	1, 2
Frequency range	2595	-	2620	-40	1	1
NOTE 1: This requirement is applicable for all carriers confined in 2500-2570 MHz. Sepcial restrictions apply for channel bandwidths up to 20MHz: For carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB with the minimum supported SCS of 15KHz. NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

6.5.3.3.5.26 Test requirement (network signalling value "NS_07")

FFS

6.5.3.3.5.27 Test requirement (network signalling value "NS_56")

When "NS 56" is indicated in the cell,

> The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2.3.5-36.

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.27-1. 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.

Table 6.5.3.3.5.27-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit[1] (dBm)	Measurement bandwidth	NOTE
	5 MHz, 10MHz		
1541 ≤ f ≤ 1559	-102	2kHz	Averaged over any 2millisecond active transmission interval
1559≤ f ≤ 1608	-85	700Hz	
1608≤ f ≤ 1610	-85 +5/2 (f-1608)	700Hz	
1610≤ f ≤ 1625	-80+ 66/15 (f-1610)	700Hz	
1541 ≤ f ≤ 1608	-75	1MHz	Averaged over any 2millisecond active transmission interval
1608≤ f ≤ 1610	-75 + 5/2 (f-1608)	1MHz	
1610≤ f ≤ 1627.5	-70+ 57/17.5 (f-1610)	1MHz	
1627.5	-37	4kHz	
1638.5 ≤f ≤ 1645.5	-28	4kHz	
1657.5 ≤f ≤ 1660.5	-28	4kHz	
NOTE 1: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna.			

6.5.4 Transmit intermodulation

6.5.4.1 Test purpose

To verify that the UE transmit intermodulation does not exceed the described value in the test requirement.

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.5.4.2 Test applicability

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

6.5.4.3 Minimum conformance requirements

UE transmit intermodulation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each transmitter antenna port with the other antenna port(s) if any terminated. Both the wanted signal power and the intermodulation product power are measured through NR rectangular filter with measurement bandwidth shown in Table 6.5.4.3-1.

The requirement of transmit intermodulation is specified in Table 6.5.4.3-1.

Table 6.5.4.3-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel centre	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40dBc	
Intermodulation product	< -29dBc	< -35dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCSs for the channel BW as defined in Table 6.5.2.4.1.3-1	
Measurement offset from channel centre	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.4.

6.5.4.4 Test description

6.5.4.4.1 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, and are shown in table 6.5.4.4.1-1. 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 6.5.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 2)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (NOTE 1)**
1	N/A for transmit intermodulation test case	DFT-s-OFDM PI/2 BPSK	Inner Full
2		DFT-s-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.3.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.5.4.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.5.4.4.3.

6.5.4.4.2 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 6.5.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands to the UE until the UE transmits at its P_{UMAX} level.

3. Measure the rectangular filtered mean power of the UE. For TDD, only slots consisting of only UL symbols are under test for the wanted signal and for the intermodulation product.

4. Set the interference signal frequency below the UL carrier frequency using the first offset in table 6.5.4.5-1.

5. Set the interference CW signal level according to table 6.5.4.5-1.

6. Search the intermodulation product signals below and above the UL carrier frequency, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.

7. Set the interference signal frequency above the UL carrier frequency using the first offset in table 6.5.4.5-1.

8. Search the intermodulation product signals below and above the UL carrier frequency, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.

9. Repeat the measurement using the second offset in table 6.5.4.5-1.

6.5.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exception:

Table 6.5.4.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.5.4.5 Test requirement

The ratio derived in step 6 and 8, shall not exceed the described value in table 6.5.4.5-1.

Table 6.5.4.5-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel centre	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40dBc	
Intermodulation product	< -29dBc	< -35dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCSs for the channel BW as defined in Table 6.5.2.4.1.5-1	
Measurement offset from channel centre	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$
Note 1: The test requirements do not apply when the interfering signal overlaps with the channel bandwidth of the downlink signal.		

6.5A Output RF spectrum emissions for CA

6.5A.1 Occupied bandwidth for CA

6.5A.1.0 Minimum conformance requirements

6.5A.1.0.1 Void

6.5A.1.0.1a Occupied bandwidth for Intra-band contiguous CA

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.3A.3.

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

For intra-band non-contiguous carrier aggregation, the OBW requirement is met when the ratio of the transmitted power in all sub-blocks of the uplink CA configuration to the total integrated power of the transmitted spectrum is greater than 99%.

6.5A.1.0.3 Occupied bandwidth for Inter-band CA

For inter-band carrier aggregation with uplink assigned to two NR bands, the occupied bandwidth is defined per component carrier. Occupied bandwidth is the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on assigned channel bandwidth on the component carrier. The occupied bandwidth shall be less than the channel bandwidth specified in Table 6.5.1.3-1.

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

Editor's Note:

- Due to lack of MPR requirements in core specification, this test case is incomplete for intra-band contiguous UL CA for power class 2 UEs indicating IE dualPA-Architecture supported, and incomplete for intra-band non-contiguous UL CA for power class 2 UEs, and power class 3 UEs when signalling is absent for dualPA-Architecture.

- MU needs to be reassessed.

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 for 2 UL CA

6.5A.1.1.2 Test applicability

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

6.5A.1.1.3 Minimum conformance requirements

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

6.5A.1.1.4 Test description

6.5A.1.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 6.5A.1.1.4.1-1 for inter-band UL CA, table 6.5A.1.1.4.1-2 for intra-band contiguous CA and table 6.5A.1.1.4.1-3 for intra-band non-contiguous CA. 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: Inter band CA Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Mid range for both PCC and SCC (NOTE 4)</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Lowest N_{RB_agg} for both PCC and SCC
Highest N_{RB_agg} for both PCC and SCC</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="3">Smallest supported SCS per Channel Bandwidth</td></tr>
<tr><th colspan="5">Test Parameters</th></tr>
<tr><th rowspan="3">Test ID</th><th rowspan="3">Downlink Configuration for PCC & SCC</th><th colspan="3">Uplink Configuration</th></tr>
<tr><th rowspan="2">Modulation for all CCs (NOTE 2)</th><th colspan="2">RB allocation (NOTE 1)</th></tr>
<tr><th>PCC</th><th>SCC</th></tr>
<tr><td>1</td><td>N/A for this test</td><td>CP-OFDM QPSK</td><td>Outer_Full</td><td>Outer_Full</td></tr>
<tr><td colspan="5">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 2: CA Configuration Test CC Combination settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.3A.4-1.
NOTE 3: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.3-1.
NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.</td></tr>
</table>

Table 6.5A.1.1.4.1-2: Intra band contiguous CA Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		All aggregated channel bandwidth	
Test SCS as specified in Table 5.3.5-1		Smallest supported SCS per Channel Bandwidth	
Test Parameters			
Test ID	**Downlink Configuration for PCC & SCC**	**Uplink Configuration**	
		Modulation for all CCs (NOTE 2)	**RB allocation (NOTE 1)**
1	N/A for this test	CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1A-1a. NOTE 2: CA Configuration Test CC Combination settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest NRB_PCC is tested.			

Table 6.5A.1.1.4.1-3: Intra band non-contiguous CA Test Configuration Table

Initial Conditions									
Test Environment as specified in TS 38.508-1 [5] subclause 4.1					Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1					For test frequencies refer to “Range” columns				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1					All aggregated channel bandwidth				
Test SCS as specified in Table 5.3.5-1					Smallest supported SCS per Channel Bandwidth				
Test Parameters									
ID	**CA config**					**DL config**	**UL config**		
	PCC		**SCC**		**W_{gap}**		**CC MOD**	**RB allocation (NOTE 1)**	
	Band	**Range**	**Band**	**Range**				**PCC**	**SCC**
1	nX	CC1	nX	CC2	Max (NOTE 4)	N/A	CP-OFDM QPSK	Outer_Full	Outer_Full
NOTE 1: The RB allocation is defined in table 6.1-1 for each CC. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A.2-1. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested. NOTE 4: The Wgap is defined to be widest possible on band based on the PCC and SCC configuration									

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2.1 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5A.1.1.4.1-1 to Table 6.5A.1.1.4.1-3.
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 [5] 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 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.5A.1.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).
4. 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 or Table 6.5A.1.1.4.1-2 as appropriate. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
5. Send continuously power control “up” commands to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.
6. **For inter-band CA:** measure the power spectrum distribution of both PCC and SCC within two times or more range over the requirement for Occupied Bandwidth specification centring on the current carrier frequency.

For Intra-band contiguous CA: measure the power spectrum distribution over all component carriers within two times or more range over the aggregated channel bandwidth requirement for Occupied Bandwidth specification centring on the centre of aggregated channel bandwidth. The characteristics of the filter shall be approximately Gaussian (typical spectrum analyser filter). Other methods to measure the power spectrum distribution are allowed. The measuring duration is at least 1ms over consecutive active uplink slots.

For intra-band non-contiguous CA: measure the power spectrum distribution of each sub-block over all component carriers within the requirement for Occupied Bandwidth for CA specification, centring on the carrier frequency of each sub-block in CA configuration. The characteristic of the filter shall be approximately Gaussian (typical spectrum analyzer filter). Other methods to measure the power spectrum distribution are allowed. The measuring duration is one active uplink subframe. For TDD slots with transient periods are not under test.

7. Calculate the total power within the range of all frequencies measured in step 6 and save this value as “Total power”. “Total power” is calculated for each CC separately for inter-band carrier aggregation, and for all CCs together for intra-band contiguous and non-contiguous carrier aggregation.
8. Identify the measurement window whose centre is aligned on the centre of the channel bandwidth on each carrier for inter-band carrier aggregation, or on the centre of the aggregated channel bandwidth for intra-band contiguous carrier aggregation or centring on each carrier frequency of each sub-block for which the sum of the power measured is 99% of the “Total power”.
9. The “Occupied Bandwidth” is the width of the measurement window obtained in step 8.

6.5A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.5A.1.1.4.3-1: FrequencyInfoUL-SIB for inter-band CA

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		Power class 3 and Inter-band CA

Table 6.5A.1.1.4.3-2: FrequencyInfoUL-SIB for intra-band contiguous CA (contiguous RB allocation)

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	15		Power class 3 and Bandwidth class B
	10		Power class 3 and Bandwidth class C

6.5A.1.1.5 Test requirements

For inter-band carrier aggregation, he measured Occupied Bandwidth for each component carrier shall not exceed values in Table 6.5A.1.1.5-1.

Table 6.5A.1.1.5-1: Occupied channel bandwidth

	NR channel bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Occupied channel bandwidth (MHz)	5	10	15	20	25	30	40	50	60	70	80	90	100

For intra-band contiguous carrier aggregation, the measured Occupied Bandwidth shall not exceed the aggregated channel bandwidth as defined in subclause 5.3A.3.

For intra-band non-contiguous carrier aggregation, the measured Occupied Bandwidth shall not exceed values of channel bandwidth as defined in section 5.5A.2.

6.5A.2 Out of band emission for CA

6.5A.2.1 General

This clause contains requirements for out of band emissions for UE configured of carrier aggregation.

6.5A.2.2 Spectrum emission mask

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

- This test case in incomplete when signalling is absent for dualPA-Architecture IE due to lack of core requirements.

6.5A.2.2.0 Minimum conformance requirements

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the aggregated channel bandwidth. For intra-band contiguous carrier aggregation, the power of any UE emission shall not exceed the levels specified in Table 6.5A.2.2.0-1 for the specified channel bandwidth.

For power class 2 intra-band contiguous carrier aggregation, the spectrum emission mask is measured as the sum from both UE transmit antenna connectors when UE indicates support for *dualPA-Architecture* IE.

Table 6.5A.2.2.0-1: General NR CA spectrum emission mask

Δf_{OOB} (MHz)	**Spectrum emission limit(dBm)**	**MBW(MHz)**
± 0 - 1	-13	Min(0.01*$BW_{channel\_CA}$, 0.4)
± 1 - 5	-10	1MHz
± 5 – $BW_{channel\_CA}$	-13	1MHz
±$BW_{channel\_CA}$-$BW_{channel\_CA}$+5	-25	1MHz

For intra-band non-contiguous carrier aggregation the spectrum emission mask requirement is defined as a composite spectrum emissions mask. Composite spectrum emission mask applies to frequencies up to ΔfOOB starting from the edges of the sub-blocks. Composite spectrum emission mask is defined as follows:

a) Composite spectrum emission mask is a combination of individual sub-block spectrum emissions masks

b) In case the sub-block consist of one component carrier the sub-lock general spectrum emission mask is defined in subclause 6.5.2.2

c) If for some frequency sub-block spectrum emission masks overlap then spectrum emission mask allowing higher power spectral density applies for that frequency

d) If for some frequency a sub-block spectrum emission mask overlaps with the sub-block bandwidth of another sub-block, then the emission mask does not apply for that frequency.

When signalling for dualPA-Architecture IE is absent, carrier leakage or I/Q image may land inside the gap spectrum between 2 UL CCs when UL CCs are synchronized with frequencies in the gap.

For inter-band carrier aggregation with uplink assigned to two NR bands, the minimum conformance requirements specified in subclause 6.5.2.2 shall apply on each component carrier with all component carriers active. If for some frequency spectrum emission masks of component carriers overlap then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency a component carrier spectrum emission mask overlaps with the channel bandwidth of another component carrier, then the emission mask does not apply for that frequency.

6.5A.2.2.1 Spectrum emission mask for CA (2UL CA)

6.5A.2.2.1.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth for 2UL 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 2UL CA.

6.5A.2.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in subclause6.5A.2.2.0.

6.5A.2.2.1.4 Test description

6.5A.2.2.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Tables 6.5A.2.2.1.4.1-1 through 6.5A.2.2.1.4.1-3. 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: Inter band CA Test Configuration Table

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1			Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest N_{RB_agg} for both PCC and SCC Highest N_{RB_agg} for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1			Smallest and biggest supported SCS per Channel Bandwidth		
Test Parameters					
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**		
			Modulation (NOTE 3)	**RB allocation (NOTE 1)**	
				PCC	**SCC**
1[3]	Low	N/A	DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left	Edge_1RB_Left
2[3]	High		DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right	Edge_1RB_Right
3	Low		DFT-s-OFDM QPSK	Edge_1RB_Left	Edge_1RB_Left
4	High		DFT-s-OFDM QPSK	Edge_1RB_Right	Edge_1RB_Right
5	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left	Edge_1RB_Left
6	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right	Edge_1RB_Right
7	Default		DFT-s-OFDM 64 QAM	Outer_Full	Outer_Full
8	Default		DFT-s-OFDM 256 QAM	Outer_Full	Outer_Full
9	Low		CP-OFDM QPSK	Edge_1RB_Left	Edge_1RB_Left
10	High		CP-OFDM QPSK	Edge_1RB_Right	Edge_1RB_Right
11	Low		CP-OFDM 16 QAM	Edge_1RB_Left	Edge_1RB_Left
12	High		CP-OFDM 16 QAM	Edge_1RB_Right	Edge_1RB_Right
13	Default		CP-OFDM 64 QAM	Outer_Full	Outer_Full
14	Default		CP-OFDM 256 QAM	Outer_Full	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.					

Table 6.5A.2.2.1.4.1-2: Intra-band contiguous CA Test Configuration Table for PC3 and PC2

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1		Low range High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg}, Highest N_{RB_agg} (NOTE 1)		
Test SCS as specified in Table 5.5A.3-1		Lowest, Highest		
Test Parameters for CA bandwidth class B and C				
Test ID	**DL configuration for PCC & SCC**	**UL configuration**		
		Modulations for all CCs (NOTE 2)		**RB allocation (NOTE 3)**
1	N/A	DFT-s-OFDM	Pi/2 BPSK	Outer Full
2			QPSK	Outer Full
3			16QAM	Outer Full
4			64QAM	Outer Full
5			256QAM	Outer Full
6		CP-OFDM	QPSK	Outer Full
7			16QAM	Outer Full
8			64QAM	Outer Full
9			256QAM	Outer Full
NOTE 1: The Test CC Combination settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1. NOTE 3: The specific configuration of each RB allocation is defined in Table 6.1A-1a. NOTE 4: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest N_{RB_PCC} is tested.				

Table 6.5A.2.2.1.4.1-3: Intra-band non-contiguous CA Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest for both PCC and SCC Highest for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1		Smallest and biggest supported SCS per Channel Bandwidth		
Test Parameters				
Test ID	**Downlink Configuration**	**Uplink Configuration**		
		Modulation (NOTE 4)	**RB allocation (NOTE 2)**	
			PCC	**SCC**
1	N/A	DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left	Edge_1RB_Right
2		DFT-s-OFDM QPSK	Edge_1RB_Left	Edge_1RB_Right
3		DFT-s-OFDM 16 QAM	Edge_1RB_Left	Edge_1RB_Right
4		DFT-s-OFDM 64 QAM	Edge_1RB_Left	Edge_1RB_Right
5		DFT-s-OFDM 256 QAM	Edge_1RB_Left	Edge_1RB_Right
6		CP-OFDM QPSK	Edge_1RB_Left	Edge_1RB_Right
7		CP-OFDM 16 QAM	Edge_1RB_Left	Edge_1RB_Right
8		CP-OFDM 64 QAM	Edge_1RB_Left	Edge_1RB_Right
9		CP-OFDM 256 QAM	Edge_1RB_Left	Edge_1RB_Right
NOTE 1: This test configuration is only applicable for UEs indicating IE *dualPA-Architecture* supported NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 3: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1. NOTE 4: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Tables 6.5A.2.2.1.4.1-1 through 6.5A.2.2.1.4.1-3 as appropriate.

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 [5] 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 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.5A.2.2.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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 6.5A.2.2.1.4.1-1 through 6.5A.2.2.1.4.1-3 on both PCC and SCC as

appropriate. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Send continuously power control “up” commands in every uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.

6. For inter-band CA: measure the mean power of the UE in the channel bandwidth of the radio access mode for each CC according to the test configuration, which shall meet the requirements described in clause 6.2A.2. The period of the measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD slots with transient periods are not under test.

   For intra-band CA: measure the mean power over all component carriers in the CA configuration of the radio access mode, which shall meet the requirements described in clause 6.2A.2. The period of the measurement shall be at least the continuous duration of one active sub-frame (1ms) and in the uplink symbols. For TDD slots with transient periods are not under test.

7. For inter-band CA: measure the power of the transmitted signal with a measurement filter of bandwidths for each CC according to Table 6.5A.2.2.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

   For intra-band contiguous CA: measure the power of the transmitted signal with a measurement filter of bandwidths according to table 6.5A.2.2.1.5-3. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs. For power class 2 UE, the power is measured as the sum from both UE transmit antenna connectors when UE indicates support for *dualPA-Architecture* IE.

   For intra-band non-contiguous CA: measure the power of the transmitted signal with a measurement filter of bandwidths for each CC according to Table 6.5A.2.2.1.5-1 except the Wgap area. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5A.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.5A.2.2.1.4.3-1: FrequencyInfoUL-SIB for inter-band CA

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		Power class 3 and Inter-band CA Test IDs 3, 4, 7
	17		Power class 3 and Inter-band CA Test IDs 5, 6, 13
	16		Power class 3 and Inter-band CA Test IDs 1, 2, 8-12
	14		Power class 3 and Inter-band CA Test IDs 14

Table 6.5A.2.2.1.4.3-2: FrequencyInfoUL-SIB for intra-band contiguous CA

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		Power class 3 and Inter-band CA Test IDs 2
	17		Power class 3 and Inter-band CA Test IDs 3
	16		Power class 3 and Inter-band CA Test IDs 1, 4, 5, 6
	14		Power class 3 and Inter-band CA Test IDs 7
	15		Power class 2 and Test IDs 1, 2, 3, 4
	14		Power class 2 and Test IDs 5, 6, 7, 8, 9

6.5A.2.2.1.5 Test requirement

The measured UE mean power in the applicable channel bandwidth, derived in step 6, shall fulfil requirements in clause 6.2A.2 as appropriate, and the power of any UE emission, derived in step 7, shall fulfil requirements in Table 6.5A.2.2.1.5-1 for inter-band CA and table 6.5A.2.2.1.5-3 for intra-band contiguous CA. If for some frequency spectrum emission masks of component carriers overlap then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency a component carrier spectrum emission mask overlaps with the channel bandwidth of another component carrier, then the emission mask does not apply for that frequency.

Table 6.5A.2.2.1.5-1: NR General spectrum emission mask

<table>
<tr><th colspan="15">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>ΔfOOB (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>70 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0-1</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1 % channel bandwidth</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-24</td><td>-24</td><td>-24</td><td>-24</td><td>-24</td><td>-24</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td rowspan="22">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13+TT</td><td rowspan="2">-13+TT</td><td rowspan="3">-13+TT</td><td rowspan="4">-13+TT</td><td rowspan="5">-13+TT</td><td rowspan="6">-13+TT</td><td rowspan="8">-13+TT</td><td rowspan="10">-13+TT</td><td rowspan="12">-13+TT</td><td rowspan="14">-13+TT</td><td rowspan="16">-13+TT</td><td rowspan="18">-13+TT</td><td rowspan="20">-13+TT</td></tr>
<tr><td>± 6-10</td><td>-25+TT</td></tr>
<tr><td>± 10-15</td><td></td><td>-25+TT</td></tr>
<tr><td>± 15-20</td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 20-25</td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 25-30</td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 30-35</td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 35-40</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 40-45</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 45-50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 50-55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 55-60</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 60-65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 65-70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 70-75</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 75-80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-85</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 85-90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 90-95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 95-100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 100-105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td colspan="15">Note 1: The first and last measurement position with a 30 kHz filter is at ΔfOOB equals to 0.015 MHz and 0.985 MHz.
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.</td></tr>
</table>

Table 6.5A.2.2.1.5-2: Test Tolerance for Spectrum emission mask

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	1.5dB	1.8dB
40MHz < BW ≤ 100MHz	1.5dB	1.8dB

Table 6.5A.2.2.1.5-3: NR General spectrum emission mask for intra-band contiguous CA

Δf_{OOB} (MHz)	Spectrum emission limit (dBm)	MBW (MHz)
± 0 - 1	-13+TT	Min(0.01*$BW_{channel\_CA}$, 0.4)
± 1 - 5	-10+TT	1MHz
± 5 – $BW_{channel\_CA}$	-13+TT	1MHz
±$BW_{channel\_CA}$-$BW_{channel\_CA}$+5	-25+TT	1MHz

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.

6.5A.2.4 Adjacent channel leakage ratio

6.5A.2.4.1 NR ACLR

6.5A.2.4.1.0 Minimum conformance requirements

6.5A.2.4.1.0.1 NR ACLR for intra-band contiguous CA

For intra-band contiguous carrier aggregation the carrier aggregation the Adjacent Channel Leakage power Ratio is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power and adjacent aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.4.1.0.1-1. If the measured adjacent channel power is greater than –50dBm then the NR_{ACLR} shall be higher than the value specified in Table 6.5A.2.4.1.0.1-1.

Table 6.5A.2.4.1.0.1-1: General requirements for intra-band contiguous CA ACLR

	ACLR / Measurement bandwidth
CA ACLR	30 dB
CA Measurement bandwidth (NOTE 1)	Nominal channel space+$MBW_{ACLR,low}$/2+ $MBW_{ACLR,high}$/2
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
Difference between ACLR MBW center and $F_{c,low}$	MBW_{shift}= (MBW_{ACLR_CA}-$MBW_{ACLR,low}$)/2
NOTE 1: $MBW_{ACLR,low}$ and $MBW_{ACLR,high}$ are the single-channel ACLR measurement bandwidths specified for channel bandwidths $BW_{channel(low)}$ and $BW_{channel(high)}$ in 6.5.2.4.1.3, respectively.	

6.5A.2.4.1.0.2 NR ACLR for intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation, CA Adjacent Channel Leakage power Ratio(CA_{ACLR}) is the ratio of the sum of the filtered mean power centred on each assigned channel frequency to the filtered mean power centred on an adjacent NR channel frequency at nominal channel spacing. In case the gap bandwidth Wgap between 2 uplink CCs is smaller than maximum of the 2 uplink channel bandwidths then no CA_{ACLR} requirement is set for the gap. Each assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.5.2.4.1.3-1. If the measured adjacent channel power is greater than –50dBm then the ACLR shall be higher than the value specified in Table 6.5A.2.4.1.0.2-1.

Table 6.5A.2.4.1.0.2-1: General requirements for intra-band non-contiguous CA ACLR

	ACLR / Measurement bandwidth
CA ACLR	30 dB
CA Measurement bandwidth for each sub block (NOTE 1)	MBW_{ACLR}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel}$ / - $BW_{Channel}$
NOTE 1: MBW_{ACLR} is the single-channel ACLR measurement bandwidths specified in 6.5.2.4.1.3.	

When the signalling is absent for dualPA-Architecture IE, if carrier leakage or I/Q image lands inside the gap spectrum between 2 UL CCs when UL CCs are synchronized with frequencies in the gap , exception to the ACLR requirement with 3dB relaxation applies.

6.5A.2.4.1.0.3 NR ACLR for Inter-band CA

For inter-band carrier aggregation with uplink assigned to two NR bands, the NR Adjacent Channel Leakage power Ratio (NRACLR) is defined per component carrier while both component carriers are active and the requirement is specified in clause 6.5.2.4.1.3.

6.5A.2.4.1.1 NR ACLR for CA (2UL CA)

Editor's Note: The following aspects are not yet determined:

- MU and TT for aggregate BW>100MHz are FFS.

6.5A.2.4.1.1.1 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 2UL CA.

6.5A.2.4.1.1.2 Test applicability

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

6.5A.2.4.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in subclause 6.5A.2.4.1.0.

6.5A.2.4.1.1.4 Test description

6.5A.2.4.1.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in the test configuration tables in clause 6.2A.2.1.4.1. 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.2.4.1.1.4.1-1: Void

Table 6.5A.2.4.1.1.4.1-2: Void

Table 6.5A.2.4.1.1.4.1-3: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2A.2.1.4.1.
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 [5] clause 4.5. Message contents are defined in clause 6.5A.2.4.1.1.4.3

6.5A.2.4.1.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.5A.2.4.1.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).
4. 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 the test configuration tables in clause 6.2A.2.1.4.1 on both PCC and SCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
5. Send continuously power control “up” commands in every uplink scheduling information to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
6. Measure the sum of mean transmitted power over all component carriers in the CA configuration of the radio access mode, as measured in step 6 of 6.2A.2.1.4.2, which shall meet the requirements in clause 6.2A.2.1.5 as appropriate.
7. For intra-band contiguous 2UL CA UE, execute 7a) to 7c):

   7a) Measure the rectangular filtered mean power for the assigned NR aggregated channel bandwidth.

   7b) Measure the rectangular filtered mean power of the first NR adjacent aggregated channel on both lower and upper side of the assigned NR channel, respectively.

   7c) Calculate the ratios of the power between the values measured in step 7a) over step 7b) for lower and upper CA NR_{ACLR}, respectively.

8. For intra-band non-contiguous 2UL CA UE, execute 8a) to 8e):

   8a) Measure the rectangular filtered mean power for the assigned NR channel on the lowest sub-block and highest sub-block respectively.

   8b) Measure the rectangular filtered mean power of the first NR adjacent channel on lower side of the lowest sub-block, and the higher side of the highest sub-block (out of gap measurement).

   8c) If Wgap is larger or equeal to either of the sub-block bandwidths, perform this step, otherwise continue to next step. Measure the rectangular filtered mean power of the first NR adjacent channel on higher side of the lowest sub-block, and/or the lower side of the highest sub-block (in gap measurement).

   8d) Calculate the ratio of the power between the values measured in step 8a) over step 8b) for CA NR_{ACLR} (out of gap measurement).

8e) Calculate the ratio of the power between the values measured in step 8a) over step 8c) for CA NR_{ACLR} (in gap measurement).

9. For inter-band 2UL CA UE, execute 9a) to 9f):

9a) Measure the rectangular filtered mean power for the assigned NR channel on PCC.

9b) Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR channel on PCC, respectively.

9c) Calculate the ratios of the power between the values measured in step 7 over step 8 for lower and upper NR ACLR, respectively.

9d) Measure the rectangular filtered mean power for the assigned NR channel on SCC.

9e) Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR channel on SCC, respectively.

9f) Calculate the ratios of the power between the values measured in step 9d over step 9e for lower and upper NR ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2A.2.1.4.1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5A.2.4.1.1.4.3 Message contents

Message contents are same as 6.2A.2.1.4.3.

Table 6.5A.2.4.1.1.4.3-1: Void

6.5A.2.4.1.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 6, shall fulfil requirements in clause 6.2A.2.1 as appropriate, and if the measured adjacent channel power is greater than -50 dBm, then the measured NR ACLR derived in step 7c, step 8e, step 6c and step 9f, shall be higher than the limits in Table 6.5A.2.4.1.1.5-1, 6.5A.2.4.1.1.5-2 and 6.5A.2.4.1.1.5-3 respectively.

Table 6.5A.2.4.1.1.5-1: General requirements for intra-band contiguous CA ACLR

	ACLR / Measurement bandwidth
CA ACLR	30 - TT dB
CA Measurement bandwidth (NOTE 1)	Nominal channel space+$MBW_{ACLR,low}$/2+ $MBW_{ACLR,high}$/2
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$
Difference between ACLR MBW center and $F_{c,low}$	MBW_{shift}= (MBW_{ACLR_CA}-$MBW_{ACLR,low}$)/2
NOTE 1: $MBW_{ACLR,low}$ and $MBW_{ACLR,high}$ are the single-channel ACLR measurement bandwidths specified for channel bandwidths $BW_{channel(low)}$ and $BW_{channel(high)}$ in 6.5.2.4.1, respectively.	

Table 6.5A.2.4.1.1.5-2: General requirements for intra-band non-contiguous CA ACLR

	ACLR / Measurement bandwidth
CA ACLR	30 - TT dB
CA Measurement bandwidth for each sub block (NOTE 1)	MBW_{ACLR}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel}$ / - $BW_{Channel}$
NOTE 1: MBW_{ACLR} is the single-channel ACLR measurement bandwidths specified in 6.5.2.4.1.	

Table 6.5A.2.4.1.1.5-3: General requirements for inter-band CA ACLR

	Power class 1	Power class 2	Power class 3
NR ACLR		31 - TT dB	30 - TT dB

Table 6.5A.2.4.1.1.5-4: NR ACLR measurement bandwidth for inter-band CA

NR channel bandwidth / NR ACLR measurement bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
NR ACLR measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	78.15	88.23	98.31

Table 6.5A.2.4.1.1.5-5: Test Tolerance for NR ACLR

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 100MHz	0.8dB	0.8dB
Aggregated BW ≤ 200MHz	FFS	FFS

6.5A.2.4.2 UTRA ACLR

Editor's note:

- No UTRA ACLR minimum requirements for intra-band CA are specified in RAN4

6.5A.2.4.2.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the UTRA Adjacent Channel Leakage power Ratio (UTRA ACLR) is defined per component carrier while both component carrier are active and the requirement is specified in clause 6.5.2.4.2.3.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5A.2.4.2.

6.5A.2.4.2.1 UTRA ACLR for CA (2UL CA)

6.5A.2.4.2.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent UTRA channels in terms of Adjacent Channel Leakage power Ratio (UTRA ACLR) for 2UL CA.

6.5A.2.4.2.1.2 Test applicability

This test case applies for network signalling values NS_3U, NS_5U, NS_43U, and NS_100 to all types of NR UE release 15 and forward that supports 2UL inter-band CA.

6.5A.2.4.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in subclause 6.5A.2.4.2.0.

6.5A.2.4.2.1.4 Test description

6.5A.2.4.2.1.4.1 Initial conditions

Same as in subclause 6.2A.3.1.4.1 with the following exepction;

- Only network signalling values NS_3U, NS_5U, NS_43U, and NS_100 with the corresponding CA configuration defined in Table 6.2A.3.1.4.1-1 need to perform UTRA ACLR test.
- Message contents in step 6 are defined in clause 6.5A.2.4.2.1.4.3.

6.5A.2.4.2.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.5A.2.4.2.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).
4. 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 the applicable test configuration tables in clause 6.2A.3.1.4.1 on both PCC and SCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
5. Send continuously power control “up” commands in every uplink scheduling information to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
6. Measure the sum of mean transmitted power over all component carriers in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of 1ms uplink. For TDD only slots consisting of only UL symbols are under test. For FDD band in inter-band CA with both TDD band and FDD band, only slots overlapping with only UL symbols in TDD are under test.
7. Measure the rectangular filtered mean power for the assigned NR channel on PCC.
8. Measure the RRC filtered mean power of the first and the second UTRA adjacent channel on both lower and upper side of the assigned NR channel on PCC, respectively.
9. Calculate the ratios of the power between the values measured in step 7 over step 8 for lower and upper UTRA ACLR, respectively.
10. Measure the rectangular filtered mean power for the assigned NR channel on SCC.
11. Measure the RRC filtered mean power of the first and the second UTRA adjacent channel on both lower and upper side of the assigned NR channel on SCC, respectively.
12. Calculate the ratios of the power between the values measured in step 10 over step 11 for lower and upper UTRA ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5A.2.4.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

6.5A.2.4.2.1.4.3.1 Message contents exceptions (network signalling value "NS_100" on PCC)

Table 6.5A.2.4.2.1.4.3.1-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_100" on PCC

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission*			
Information Element	**Value/remark**	**Comment**	**Condition**
AdditionalSpectrumEmission	1 (NS_100)		not for band n65
	2 (NS_100)		for band n65

6.5A.2.4.2.1.4.3.2 Message contents exceptions (network signalling value "NS_43U" on PCC)

Table 6.5A.2.4.2.1.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_43U" on PCC

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission*			
Information Element	**Value/remark**	**Comment**	**Condition**
AdditionalSpectrumEmission	3 (NS_43U)		

6.5A.2.4.2.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 6, shall fulfil requirements in clause 6.2A.3.1 as appropriate, and if the measured adjacent channel power is greater than –50 dBm, then the measured UTRA ACLR for each CC, derived in step 9 and step 13, shall be higher than the limits in Table 6.5A.2.4.2.1.5-2.

Table 6.5A.2.4.2.1.5-1: Measurement bandwidth for NR carrier

	NR channel bandwidth / UTRA ACLR measurement bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
NR channel measurement bandwidth (MHz)	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.15	88.23	98.31
UTRA channel Measurement bandwidth (MHz)	3.84												
1st Adjacent channel centre frequency offset	± 2.5 MHz from NR channel edge												
2nd Adjacent channel centre frequency offset	± 7.5 MHz from NR channel edge												

Table 6.5A.2.4.2.1.5-2: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB -TT
$UTRA_{ACLR2}$	36 dB - TT

Table 6.5A.2.4.2.1.5-3: Test Tolerance for UTRA ACLR

	f ≤ 3.0GHz	**3.0GHz < f ≤ 6GHz**
BW ≤ 100MHz	0.8dB	0.8dB

6.5A.3 Spurious emission for CA

6.5A.3.1 General spurious emissions for CA

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

- Extending the coverage of the TCs with intra-band CA scenarios is FFS

6.5A.3.1.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the spurious emission requirement Table 6.5.3.1.3-2 apply for the frequency ranges that are more than F_{OOB} as defined in Table 6.5.3.1.3-1 away from edges of the assigned channel bandwidth on a component carrier. If for some frequency a spurious emission requirement of individual component carrier overlaps with the spectrum emission mask or channel bandwidth of another component carrier then it does not apply.

NOTE 1: For inter-band carrier aggregation with uplink assigned to two NR bands the requirements in Table 6.5.3.1.3-2 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.5.3.1.3-2 would be considered to be verified by the measurements verifying the one uplink inter-band CA spurious emission requirement.

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.5A.3.1.0-1 from the edge of the aggregated channel bandwidth. For frequencies ΔfOOB greater than FOOB as specified in Table 6.5A.3.1.0-1 the spurious emission requirements in Table 6.5.3.1.3-2 are applicable.

Table 6.5A.3.1.0-1: Boundary between out of band and spurious emission domain for intra-band contiguous carrier aggregation

Aggregated Channel bandwidth	OOB boundary F_{OOB} (MHz)
$BW_{Channel\_CA}$	$BW_{Channel\_CA} + 5$

For intra-band non-contiguous carrier aggregation transmission the spurious emission requirement is defined as a composite spurious emission requirement. Composite spurious emission requirement applies to frequency ranges that are more than FOOB away from the edges of each carrier in the gap and out of the gap. Composite spurious emission requirement is defined as follows

a) Composite spurious emission requirement is a combination of individual sub-block spurious emission requirements

b) In case the sub-block consist of one component carrier the sub-lock spurious emission requirement and FOOB are defined in subclause 6.5.3.1

c) If for some frequency an individual sub-block spurious emission requirement overlaps with the general spectrum emission mask or the sub-block bandwidth of another sub-block then it does not apply

For the signalling is absent for dualPA-Architecture IE, if carrier leakage or I/Q image lands inside the gap spectrum between 2 UL CCs when UL CCs are synchronized with frequencies in the gap, exception to the general spurious requirement applies.

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5A.3.1

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

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 2UL CA.

6.5A.3.1.1.3 Minimum conformance requirements

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

6.5A.3.1.1.4 Test description

6.5A.3.1.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, 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: Inter band CA Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Low range for PCC and SCC High range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg} for both PCC and SCC Highest N_{RB_agg} for both PCC and SCC		
Test SCS as specified in Table 5.5A.3-1		Lowest		
Test Parameters				
Test ID	**Downlink Configuration**	**Uplink Configuration**		
		Modulation	**RB allocation (NOTE 1)**	
			PCC	**SCC**
1	N/A	CP-OFDM QPSK	Outer_Full	Outer_Full
2		CP-OFDM QPSK	Edge_1RB_Left	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
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 [5] 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. 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 [5] clause 5.1.1. Message contents are defined in clause 6.5A.3.1.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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 on both PCC and SCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

6. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5A.3.1.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5A.3.1.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5A.3.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.5A.3.1.1.4.3-1: FrequencyInfoUL-SIB

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	16		Power class 3 and Inter-band CA

6.5A.3.1.1.5 Test requirement

This clause specifies the requirements for the specified NR band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5A.3.1.1.5-1. The test requirement of configurations for CA operating band including Band n41 also apply for the corresponding CA operating bands with Band n90 replacing Band n41.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than Δf_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth. If for some frequency a spurious emission requirement of individual component carrier overlaps with the spectrum emission mask or channel bandwidth of another component carrier then it does not apply.

The measured average power of spurious emission, derived in step 6, shall not exceed the described value in Table 6.5A.3.1.1.5-1.

Table 6.5A.3.1.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement Bandwidth	Notes
Test requirements for CA_n3A-n78A Configuration			
270 MHz ≤ f ≤ 380 MHz	-36 dBm+TT	100 kHz	
1515MHz ≤ f ≤ 2090 MHz 3270 MHz ≤ f ≤ 3830 MHz 4815 MHz ≤ f ≤ 5890 MHz 6720 MHz ≤ f ≤ 7370 MHz 8310 MHz ≤ f ≤ 9385 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n8A-n78A Configuration			
780 MHz ≤f ≤1000 MHz	-36 dBm+TT	100 kHz	
1000MHz £ f £ 1015 MHz 1470 MHz £ f £ 2040 MHz 2385 MHz ≤ f ≤ 2920 MHz 3290 MHz ≤ f ≤ 3810 MHz 4180 MHz ≤ f ≤4715 MHz 5060 MHz ≤ f ≤5630 MHz 5685 MHz ≤ f ≤6720 MHz 7480 MHz ≤ f ≤8515 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n24A-n41A Configuration			
563 MHz ≤ f ≤ 825 MHz 835.5 MHz ≤ f ≤ 1000 MHz	-36 dBm+TT	100 kHz	
1000 MHz ≤ f ≤ 1063.5 MHz 3331.5 MHz ≤ f ≤ 3753.5 MHz 4122.5 MHz ≤ f ≤ 4350.5 MHz 5749 MHz ≤ f ≤ 6011 MHz 6618.5 MHz ≤ f ≤ 7040.5 MHz	-25 dBm+TT	1 MHz	
Test requirements for CA_n24A-n48A Configuration			
229 MHz ≤ f ≤ 447 MHz	-36 dBm+TT	100 kHz	
1889.5 MHz ≤ f ≤ 2073.5 MHz 5176.5 MHz ≤ f ≤ 5360.5 MHz 5439.5 MHz ≤ f ≤ 5773.5 MHz 6803 MHz ≤ f ≤ 7021 MHz 8726.5 MHz ≤ f ≤ 9060.5 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n24A-n77A Configuration			
21 MHz ≤ f < 30 MHz	-36 dBm+TT	10 kHz	
30 MHz ≤ f < 947 MHz	-36 dBm+TT	100 kHz	
1639.5 MHz ≤ f ≤ 2573.5 MHz 4926.5 MHz ≤ f ≤ 7521 MHz 8226.5 MHz ≤ f ≤ 10060.5 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n26A-n66A Configuration			
12 MHz ≤ f < 30 MHz	-36 dBm+TT	10 kHz	
30 MHz ≤ f ≤ 152 MHz 861 MHz ≤ f ≤ 966 MHz	-36 dBm+TT	100 kHz	
2524 MHz ≤ f ≤ 2746 MHz 3338 MHz ≤ f ≤ 3478 MHz 4234 MHz ≤ f ≤ 4409 MHz	-30 dBm+TT	1 MHz	

Test requirements for CA_n26A-n70A Configuration			
3 MHz ≤ f < 30 MHz	-36 dBm+TT	10 kHz	
30 MHz ≤ f < 82 MHz	-36 dBm+TT	100 kHz	
846 MHz ≤ f ≤ 896 MHz	-36 dBm+TT	100 kHz	
2509 MHz ≤ f ≤ 2606 MHz 3323 MHz ≤ f ≤ 3408 MHz 4204 MHz ≤ f ≤ 4269 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n28A-n41A Configuration			
1000MHz ≤ f ≤ 1284 MHz 1748MHz ≤ f ≤ 1987 MHz 3199MHz ≤ f ≤ 3438 MHz 3902MHz ≤ f ≤ 4186 MHz 4244MHz ≤ f ≤ 4677 MHz 5695MHz ≤ f ≤ 6128MHz	-25 dBm+TT	1MHz	
Test requirements for CA_n41A-n79A Configuration			
8 MHz ≤ f ≤30 MHz	-36 dBm+TT	10kHz	
30 MHz ≤ f ≤980 MHz	-36 dBm+TT	100kHz	
1710MHz ≤ f ≤ 2504MHz	-30 dBm+TT	1MHz	
6110MHz ≤ f ≤ 7690MHz			
9392MHz ≤ f ≤ 10380MHz			
11296MHz ≤ f ≤ 12690MHz			
Test requirements for CA_n48A-n66A Configuration			
10 MHz ≤ f < 30 MHz	-36 dBm+TT	10 kHz	
30 MHz ≤ f < 280 MHz	-36 dBm+TT	100 kHz	
1770 MHz ≤ f ≤ 1990 MHz 5260 MHz ≤ f ≤ 5690 MHz 6970 MHz ≤ f ≤ 7260 MHz 8810 MHz ≤ f ≤ 9180 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n48A-n70A Configuration			
130 MHz ≤ f ≤ 310 MHz	-36 dBm+TT	100 kHz	
1840 MHz ≤ f ≤ 2005 MHz 5245 MHz ≤ f ≤ 5705 MHz 6940 MHz ≤ f ≤ 7120 MHz 8795 MHz ≤ f ≤ 9110 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n48A-n71A Configuration			
2154 MHz ≤ f ≤ 2374 MHz 2852 MHz ≤ f ≤ 3037 MHz	-30 dBm+TT	1 MHz	

4213 MHz ≤ f ≤ 4398 MHz 4876 MHz ≤ f ≤ 5096 MHz 6402 MHz ≤ f ≤ 6737 MHz 7763 MHz ≤ f ≤ 8098 MHz			
Test requirements for CA_n66A-n71A Configuration			
314 MHz ≤ f < 454 MHz	-36 dBm+TT	100 kHz	
1012 MHz ≤ f ≤ 1117 MHz 2373 MHz ≤ f ≤ 2478 MHz 2722 MHz ≤ f ≤ 2897 MHz 3036 MHz ≤ f ≤ 3176 MHz 4083 MHz ≤ f ≤ 4258 MHz	-30 dBm+TT	1 MHz	
Test requirements for CA_n70A-n71A Configuration			
299 MHz ≤ f < 384 MHz 997 MHz ≤ f < 1000 MHz	-36 dBm+TT	100 kHz	
1000 MHz ≤ f ≤ 1047 MHz 2358 MHz ≤ f ≤ 2408 MHz 2692 MHz ≤ f ≤ 2757 MHz 3021 MHz ≤ f ≤ 3106 MHz 4053 MHz ≤ f ≤ 4118 MHz	-30 dBm+TT	1 MHz	

Table 6.5A.3.1.1.5-2: Test Tolerance for General spurious emissions

	f ≤ 3.0GHz	**3.0GHz < f ≤ 6GHz**
BW ≤ 40MHz	0	0
40MHz < BW ≤ 100MHz	0	0

6.5A.3.2 Spurious emission for UE co-existence

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

- Extending the coverage of the TCs with intra-band CA scenarios is FFS.

6.5A.3.2.0 Minimum conformance requirements

6.5A.3.2.0.1 Spurious emissions for UE co-existence for intra-band contiguous CA

This clause specifies the requirements for the specified intra-band contiguous carrier aggregation configurations for coexistence with protected bands, the requirements in Table 6.5A.3.2.0.1-1 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.

Table 6.5A.3.2.0.1-1: Requirements for uplink intra-band contiguous carrier aggregation

NR CA combination	Spurious emission						
	Protected Band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 50, 51, 52, 65, 66, 67, 68, 72, 74, 75, 76, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	2570	-	2575	+1.6	5	1, 2, 3
	Frequency range	2575	-	2595	-15.5	5	1, 2, 3
	Frequency range	2595	-	2620	-40	1	1, 2
CA_n41	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 24, 25, 26, 27, 28, 29, 30, 34, 39, 42, 44, 45, 48, 50, 51, 52, 65, 66, 70, 71, 73, 74, 85, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2, 4
	E-UTRA Band 9, 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	6
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	Frequency range	1884.5		1915.7	-41	0.3	5, 6
CA_n48	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n77	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	5
CA_n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	5
CA_n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 39, 40, 41, 42, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	5

NOTE 1: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.

NOTE 2: This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 3: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

NOTE 4: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2 MHz + N x L_{CRB} x RB_{size} kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 5: Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz.

NOTE 6: This requirement applies when the NR carrier is confined within 2545 – 2575 MHz or 2595 – 2645 MHz and the channel bandwidth is 10 or 20 MHz

6.5A.3.2.0.2 Void

6.5A.3.2.0.3 Spurious emissions for UE co-existence for Inter-band CA

For inter-band carrier aggregation with the uplink assigned to two NR bands, the requirements in Table 6.5A.3.2.0.3-1 and Table 6.5A.3.2.0.3-2 apply on each component carrier with both component carriers are active.

NOTE: For inter-band carrier aggregation with uplink assigned to two NR bands, the requirements in Table 6.5A.3.2.0.3-1 and Table 6.5A.3.2.0.3-2 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.5A.3.2.0.3-1 and Table 6.5A.3.2.0.3-2 would be considered to be verified by the measurements verifying the one uplink inter-band CA UE to UE co-existence requirements.

Table 6.5A.3.2.0.3-1: Requirements for uplink inter-band carrier aggregation (two bands)

NR CA combination	Spurious emission						
	Protected Band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31, 38, 40, 41, 72, 73 NR band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 32, 42, 43, 50, 51, 52, 65, 74, 75, 76 NR band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	15
	Frequency range	758	-	773	-30	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n1-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	NR band n77, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1880		1895	-40	1	4, 14
	Frequency range	1895		1915	-15.5	5	4, 7, 14
	Frequency range	1915		1920	+1.6	5	4, 7, 14
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n3-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31 38, 40, 41, 72	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 32, 42, 43, 50, 51, 74, 75, 76 NR band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	15
	Frequency range	758	-	773	-30	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	1880	-	1895	-40	1	4, 6

	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
	Frequency range	1839.9	-	1879.9	-50	1	4
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 11
CA_n3-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 43, 44. 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4
	UTRA Band 22, 42, 52 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n3-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n8-n78	E-UTRA Band 1, 8, 11, 20, 21, 28, 34, 39, 40, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 7, 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n78	UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 28, 34, 39, 41, 42, 65, 74, NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n78-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2-1 in TS 38.101-1 or Table 5.5-1 in TS 36.101

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2 MHz + N x L_{CRB} x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7 MHz

NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.

NOTE 5: Void.

NOTE: To simplify Table 6.5A.3.2.0.3-1, E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation or both E-UTRA and NR operation. NR band numbers are listed for bands which are specified only for NR operation.

Table 6.5A.3.2.0.3-2: Requirements for uplink inter-band carrier aggregation (two bands) Rel-16

NR CA Configuration	Spurious emission						
	Protected Band	Frequency range (Mhz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31, 38, 40, 41, 72, 73 NR band n79	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 32, 42, 43, 50, 51, 52, 65, 74, 75, 76 NR band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	15
	Frequency range	758	-	773	-30	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n1-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	NR band n77, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1880		1895	-40	1	4, 14
	Frequency range	1895		1915	-15.5	5	4, 7, 14
	Frequency range	1915		1920	+1.6	5	4, 7, 14
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7

CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n2A-n77A	E-UTRA Band 4, 5, 12, 13, 14, 17, 26, 29, 30, 41, 65, 66, 70, 71, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25	FDL_low	-	FDL_high	-50	1	2
CA_n3-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 43, 44. 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4
	UTRA Band 22, 42, 52 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n3-n41	E-UTRA Band 1, 5, 8, 11, 18, 19, 20, 21, 26, 27, 28, 34, 39, 44, 45, 50, 51, 65, 73, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 42, NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n3-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n5-n77	E-UTRA Band 1, 2, 3, 4, 8, 11, 12, 13, 14, 17, 18, 19, 21, 25, 26, 28, 29, 30, 34, 40, 65, 66, 70, 71, 74, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n8-n39	E-UTRA Band 1, 34, 40, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 22, 41, 42 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
CA_n8-n40	E-UTRA Bands 1, 5, 11, 18, 19, 20, 21, 26, 28, 31, 32, 33, 34, 38, 39, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Bands 3, 7, 22, 41, 42, 43, 52 NR Bands n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n8-n78	E-UTRA Band 1,8, 11, 20, 21, 28, 34, 39, 40, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 7, 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n28-n40	E-UTRA Band 1, 3, 5, 7, 8, 18, 19, 20, 26, 27, 28, 31, 34, 38, 41, 72	F_{DL_low}	-	F_{DL_high}	-50	1	

	E-UTRA Band 11, 21, 22, 32, 42, 43, 50, 51, 52, 65, 73, 74, 75, 76 NR band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n28-n41	E-UTRA Band 2, 3, 5, 8, 25, 26, 27, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 42, 50, 51, 52, 65, 66, 73, 74 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 18, 19	F_{DL_low}	-	F_{DL_high}	-50	1	11
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	13
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 11
CA_n39-n40	E-UTRA Band 1, 8, 22, 26, 28, 34, 41, 42, 44, 45, 50, 51, 52, 73, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805		1855	-40	1	8
	Frequency range	1855		1880	-15.5	5	4, 7, 8
CA_n39-n41	E-UTRA Band 1, 8, 26, 28, 34, 40, 42, 44, 45, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n39-n79	E-UTRA Band 1, 8, 28, 34, 40, 41, 44, 45	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4, 8
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n40-n41	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 27, 28, 34, 39, 42, 44, 45, 50, 51, 65, 73, 74, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n78	UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 28, 34, 39, 41, 42, 65, 74, NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n41-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 42, 44, 45, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3

CA_n48-n66	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 24, 25, 26, 27, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n66-n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 26, 27, 30, 43, 50, 51, 53, 66, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 42, 48, 70 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	4
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	4
CA_n66-n77	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 26, 29, 30, 41, 65, 66, 70, 71, 103	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n70-n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 26, 27, 30, 48, 66, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 7, 25, 41, 70, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	4
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-38	1	4

NOTE 1: FDL_low and FDL_high refer to each frequency band specified in Table 5.2-1 or Table 5.5-1 in TS 36.101
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz
NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 and Table 6.5A.3.1-1 from the edge of the channel bandwidth.
NOTE 5: Void.
NOTE 6: This requirement is applicable for any channel bandwidths within the range 1920 – 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 – 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 7: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 8: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz.
NOTE 9: Void.
NOTE 10: Void.
NOTE 11: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 12: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 13: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718 - 728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and Rbstart < 48.
NOTE 14: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
NOTE 15: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).

Table 6.5A.3.2.0.3-3: Requirements for uplink inter-band carrier aggregation (two bands) Rel-17

NR CA Configuration	Spurious emission						
	Protected Band	Frequency range (Mhz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7
CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1880	-	1895	-40	1	4, 6
	Frequency range	1895	-	1915	-15.5	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6	5	4, 6, 7

CA_n3-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n8-n39	E-UTRA Band 1, 34, 40, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 22, 41, 42 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
CA_n8-n78	E-UTRA Band 1,8, 11, 20, 21, 28, 34, 39, 40, 65, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 7, 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n24-n41	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
CA_n24-n48	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 41, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n24-n77	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 41, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n26-n66	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 24, 25, 26, 29, 30, 43, 47, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 42, 48, 53 NR band 77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n26-n70	E-UTRA Band 2, 5, 10, 12, 13, 14, 17, 24, 25, 29, 30, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41, 53	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n28-n41	E-UTRA Band 2, 3, 5, 8, 25, 26, 27, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 42, 50, 51, 52, 65, 66, 73, 74 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 18, 19	F_{DL_low}	-	F_{DL_high}	-50	1	11
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	13
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 11
CA_n39-n40	E-UTRA Band 1, 8, 22, 26, 28, 34, 41, 42, 44, 45, 50, 51, 52, 73, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805		1855	-40	1	8
	Frequency range	1855		1880	-15.5	5	4, 7, 8
CA_n39-n41	E-UTRA Band 1, 8, 26, 28, 34, 40, 42, 44, 45, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8

CA_n39-n79	E-UTRA Band 1, 8, 28, 34, 40, 41, 44, 45	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4, 8
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n41-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 42, 44, 45, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n48-n66	E-UTRA Band 2, 4, 5, 7, 12, 13, 14, 17, 24, 25, 26, 27, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n48-n70	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50	1	16
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50	1	2, 16
CA_n48-n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 30, 50, 51, 53, 66, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 70	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	15
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	15
CA_n66-n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 26, 27, 30, 43, 50, 51, 53, 66, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 25, 41, 42, 48, 70 NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	4
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-50	1	4
CA_n70-n71	E-UTRA Band 4, 5, 12, 13, 14, 17, 26, 27, 30, 48, 66, 74, 85	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2, 7, 25, 41, 70, NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 29	F_{DL_low}	-	F_{DL_high}	-38	1	4
	E-UTRA Band 71	F_{DL_low}	-	F_{DL_high}	-38	1	4

NOTE 1: FDL_low and FDL_high refer to each frequency band specified in Table 5.2-1 or Table 5.5-1 in TS 36.101
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz
NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 and Table 6.5A.3.1-1 from the edge of the channel bandwidth.
NOTE 5: Void.
NOTE 6: This requirement is applicable for any channel bandwidths within the range 1920 – 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 – 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 7: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 8: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz.
NOTE 9: Void.
NOTE 10: Void.
NOTE 11: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 12: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 13: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718 - 728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and Rbstart < 48.
NOTE 14: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
NOTE 15: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 16: The same configuration applies to corresponding NR-DC configuration in Table 4.3.1.1.7.1-1 in [5]. If UE supporting NR-DC configuration do not support the corresponding CA configuration, NR-DC configuration is used in this test.

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5A.3.2.

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

6.5A.3.2.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions for 2UL CA.

6.5A.3.2.1.2 Test applicability

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

6.5A.3.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in subclause 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, 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 configuration, 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: Inter band CA Test Configuration Table

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1	For test frequencies refer to “Range” columns.
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Refer to “PCC N_{RB}@SCS”and “SCC N_{RB}@SCS ” columns
Test SCS as specified in Table 5.5A.3-1	Lowest SCS for default test points. CA configuration specific test points: Refer to “PCC N_{RB}@SCS”and “SCC N_{RB}@SCS ” columns

Test Parameters for CA Configurations

ID	CA Configuration / N_{RB_agg} (Note 4)						DL Allocation			UL Allocation (Note 2,3)		
	CA Configuration				PCC N_{RB} @SCS	SCC N_{RB}@SCS	CC MOD	PCC & SCC RB allocation		CC MOD	PCC & SCC RB allocations (L_{CRB} @ RB_{start})	
	PCC		SCC					PCC	SCC			
	Band	Range	Band	Range								
Default Test Settings for a CA_XA-YA Configuration												
1	X	Low	Y	Low	Highest N_{RB}@SCS	Highest N_{RB}@SCS	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@0	1@0
2	X	High	Y	High	Highest N_{RB}@SCS	Highest N_{RB}@SCS	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@RB_{max}	1@RB_{max}
Test Settings for CA_n1A-n78A Configuration												
1	n1	High	n78	High	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@105	1@272
2	n1	Low	n78	3455MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@0	1@0
3	n1	Low	n78	3475MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@0	1@0
4	n1	High	n78	High	106@15kHz	106@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@105	106@0
5	n1	Low	n78	High	106@15kHz	106@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@0	106@0
Test Settings for CA_n2A-n77A Configuration												
1	n2	Low	n77	Mid	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@0	1@272
2	n2	High	n77	3900MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@99	1@200
3	n2	HIgh	n77	4000MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@99	1@272
Test Settings for CA_n3A-n78A Configuration												
1	n3	Mid	n78	Mid	160@15kHz	270@15kHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@160	1@270
2	n3	Mid	n78	Mid	78@30KHz	273@30KHz	CP-OFDM QPSK	NA		CP-OFDM QPSK	1@78	1@273

3	n3	Mid	n78	Mid	38@60KHz	135@60KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@38	1@135
Test Settings for CA_n5A-n77A Configuration											
1	n5	High	n77	Mid	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@105	1@29
2	n5	Low	n77	Mid	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@272
3	n5	Low	n77	4053.06MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
4	n5	Low	n77	3600MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
5	n5	Low	n77	3658.14MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
6	n5	Low	n77	3540.54MHz	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
7	n5	High	n77	High	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@105	1@272
Test Settings for CA_n24A-n41A Configuration											
1	n24	High	n41	Low	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@136
2	n24	Low	n41	Low	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@52	1@108
3	n24	High	n41	Low	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@136
4	n24	Low	n41	Low	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@94
5	n24	High	n41	High	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@192
Test Settings for CA_n24A-n48A Configuration											
1	n24	High	n48	Mid	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@136
2	n24	High	n48	High	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
Test Settings for CA_n24A-n77A Configuration											
1	n24	Low	n77	Mid	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@136
2	n24	Low	n77	3930 MHz	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@273
3	n24	Low	n77	3930 MHz	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@262

4	n24	Low	n77	3930 MHz	52@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@52	1@196
Test Settings for CA_n26A-n66A Configuration											
1	n26	High	n66	High	106@15kHz	216@15kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@105	1@0
Test Settings for CA_n26A-n70A Configuration											
1	n26	Low	n70	Low	106@15kHz	79@15kHz	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
Test Settings for CA_n8A-n78A Configuration											
1	n8	Mid	n78	Mid	106@15kHz	270@15kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
2	n8	Mid	n78	Mid	106@15kHz	270@15kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@106	1@270
3	n8	Low	n78	Low	51@30KHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@51	1@273
4	n8	Mid	n78	Mid	51@30KHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@51	1@273
Test Settings for CA_n28A-n41A Configuration											
1	n28	High	n41	High	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@105	1@272
2	n28	Low	n41	Mid	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
3	n28	Low	n41	High	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@272
4	n28	Low	n41	High	106@15kHz	273@30kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
Test Settings for CA_n41A-n79A Configuration											
1	n41	High	n79	4870MHz	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@272	1@0
2	n41	Mid	n79	Low	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@136	1@136
3	n41	High	n79	Low	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@272	1@272
4	n41	High	n79	4450MHz	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@272	1@136
5	n41	High	n79	4500MHz	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@272	1@136

6	n41	Mid	n79	Low	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@136	1@0
7	n41	High	n79	Mid	273@30KHz	273@30KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@272	1@136
Test Settings for CA_n48A-n66A Configuration											
1	n48	High	n66	Low	216@30kHz	216@15kHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@215	1@0
Test Settings for CA_n48A-n70A Configuration											
1	n48	High	n70	High	216@15KHz	79@15KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@215	1@78
2	n48	High	n70	Low	216@15KHz	79@15KHz	QPSK	NA	QPSK / CP-OFDM QPSK	1@215	1@0
Test Settings for CA_n48A-n71A Configuration											
1	n48	3550	n71	698	216@30kHz	106@15kHz	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@215	1@105
2	n48	High	n71	Mid	216@30kHz	106@15kHz	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@215	1@0
Test Settings for CA_n66A-n71A Configuration											
1	n66	Low	n71	Low	216@15 KHz	216@15 KHz	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
Test Settings for CA_n66A-n77A Configuration											
1	n66	High	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@215	1@272
2	n66	Low	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@119
3	n66	Low	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@167
4	n66	Low	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@231
5	n66	High	n77	Mid	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@215	1@100
6	n66	Low	n77	3892.11MHz	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@0
7	n66	High	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@215	1@93
8	n66	Low	n77	High	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@198

9	n66	Low	n77	Mid	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@47
10	n66	Low	n77	Highd	216@15kHz	273@30KHz	CP-OFDM QPSK	NA	CP-OFDM QPSK	1@0	1@216
Test Settings for CA_n70A-n71A Configuration											
1	n70	Low	n71	Low	79@15 KHz	106@15 KHz	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [6] subclause4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
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 [5] 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. Configure SCC according to Annex C.0, C.1, and Annex C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.5A.3.2.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).
4. 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 on both PCC and SCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
6. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.2.3-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.2.3-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5A.3.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with following exception.

Table 6.5A.3.2.1.4.3-1: FrequencyInfoUL-SIB

Derivation Path: TS 38.508-1 [5] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	16		Power class 3 and Inter-band CA

6.5A.3.2.1.5 Test requirement

Test requirements for Spurious Emissions UE Co-existence are the same as the minimum requirements. The measured average power of spurious emission, derived in step 6, shall not exceed the described value in Tables 6.5A.3.2.1.5-1, 6.5A.3.2.1.5-1a (Rel-16) and 6.5A.3.2.1.5-1 (Rel-17). The test requirement of configurations for CA operating band including Band n41 also apply for the corresponding CA operating bands with Band n90 replacing Band n41.

Table 6.5A.3.2.1.5-1: Requirements for uplink inter-band carrier aggregation (two bands) Rel-15

NR CA Configuration	Spurious emission						
	Protected Band	Frequency range (Mhz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31, 38, 40, 41, 72, 73 NR band n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 1, 22, 32, 42, 43, 50, 51, 52, 65, 74, 75, 76 NR band n77, n78	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 15
	Frequency range	470	-	694	-42+TT	8	4, 14
	Frequency range	470	-	710	-26.2+TT	6	15
	Frequency range	758	-	773	-30+TT	1	4
	Frequency range	773	-	803	-50+TT	1	
	Frequency range	662	-	694	-26.2+TT	6	4
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n1-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR band n78	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	NR band n77, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1880		1895	-40+TT	1	4, 14
	Frequency range	1895		1915	-15.5+TT	5	4, 7, 14
	Frequency range	1915		1920	+1.6+TT	5	4, 7, 14
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n3-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31 38, 40, 41, 72	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 32, 42, 43, 50, 51, 74, 75, 76 NR band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 15
	Frequency range	470	-	694	-42+TT	8	4, 14
	Frequency range	470	-	710	-26.2+TT	6	15
	Frequency range	758	-	773	-30+TT	1	4
	Frequency range	773	-	803	-50+TT	1	
	Frequency range	662	-	694	-26.2+TT	6	4
	Frequency range	1880	-	1895	-40+TT	1	4, 6

	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
	Frequency range	1839.9	-	1879.9	-50+TT	1	4
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3, 11
CA_n3-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 43, 44. 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	UTRA Band 22, 42, 52 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n3-n78	E-UTRA Band 3, 34, 39	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n8-n78	E-UTRA Band 8, 20, 28, 34, 39, 40	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 3, 7,41	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n40-n78	UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n40-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 28, 34, 39, 41, 42, 65, 74, NR band n78	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n78-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3

NOTE 1: FDL_low and FDL_high refer to each frequency band specified in Table 5.2-1 or Table 5.5-1 in TS 36.101

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz

NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 and Table 6.5A.3.1-1 from the edge of the channel bandwidth.

Table 6.5A.3.2.1.5-1a: Requirements for uplink inter-band carrier aggregation (two bands) Rel-16

NR CA Configuration	Spurious emission						
	Protected Band	Frequency range (Mhz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n28	E-UTRA Band 5, 7, 8, 18, 19, 20, 26, 27, 31, 38, 40, 41, 72, 73 NR band n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 1, 22, 32, 42, 43, 50, 51, 52, 65, 74, 75, 76 NR band n77, n78	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 12
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50+TT	1	11, 15
	Frequency range	470	-	694	-42+TT	8	4, 14
	Frequency range	470	-	710	-26.2+TT	6	15
	Frequency range	758	-	773	-30+TT	1	4
	Frequency range	773	-	803	-50+TT	1	
	Frequency range	662	-	694	-26.2+TT	6	4
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n1-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 41, 42, 43, 44, 45, 50, 51, 52, 65, 67, 68, 69, 72, 73, 74, 75, 76 NR band n78	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
	NR band n77, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1880		1895	-40+TT	1	4, 14
	Frequency range	1895		1915	-15.5+TT	5	4, 7, 14
	Frequency range	1915		1920	+1.6+TT	5	4, 7, 14
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7

CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n2A-n77A	E-UTRA Band 4, 65, 66, 70	F_{DL_low}	-	F_{DL_high}	-50 +TT	1	
	E-UTRA Band 2, 25	F_{DL_low}	-	F_{DL_high}	-50 +TT	1	2
CA_n3-n40	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 43, 44. 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4
	UTRA Band 22, 42, 52 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n3-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n5-n77	E-UTRA Band 1, 2, 3, 4, 8, 11, 12, 13, 14, 17, 18, 19, 21, 25, 26, 28, 29, 30, 34, 40, 65, 66, 70, 71, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n8-n39	E-UTRA Band 1, 34, 40, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 22, 41, 42 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
CA_n8-n40	E-UTRA Bands 1, 5, 11, 18, 19, 20, 21, 26, 28, 31, 32, 33, 34, 38, 39, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Bands 3, 7, 22, 41, 42, 43, 52 NR Bands n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n8-n78	E-UTRA Band 1, 8, 11, 20, 21, 28, 34, 39, 40, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 3, 7,41	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n28-n40	E-UTRA Band 1, 3, 5, 7, 8, 18, 19, 20, 26, 27, 28, 31, 34, 38, 41, 72	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 11, 21, 22, 32, 42, 43, 50, 51, 52, 65, 73, 74, 75, 76 NR band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n28-n41	E-UTRA Band 2, 3, 5, 8, 25, 26, 27, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 42, 50, 51, 52, 65, 66, 73, 74 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 18, 19	FDL_low	-	FDL_high	-50	1	11
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15

	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	13
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 11
CA_n39-n40	E-UTRA Band 1, 8, 22, 26, 28, 34, 41, 42, 44, 45, 50, 51, 52, 73, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805		1855	-40	1	8
	Frequency range	1855		1880	-15.5	5	4, 7, 8
CA_n39-n41	E-UTRA Band 1, 8, 26, 28, 34, 40, 42, 44, 45, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n39-n79	E-UTRA Band 1, 8, 28, 34, 40, 41, 44, 45	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4, 8
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n40-n41	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 27, 28, 34, 39, 42, 44, 45, 50, 51, 65, 73, 74, NR Band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n78	UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 44, 45, 50, 51, 65, 67, 68, 69, 72, 73, 74, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n40-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 26, 28, 34, 39, 41, 42, 65, 74, NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n41-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 42, 44, 45, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n48-n66	E-UTRA Band 5, 25	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n66-n71	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
CA_n66-n77	E-UTRA Band 2, 4, 12, 13, 14, 17, 29, 30, 65, 66, 70, 71, 103	F_{DL_low}	-	F_{DL_high}	-50 +TT	1	
CA_n70-n71	E-UTRA Band 30	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2

NOTE 1: FDL_low and FDL_high refer to each frequency band specified in Table 5.2-1 or Table 5.5-1 in TS 36.101
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz
NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 and Table 6.5A.3.1-1 from the edge of the channel bandwidth.
NOTE 5: This requirement is applicable only for the following cases: - for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 902.5 MHz ≤ Fc < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB - for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 907.5 MHz ≤ Fc ≤ 912.5 MHz without any restriction on uplink transmission bandwidth. - for carriers of 10 MHz channel bandwidth when carrier centre frequency (Fc) is Fc = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RBstart> 3.
NOTE 6: This requirement is applicable for any channel bandwidths within the range 1920 – 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 – 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 7: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 8: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz.
NOTE 9: Void.
NOTE 10: Void.
NOTE 11: Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 12: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 13: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718 - 728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and Rbstart < 48.
NOTE 14: This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
NOTE 15: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).

Table 6.5A.3.2.1.5-1b: Requirements for uplink inter-band carrier aggregation (two bands) Rel-17

NR CA Configuration	Spurious emission						
	Protected Band	Frequency range (Mhz)			Maximum Level (dBm)	MBW (MHz)	NOTE
CA_n1-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7

CA_n1-n79	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 21, 26, 28, 34, 40, 41, 42, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1880	-	1895	-40+TT	1	4, 6
	Frequency range	1895	-	1915	-15.5+TT	5	4, 6, 7
	Frequency range	1915	-	1920	+1.6+TT	5	4, 6, 7
CA_n3-n78	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n8-n39	E-UTRA Band 1, 34, 40, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 22, 41, 42 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50+TT	1	4
CA_n8-n78	E-UTRA Band 1, 8, 11, 20, 21, 28, 34, 39, 40, 65, 74	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	E-UTRA Band 3, 7,41	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
	Frequency range	1884.5	-	1915.7	-41+TT	0.3	3
CA_n24-n41	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 48, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2
CA_n24-n48	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 41, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
CA_n24-n77	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 25, 26, 29, 30, 41, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50+TT	1	
CA_n26-n66	E-UTRA Band 5, 26	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 42 NR band 77	F_{DL_low}	-	F_{DL_high}	-50	1	2
CA_n26-n70	E-UTRA Band 5	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
CA_n28-n41	E-UTRA Band 2, 3, 5, 8, 25, 26, 27, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 42, 50, 51, 52, 65, 66, 73, 74 NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 18, 19	FDL_low	-	FDL_high	-50	1	11
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	11, 15
	E-UTRA Band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11, 12
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26.2	6	13
	Frequency range	662	-	694	-26.2	6	4
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 11
CA_n39-n40	E-UTRA Band 1, 8, 22, 26, 28, 34, 41, 42, 44, 45, 50, 51, 52, 73, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805		1855	-40	1	8
	Frequency range	1855		1880	-15.5	5	4, 7, 8
CA_n39-n41	E-UTRA Band 1, 8, 26, 28, 34, 40, 42, 44, 45, 50, 51, 74	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8

CA_n39-n79	E-UTRA Band 1, 8, 28, 34, 40, 41, 44, 45	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1805	-	1855	-40	1	4, 8
	Frequency range	1855	-	1880	-15.5	5	4, 7, 8
CA_n41-n79	E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 42, 44, 45, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 40	F_{DL_low}	-	F_{DL_high}	-40	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3
CA_n48-n66	E-UTRA Band 2, 25	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n48-n70	E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 66, 70, 71, 85	F_{DL_low}	-	F_{DL_high}	-50+TT	1	16
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50+TT	1	2, 16
CA_n48-n71	E-UTRA Band 4, 30, 66	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_n66-n71	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
CA_n70-n71	E-UTRA Band 30	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2

NOTE 1:	FDL_low and FDL_high refer to each frequency band specified in Table 5.2-1 or Table 5.5-1 in TS 36.101
NOTE 2:	As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
NOTE 3:	Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz
NOTE 4:	These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1-1 and Table 6.5A.3.1-1 from the edge of the channel bandwidth.
NOTE 5:	This requirement is applicable only for the following cases: - for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 902.5 MHz ≤ Fc < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB - for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 907.5 MHz ≤ Fc ≤ 912.5 MHz without any restriction on uplink transmission bandwidth. - for carriers of 10 MHz channel bandwidth when carrier centre frequency (Fc) is Fc = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RBstart> 3.
NOTE 6:	This requirement is applicable for any channel bandwidths within the range 1920 – 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 – 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
NOTE 7:	For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
NOTE 8:	This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1895 - 1903 MHz.
NOTE 9:	Void.
NOTE 10:	Void.
NOTE 11:	Applicable when the assigned NR carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
NOTE 12:	As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 13:	This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718 - 728 MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and Rbstart < 48.
NOTE 14:	This requirement is applicable in the case of a 10 MHz NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
NOTE 15:	As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
NOTE 16:	The same configuration applies to corresponding NR-DC configuration in Table 4.3.1.1.7.1-1 in [5]. If UE supporting NR-DC configuration do not support the corresponding CA configuration, NR-DC configuration is used in this test.

Table 6.5A.3.2.1.5-2: Test Tolerance for uplink inter-band carrier aggregation (two bands)

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	0	0
40MHz < BW ≤ 100MHz	0	0

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than Δf_{OOB} (MHz) in Table 6.5.3.2.3-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5.3.2.3-1 apply for all transmitter band configurations (NRB) and channel bandwidths for all CC combinations.

6.5A.4 Transmit intermodulation for CA

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

- Extending the coverage of the TCs with intra-band CA scenarios is FFS

6.5A.4.0 Minimum conformance requirements

For inter-band carrier aggregation with uplink assigned to two NR bands, the transmit intermodulation requirement is specified in Table 6.5.4-1 which shall apply on each component carrier with both component carriers active.

6.5A.4.1 Transmit intermodulation for CA (2UL CA)

6.5A.4.1.1 Test purpose

To verify that the UE transmit intermodulation does not exceed the described value in the test requirement.

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.5A.4.1.2 Test applicability

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

6.5A.4.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in subclause 6.5A.4.0.

6.5A.4.1.4 Test description

6.5A.4.1.4.1 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 configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 6.5A.4.1.4.1-1. 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.4.1.4.1-1: Inter-band CA Test Configuration Table

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1.1.3 for inter band CA in FR1		Mid range for PCC and SCC (NOTE 4)			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest N_{RB_agg} for both PCC and SCC Highest N_{RB_agg} for both PCC and SCC			
Test SCS as specified in Table 5.5A.3-1		Smallest and biggest supported SCS per Channel Bandwidth			
Test Parameters					
Test ID	**Downlink Configuration**	**Uplink Configuration**			
		Modulation(NOTE 3)	**RB allocation (NOTE 1)**		
			PCC	**SCC**	
1[3]	N/A	DFT-s-OFDM PI/2 BPSK	Inner Full	Inner Full	
2		DFT-s-OFDM QPSK	Inner Full	Inner Full	
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: Test Channel Bandwidths and Test SCS are checked separately for each NR CA band combination, which applicable channel bandwidths and SCS are specified in Table 5.5A3-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with Low range test frequencies.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.5A.4.1.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.5A.4.1.4.3.

6.5A.4.1.4.2 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 [5] clause 5.5.1. Message contents are defined in clause 6.5A.4.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. 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.4.1.4.1-1 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Send continuously uplink power control "up" commands on PCC and SCC to the UE until the UE transmits at its P_{UMAX} level; allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level

6. Measure the rectangular filtered mean power of the UE. For TDD slots with transient periods are not under test for the wanted signal and for the intermodulation product.

7. Set the interference signal frequency below the UL carrier frequency of the PCC using the first offset in Table 6.5A.4.1.5-1.

8. Set the interference CW signal level according to Table 6.5A.4.1.5-1.

9. Search the intermodulation product signals below and above the UL carrier frequency of the PCC, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 6.

10. Set the interference signal frequency above the UL carrier frequency of the PCC using the first offset in Table 6.5A.4.1.5-1.

11. Search the intermodulation product signals below and above the UL carrier frequency of the PCC, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 6.

12. Set the interference signal frequency below the UL carrier frequency of the SCC using the first offset in Table 6.5A.4.1.5-1.

13. Search the intermodulation product signals below and above the UL carrier frequency of the SCC, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 6.

14. Set the interference signal frequency above the UL carrier frequency of the SCC using the first offset in Table 6.5A.4.1.5-1.

15. Search the intermodulation product signals below and above the UL carrier frequency of the SCC, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 6.

16. Repeat the measurement using the second offset in Table 6.5A.4.1.5-1.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5A.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.5A.4.1.5 Test requirement

The ratio derived in steps9, 11, 13 and 15, shall not exceed the described value in Table 6.5A.4.1.5-1.

Table 6.5A.4.1.5-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel centre	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40dBc	
Intermodulation product	<-29dBc+TT	< -35dBc+TT
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCSs for the channel BW as defined in Table 6.5.2.2.3-1	
Measurement offset from channel centre	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$

Table6.5A.4.1.5-2: Test Tolerance for Transmit Intermodulation

	f ≤ 3.0GHz	3.0GHz < f ≤ 6GHz
BW ≤ 40MHz	0dB	0dB
40MHz < BW ≤ 100MHz	0dB	0dB

6.5B Output RF spectrum emissions for NR-DC

For inter-band NR-DC with one uplink carrier assigned per NR band, the output RF spectrum emissions for the corresponding inter-band CA configuration as specified in clause 6.5A applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.

6.5B.1 Occupied bandwidth for NR-DC

For inter-band dual connectivity, the occupied bandwidth for the corresponding inter-band CA configuration as specified in clause 6.5A.1 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.1.

6.5B.2 Out of band emission for NR-DC

6.5B.2.1 General

This clause contains requirements for out of band emissions for UE configured of dual connectivity.

6.5B.2.2 Spectrum emission mask

For inter-band dual connectivity, the Spectrum emission mask for the corresponding inter-band CA configuration as specified in clause 6.5A.2.2 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.2.2.

6.5B.2.4 Adjacent channel leakage ratio

For inter-band dual connectivity, the Adjacent Channel Leakage power Ratio (ACLR) for the corresponding inter-band CA configuration as specified in clause 6.5A.2.4 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.2.4.

6.5B.3 Spurious emission for NR-DC

For inter-band dual connectivity, the spurious emissions for the corresponding inter-band CA configuration as specified in clause 6.5A.3 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.3.

6.5B.4 Transmit intermodulation for NR-DC

For inter-band dual connectivity, the transmit intermodulation for the corresponding inter-band CA configuration as specified in clause 6.5A.4 applies.

Note: For NR-DC testing, replace CA by NR-DC, PCC by PCell, and SCC by PSCell in clause 6.5A.4.

6.5C Output RF spectrum emissions for SUL

For a terminal that supports SUL for the band combination specified in Table 5.2C-1, the current version of the specification assumes the terminal is configured with active transmission either on UL carrier or SUL carrier at any time in one serving cell and the UE requirements for single carrier shall apply for the active UL or SUL carrier accordingly

6.5C.1 Occupied bandwidth for SUL

6.5C.1.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE supporting SUL are less than their specific limits when UE is configured using SUL transmission.

6.5C.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.1.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.5.1.3

6.5C.1.4 Test description

Same test description as specified in clause 6.5.1.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 6.5.1.4.1-1→ use Table 6.5C.1.4-1

Table 6.5C.1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low Range, Mid Range, High Range for SUL carrier Mid Range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		All for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1		15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths				
	Downlink Configuration	**UL Configuration**	**SUL Configuration**	
Test ID	N/A	N/A	Modulation	RB allocation
1			CP-OFDM QPSK	Outer_full
Note 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. Note 2: The specific configuration of each RB allocation is defined in Table 6.1-1.				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), 4.6.3-14 with condition SUL_SUL for SUL carrier, with condition SUL, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

6.5C.1.5 Test requirement

The measured Occupied Bandwidth on SUL carrier shall not exceed values in Table 6.5C.1.5-1.

Table 6.5C.1.5-1: Occupied channel bandwidth

	NR channel bandwidth												
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Occupied channel bandwidth (MHz)	5	10	15	20	25	30	40	50	60	70	80	90	100

6.5C.2 Out of band emission for SUL

6.5C.2.1 General

Void

6.5C.2.2 Spectrum emission mask for SUL

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. For frequencies greater than (Δf_{OOB}) the spurious requirements in subclause 6.5.3 are applicable.

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.

6.5C.2.2.1 Test purpose

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

6.5C.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.2.2.3 Minimum conformance requirements

Same minimum conformance requirements as in the clause 6.5.2.2.3.

6.5C.2.2.4 Test description

Same test description as PC 3 with contiguous allocation specified in clause 6.5.2.2 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 6.5.2.2.4.1-1→ use Table 6.5C.2.2.4.1-1

Table 6.5C.2.2.4.1-1: Test Configuration Table

Initial Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range for SUL carrier Mid range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.5C-1			15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths					
Test ID	**Freq**	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
		N/A	N/A	**Modulation**	**RB allocation**
1	Low			DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left
2	High			DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right
3	Default			DFT-s-OFDM PI/2 BPSK	Outer_Full
4	Low			DFT-s-OFDM QPSK	Edger_1RB_Left
5	High			DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default			DFT-s-OFDM QPSK	Outer_Full
7	Low			DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High			DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default			DFT-s-OFDM 16 QAM	Outer_Full
10	Low			DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High			DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default			DFT-s-OFDM 64 QAM	Outer_Full
13	Low			DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High			DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default			DFT-s-OFDM 256 QAM	Outer_Full
16	Low			CP-OFDM QPSK	Edge_1RB_Left
17	High			CP-OFDM QPSK	Edge_1RB_Right
18	Default			CP-OFDM QPSK	Outer_Full
19	Low			CP-OFDM 16 QAM	Edge_1RB_Left
20	High			CP-OFDM 16 QAM	Edge_1RB_Right
21	Default			CP-OFDM 16 QAM	Outer_Full
22	Low			CP-OFDM 64 QAM	Edge_1RB_Left
23	High			CP-OFDM 64 QAM	Edge_1RB_Right
24	Default			CP-OFDM 64 QAM	Outer_Full
25	Low			CP-OFDM 256 QAM	Edge_1RB_Left
26	High			CP-OFDM 256 QAM	Edge_1RB_Right

27	Default			CP-OFDM 256 QAM	Outer_Full
28[4]	Low			DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
29[4]	High			DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
30[4]	Default			DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full
Note 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. Note 2: The specific configuration of each RF allocation is defined in Table 6.1-1. Note 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. Note 4: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.					

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_NUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL. Message contents in Table 6.5.2.2.4.3-2 in clause 6.5.2.2 only apply to Test ID 28-30 in Table 6.5C.2.2.4.1-1.

6.5C.2.2.5 Test requirement

The measured sum of the UE mean power in the channel bandwidth on the SUL carrier, derived in step 3, shall fulfil requirements in Tables 6.2C.4.5-1 as appropriate, and the power of any UE emission shall fulfil requirements in Table 6.5C.2.2.5-1.

Table 6.5C.2.2.5-1: NR General spectrum emission mask

<table>
<tr><th colspan="15">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>Δf_{OOB} (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>70 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0-1</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td>-13+TT</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1 % channel bandwidth</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-24+TT</td><td>-24+TT</td><td>-24+TT</td><td>-24+TT</td><td>-24+TT</td><td>-24+TT</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td>-10+TT</td><td rowspan="22">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13+TT</td><td rowspan="2">-13+TT</td><td rowspan="3">-13+TT</td><td rowspan="4">-13+TT</td><td rowspan="5">-13+TT</td><td rowspan="6">-13+TT</td><td rowspan="8">-13+TT</td><td rowspan="10">-13+TT</td><td rowspan="12">-13+TT</td><td rowspan="14">-13+TT</td><td rowspan="16">-13+TT</td><td rowspan="18">-13+TT</td><td rowspan="20">-13+TT</td></tr>
<tr><td>± 6-10</td><td>-25+TT</td></tr>
<tr><td>± 10-15</td><td></td><td>-25+TT</td></tr>
<tr><td>± 15-20</td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 20-25</td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 25-30</td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 30-35</td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 35-40</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 40-45</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 45-50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 50-55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 55-60</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 60-65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 65-70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 70-75</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 75-80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-85</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 85-90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 90-95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td>± 95-100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 100-105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25+TT</td></tr>
<tr><td colspan="15">Note 1: The first and last measurement position with a 30 kHz filter is at ΔfOOB equals to 0.015 MHz and 0.985 MHz.
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.
Note 4: TT = 1.5 dB for f ≤ 3GHz, TT = 1.8 dB for 3GHz < f ≤ 4.2GHz, TT = 1.8 dB for 4.2GHz < f ≤ 6.0GHz.</td></tr>
</table>

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.

6.5C.2.3 Additional spectrum emission mask for SUL

6.5C.2.3.1 Test purpose

Same test purpose as in clause 6.5.2.3.1

6.5C.2.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.2.3.3 Minimum conformance requirements

Same minimum conformance requirements as in the clause 6.5.2.3.3 with consideration of the NS_03 applicable to the SUL bands.

6.5C.2.3.4 Test description

Same test description as specified in clause 6.5.2.3.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause [4.4.3]
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), 4.6.3-14 with condition SUL_SUL for SUL carrier,and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL. All the AdditionalSpectrumEmission in 6.2.3.4.3 are sent in *SIB1* as part of *supplementaryUplink* instead of *uplinkConfigCommon*.

6.5C.2.3.5 Test requirement

6.5C.2.3.5.1 Test requirements (network signalling value "NS_03")

When "NS_03" is indicated in the cell:

- the measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in table 6.2C.5.5-1 for a NR UE.

and

- the power of any UE emission shall fulfil requirements in table 6.5C.2.3.5-1, as applicable.

Table 6.5C.2.3.5-1: Additional requirements for "NS_03"

Spectrum emission limit (dBm)/ Channel bandwidth						
ΔfOOB (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	40 MHz	Measurement bandwidth
± 0-1	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 % of channel BW
± 1-6	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 6-10	-25+ TT	-13+ TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 10-15		-25+ TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 15-20			-25+ TT	-13 + TT	-13 + TT	1 MHz
± 20-25				-25+ TT	-13+ TT	1 MHz
± 25-40					-13+ TT	1 MHz
± 40-45					-25+ TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.						

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.

6.5C.2.4 Adjacent channel leakage ratio for SUL

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.

6.5C.2.4.1 NR ACLR for SUL

6.5C.2.4.1.1 Test purpose

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

6.5C.2.4.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.2.4.1.3 Minimum conformance requirements

The minimum conformance requirements specified in Clause 6.5.2.4.1.3 applies to the UE that support SUL operating on the SUL bands.

The normative reference for this requirement is TS 38.101-1 clauses 6.5.2.4.1.

6.5C.2.4.1.4 Test description

Same test description as PC 3 with contiguous allocation specified in clause 6.5.2.4.1.4 with following exceptions:

- Instead of Table 5.3.5-1 → use Table 5.5C-1
- Instead of the test configuration tables in clause 6.2.2.4.1→ use the test configuration tables in clause 6.2C.4.4
- Instead of the requirements described in clause 6.2.2.5→ use the requirements described in clause 6.2C.4.5

Table 6.5C.2.4.1.4-1: Void

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3

- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM),Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL. Message contents in Table 6.5.2.4.1.4.3-3 in clause 6.5.2.4.1.4 only apply to Test ID 33-35 in Table 6.2C.4.4-1.

6.5C.2.4.1.5 Test requirement

The measured UE mean power in the channel bandwidth on SUL carrier, derived in step 3, shall fulfil requirements in Clause 6.2C.4.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6, shall be higher than the limits in Table 6.5C.2.4.1.5-1.

Table 6.5C.2.4.1.5-1: NR ACLR measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth												
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
NR ACLR measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	78.15	88.23	98.31

Table 6.5C.2.4.1.5-2: NR ACLR requirement

	Power class 1	Power class 2	Power class 3
NR ACLR			30 + TT dB
NOTE 1: TT = 0.8 dB for f ≤ 4.0GHz, TT = 1.0 dB for 4.0GHz < f ≤ 6.0GHz,			

6.5C.2.4.2 UTRA ACLR for SUL

6.5C.2.4.2.1 Test purpose

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

6.5C.2.4.2.2 Test applicability

This test applies for network signalling values NS_3U, NS_5U, NS_43U, and NS_100 to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.2.4.2.3 Minimum conformance requirements

The minimum conformance requirements specified in Clause 6.5.2.4.2.3 applies to the UE that support SUL operating on the SUL bands.

The normative reference for this requirement is TS 38.101-clause 6.5.2.4.2.

6.5C.2.4.2.4 Test description

Same test description as specified in clause 6.5.2.4.2.4 with following exceptions:

Initial conditions are same as in subclause 6.2C.5.4 with the following exceptions:

- Only network signalling values NS_3U, NS_5U, NS_43U, and NS_100 with the corresponding SUL band defined in Table 6.2.3.3.1-1 need to perform UTRA ACLR test.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table

4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, together with the exceptions as specified in Table 6.5C.2.4.2.4-2

Table 6.5C.2.4.2.4-2: AdditionalSpectrumEmission

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission*			
Information Element	**Value/remark**	**Comment**	**Condition**
AdditionalSpectrumEmission	3 (NS_03U) 3 (NS_05U) 1 (NS_100)	For SUL band n86 For SUL band n84 For SUL band n84 and n86	

6.5C.2.4.2.5 Test requirement

UTRA ACLR requirement is applicable when signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission*.

The measured UE mean total power in the channel bandwidth on SUL carrier, derived in step 3, shall fulfil requirements in Clause 6.2C.5.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured UTRA ACLR, derived in step 6, shall be higher than the limits in Table 6.5C.2.4.2.5-1.

Table 6.5C.2.4.2.5-1: NR ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB - TT
$UTRA_{ACLR2}$	36 dB - TT
NOTE 1: TT = 0.8 dB	

6.5C.3 Spurious emissions for SUL

6.5C.3.1 General spurious emissions for SUL

6.5C.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.

6.5C.3.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.3.1.3 Minimum conformance requirements

The general spurious emission requirement specified in clause 6.5.3.1.3 applies to the UE that support SUL operating on the SUL bands.

The normative reference for this requirement is TS 38.101-1 [2] subclauses 6.5.3.1

6.5C.3.1.4 Test description

Same test description as specified in clause 6.5.3.1.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 6.5.3.1.4.1-1→ use Table 6.5C.3.1.4-1

Table 6.5C.3.1.4-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Low range, Mid range, High range for SUL carrier Mid range for Non-SUL carrier			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier			
Test SCS as specified in Table 5.3.5-1	15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier			
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
	N/A	N/A	Modulation	RB allocation (NOTE 2)
1			CP-OFDM QPSK	OuterFull
2			CP-OFDM QPSK	Edge_1RB_Left
3			CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 3: Void				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

6.5C.3.1.5 Test requirement

The measured average power of spurious emission on the SUL carrier, derived in step 3, shall not exceed the described value in Table 6.5C.3.1.5-1.

The spurious emission limits apply for the frequency ranges that are more than ΔfOOB (MHz) in Table 6.5.3.1.3-1from the edge of the channel bandwidth.

Table 6.5C.3.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band that the upper frequency edge of the UL Band more than 2.69 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz			

6.5C.3.2 Spurious emissions for UE co-existence for SUL

6.5C.3.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions.

6.5C.3.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.3.2.3 Minimum conformance requirements

The requirements for NR bands for coexistence with protected bands specified in subclause 6.5.3.2.3 apply to the UE that support SUL operating on the SUL bands

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5.3.2.

6.5C.3.2.4 Test description

Same test description as specified in clause 6.5.3.2.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 6.5.3.2.4.1-1→ use Table 6.5C.3.2.4-1

Table 6.5C.3.2.4-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Low range, Mid range, High range for SUL carrier Mid range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1		15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Test Parameters for Channel Bandwidths				
Test ID	**Downlink Configuration**	**UL Configuration**	**SUL Configuration**	
	N/A	N/A	Modulation	RB allocation (NOTE 1)
1			CP-OFDM QPSK	OuterFull
2			CP-OFDM QPSK	Edge_1RB_Left
3			CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.				

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

6.5C.3.2.5 Test requirement

Test requirements for Spurious Emissions UE Co-existence are the same as specified in clause 6.5.3.2.3.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5.3.2.3-1 to Table 6.5.3.2.3-3. If the UE support a band, which is not defined in the table corresponding UE’s release, the requirements for this band are taken from the table of earliest release where requirements for this band are defined. This has been described in following Table 6.5C.3.2.5-1.

Table 6.5C.3.2.5-1: UE Requirements according to UE NR release and supported NR band

UE Requirements per release			
NR Band	**Rel-15**	**Rel-16**	**R17**
n80	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n81	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n82	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n83	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n84	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n86	Table 6.5.3.2.3-1	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n89	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n95	Table 6.5.3.2.3-2	Table 6.5.3.2.3-2	Table 6.5.3.2.3-3
n97	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3
n98	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3
n99	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3	Table 6.5.3.2.3-3

6.5C.3.3 Additional spurious emissions for SUL

6.5C.3.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions under the deployment scenarios where additional requirements are specified.

6.5C.3.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.3.3.3 Minimum conformance requirements

The additional spurious emission requirements specified in 6.5.3.3.3 apply to the UE operating on SUL bands.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.3.3

6.5C.3.3.4 Test description

Same test description as specified in clause 6.5.3.3.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- For NS_05, instead of table 6.5.3.3.4.1-4→ use Table 6.5C.3.3.4-1
- For NS_43, instead of table 6.5.3.3.4.1-5→ use Table 6.5C.3.3.4-2
- For NS_18, instead of table 6.5.3.3.4.1-3→ use Table 6.5C.3.3.4-3
- For NS_48, instead of table 6.5.3.3.4.1-22→ use Table 6.5C.3.3.4-4
- For NS_49, instead of table 6.5.3.3.4.1-23→ use Table 6.5C.3.3.4-5
- For NS_56, instead of table 6.5.3.3.4.1-27→ use Table 6.5C.3.3.4-6

Table 6.5C.3.3.4-1: Test Configuration Table (network signalling value "NS_05")

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Use centre frequency (Fc) as specified in test parameters for SUL carrier Mid range for Non-SUL carrier
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	5 MHz, 10 MHz, 15 MHz, 20 MHz for SUL carrier Lowest for Non-SUL carrier
Test SCS as specified in Table 5.3.5-1	15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier

Additional Spurious for SUL test parameters for NS_05

Test ID	Fc (MHz)	SUL ChBw (MHz)	Downlink Config.	Uplink Config	A-MPR	SUL Configuration		
						Modulation (NOTE 2)		RB allocation (Note 1)
1	1922.5	5	N/A	N/A	A3	DFT-s-OFDM	PI/2 BPSK	Outer_Full
2	1925	10			A1		PI/2 BPSK	Outer_Full
3	1925	10			A7		PI/2 BPSK	40@10
4	1925	10			A2		PI/2 BPSK	6@40
5	1935	10			A4		PI/2 BPSK	Outer_Full
6	1927.5	15			A1		PI/2 BPSK	Outer_Full
7	1927.5	15			A7		PI/2 BPSK	60@19
8	1927.5	15			A2		PI/2 BPSK	6@56
9	1932.5	15			A1		PI/2 BPSK	Outer_Full
10	1932.5	15			A2		PI/2 BPSK	6@68
11	1942.5	15			A5		PI/2 BPSK	Outer_Full
12	1930	20			A1		PI/2 BPSK	Outer_Full
13	1930	20			A7		PI/2 BPSK	72@28
14	1930	20			A2		PI/2 BPSK	6@76
15	1950	20			A6		PI/2 BPSK	Outer_Full
16	1922.5	5			A3		QPSK	Outer_Full
17	1925	10			A1		QPSK	Outer_Full
18	1925	10			A7		QPSK	40@10
19	1925	10			A2		QPSK	6@40
20	1927.5	15			A1		QPSK	Outer_Full
21	1927.5	15			A7		QPSK	60@19
22	1927.5	15			A2		QPSK	6@56

23	1932.5	15			A 1		QPSK	Outer_Full
24	1932.5	15			A 2		QPSK	6@68
25	1942.5	15			A 5		QPSK	Outer_Full
26	1930	20			A 1		QPSK	Outer_Full
27	1930	20			A 7		QPSK	72@28
28	1930	20			A 2		QPSK	6@76
29	1950	20			A 6		QPSK	Outer_Full
30	1922.5	5			A 3		16 QAM	Outer_Full
31	1925	10			A 1		16 QAM	Outer_Full
32	1925	10			A 7		16 QAM	40@10
33	1925	10			A 2		16 QAM	6@40
34	1927.5	15			A 1		16 QAM	Outer_Full
35	1927.5	15			A 7		16 QAM	60@19
36	1927.5	15			A 2		16 QAM	6@56
37	1932.5	15			A 1		16 QAM	Outer_Full
38	1932.5	15			A 2		16 QAM	6@68
39	1930	20			A 1		16 QAM	Outer_Full
40	1930	20			A 7		16 QAM	72@28
41	1930	20			A 2		16 QAM	6@76
42	1922.5	5			A 3		64 QAM	Outer_Full
43	1925	10			A 1		64 QAM	Outer_Full
44	1925	10			A 7		64 QAM	40@10
45	1925	10			A 2		64 QAM	6@40
46	1927.5	15			A 1		64 QAM	Outer_Full
47	1927.5	15			A 7		64 QAM	60@19
48	1927.5	15			A 2		64 QAM	6@56
49	1932.5	15			A 1		64 QAM	Outer_Full
50	1932.5	15			A 2		64 QAM	6@68
51	1930	20			A 1		64 QAM	Outer_Full
52	1930	20			A 7		64 QAM	72@28

53	1930	20			A2		64 QAM	6@76
54	1922.5	5			A3		256 QAM	Outer_Full
55	1925	10			A1		256 QAM	Outer_Full
56	1925	10			A7		256 QAM	40@10
57	1925	10			A2		256 QAM	6@40
58	1927.5	15			A1		256 QAM	Outer_Full
59	1927.5	15			A7		256 QAM	60@19
60	1927.5	15			A2		256 QAM	6@56
61	1932.5	15			A1		256 QAM	Outer_Full
62	1932.5	15			A2		256 QAM	6@68
63	1930	20			A1		256 QAM	Outer_Full
64	1930	20			A7		256 QAM	72@28
65	1930	20			A2		256 QAM	6@76
66	1922.5	5			A3		QPSK	Outer_Full
67	1925	10			A1		QPSK	Outer_Full
68	1925	10			A7		QPSK	42@10
69	1925	10			A2		QPSK	6@40
70	1935	10			A4		QPSK	Outer_Full
71	1927.5	15			A1		QPSK	Outer_Full
72	1927.5	15			A7		QPSK	60@19
73	1927.5	15			A2	CP-OFDM	QPSK	6@56
74	1932.5	15			A1		QPSK	Outer_Full
75	1932.5	15			A2		QPSK	6@68
76	1942.5	15			A5		QPSK	Outer_Full
77	1930	20			A1		QPSK	Outer_Full
78	1930	20			A7		QPSK	78@28
79	1930	20			A2		QPSK	6@76
80	1950	20			A6		QPSK	Outer_Full
81	1922.5	5			A3		16 QAM	Outer_Full
82	1925	10			A1		16 QAM	Outer_Full

83	1925	10			A 7		16 QAM	42@10
84	1925	10			A 2		16 QAM	6@40
85	1935	10			A 4		16 QAM	Outer_Full
86	1927.5	15			A 1		16 QAM	Outer_Full
87	1927.5	15			A 7		16 QAM	60@19
88	1927.5	15			A 2		16 QAM	6@56
89	1932.5	15			A 1		16 QAM	Outer_Full
90	1932.5	15			A 2		16 QAM	6@68
91	1942.5	15			A 5		16 QAM	Outer_Full
92	1930	20			A 1		16 QAM	Outer_Full
93	1930	20			A 7		16 QAM	78@28
94	1930	20			A 2		16 QAM	6@76
95	1950	20			A 6		16 QAM	Outer_Full
96	1922.5	5			A 3		64 QAM	Outer_Full
97	1925	10			A 1		64 QAM	Outer_Full
98	1925	10			A 7		64 QAM	42@10
99	1925	10			A 2		64 QAM	6@40
100	1927.5	15			A 1		64 QAM	Outer_Full
101	1927.5	15			A 7		64 QAM	60@19
102	1927.5	15			A 2		64 QAM	6@56
103	1932.5	15			A 1		64 QAM	Outer_Full
104	1932.5	15			A 2		64 QAM	6@68
105	1930	20			A 1		64 QAM	Outer_Full
106	1930	20			A 7		64 QAM	78@28
107	1930	20			A 2		64 QAM	6@76
108	1922.5	5			A 3		256 QAM	Outer_Full
109	1925	10			A 1		256 QAM	Outer_Full
110	1925	10			A 7		256 QAM	42@10
111	1927.5	15			A 1		256 QAM	Outer_Full
112	1927.5	15			A 7		256 QAM	60@19

113	1932.5	15			A 1		256 QAM	Outer_Full
114	1930	20			A 1		256 QAM	Outer_Full
115	1930	20			A 7		256 QAM	78@28
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: AMPR requirement for NS_05 is specified in 6.2.3.3.4.								

Table 6.5C.3.3.4-2: Test Configuration Table (network signalling value "NS_43")

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1				Use carrier centre frequency (F_c) as specified in test parameters for SUL carrier Mid range for Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1				5 MHz, 10 MHz, 15 MHz for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1				15 kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier		
Additional Spurious for SUL test parameters for NS_43						
Test ID	**F_c (MHz)**	**SUL Ch BW (MHz)**	**Downlink Configuration**	**Uplink Configuration**	**SUL Configuration**	
					Modulation (Note 2)	**RB allocation (Note 1)**
1	910	10	N/A	N/A	DFT-s--OFDM PI/2 BPSK	Outer_Full (A2)
2	907.5	15			PI/2 BPSK	Edge_1RB_Left (A6)
3	907.5	15			PI/2 BPSK	Outer_Full (A6)
4	902.5	5			QPSK	Outer_Full (A1)
5	910	10			QPSK	Outer_Full (A4)
6	907.5	15			QPSK	Edge_1RB_Left (A6)
7	907.5	15			QPSK	Outer_Full (A6)
8	910	10			16 QAM	Outer_Full (A5)
9	907.5	15			16 QAM	Edge_1RB_Left (A6)
10	907.5	15			16 QAM	Outer_Full (A6)
11	910	10			64 QAM	Outer_Full (A3)
12	907.5	15			64 QAM	Edge_1RB_Left (A6)
13	907.5	15			64 QAM	Outer_Full (A6)
14	907.5	15			256 QAM	Edge_1RB_Left (A6)
15	907.5	15			256 QAM	Outer_Full (A6)
16	902.5	5			CP-OFDM QPSK	Outer_Full (A1)
17	910	10			QPSK	Outer_Full (A5)
18	907.5	15			QPSK	Edge_1RB_Left (A6)
19	907.5	15			QPSK	Outer_Full (A6)
20	902.5	5			16 QAM	Outer_Full (A1)
21	910	10			16 QAM	Outer_Full (A5)
22	907.5	15			16 QAM	Edge_1RB_Left (A6)
23	907.5	15			16 QAM	Outer_Full (A6)
24	910	10			64 QAM	Outer_Full (A3)
25	907.5	15			64 QAM	Edge_1RB_Left (A6)
26	907.5	15			64 QAM	Outer_Full (A6)
27	907.5	15			256 QAM	Edge_1RB_Left (A6)
28	907.5	15			256 QAM	Outer_Full (A6)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 2: AMPR requirement for NS_43 is specified in 6.2.3.3.6.						

Table 6.5C.3.3.4-3: Test Configuration Table (network signalling value "NS_18")

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range for SUL carrier Mid range for Non-SUL carrier			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			5MHz 10MHz 20MHz 30MHz for SUL carrier Lowest for Non-SUL carrier			
Test SCS as specified in Table 5.3.5-1			15 kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier			
A-MPR test parameters for NS_18						
Test ID	**ChBw SCS**	**Downlink Configuration**	**SUL Configuration**			
			Modulation (Note 2)		**RB allocation (Note 1)**	**Comment**
1	5MHz, 10MHz, 20MHz	N/A	DFT-s OFDM	QPSK	Edge_1RB_Left	A1, A2
2				QPSK	Outer_Full	A1, A2
3				16 QAM	Edge_1RB_Left	A1, A2
4				16 QAM	Outer_Full	A1, A2
5				64 QAM	Edge_1RB_Left	A1, A2
6				64 QAM	Outer_Full	A1, A2
7				256 QAM	Edge_1RB_Left	A1, A2
8				256 QAM	Outer_Full	A1, A2
9			CP-s OFDM	QPSK	Edge_1RB_Left	A1, A2
10				QPSK	Outer_Full	A1, A2
11				16 QAM	Edge_1RB_Left	A1, A2
12				16 QAM	Outer_Full	A1, A2
13				64 QAM	Edge_1RB_Left	A1, A2
14				64 QAM	Outer_Full	A1, A2
15				256 QAM	Edge_1RB_Left	A1, A2
16				256 QAM	Outer_Full	A1, A2
17	30MHz		DFT-s OFDM	256 QAM	81@70	A3
18				256 QAM	Outer_Full	A4
19			CP-s OFDM	256 QAM	87@73	A3
20				256 QAM	Outer_Full	A4
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.						

Table 6.5C.3.3.4-4: Test Configuration Table (network signalling value "NS_48")

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Low range, High range for SUL carrier Mid range for non-SUL carrier
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	25 MHz, 30MHz, 40MHz, 50MHz for SUL carrier Lowest for non-SUL carrier
Test SCS as specified in Table 5.3.5-1	15 kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier

A-MPR test parameters for NS_48

Test ID	F_c (MHz)	Ch BW (MHz)	Uplink Configuration	Downlink Configuration	SUL Configuration		
					Modulation (Note 2)		RB allocation (Note 1)
1	Default	25	N/A	N/A	DFT-s-OFDM	QPSK	Outer_Full (A3)
2	Default	25				QPSK	Edge_1RB_Right (A3)
3	Default	30				QPSK	Outer_Full (A3)
4	Default	30				QPSK	Edge_1RB_Right (A5)
5	Default	40				QPSK	16@0 (A2)
6	Default	40				QPSK	90@0 (A3)
7	Default	40				QPSK	150@0 (A4)
8	Default	40				QPSK	192@0 (A2)
9	Default	40				QPSK	5@187 (A3)
10	Default	40				QPSK	Outer_Full (A1)
11	Default	50				QPSK	32@0 (A2)
12	Default	50				QPSK	108@0 (A4)
13	Default	50				QPSK	225@0 (A2)
14	Default	50				QPSK	5@223 (A5)
15	Default	50				QPSK	Outer_Full (A1)
16	Default	25				256 QAM	Outer_Full (A3)
17	Default	25				256 QAM	Edge_1RB_Right (A3)
18	Default	30				256 QAM	Outer_Full (A3)
19	Default	30				256 QAM	Edge_1RB_Right (A5)
20	Default	40				256 QAM	16@0 (A2)
21	Default	40				256 QAM	90@0 (A3)
22	Default	40				256 QAM	150@0 (A4)
23	Default	40				256 QAM	192@0 (A2)
24	Default	40				256 QAM	5@187 (A3)
25	Default	40				256 QAM	Outer_Full (A1)
26	Default	50				256 QAM	32@0 (A2)
27	Default	50				256 QAM	108@0 (A4)
28	Default	50				256 QAM	225@0 (A2)
29	Default	50				256 QAM	5@223 (A5)
30	Default	50				256 QAM	Outer_Full (A1)
31	Default	25			CP-OFDM	QPSK	Outer_Full (A3)
32	Default	25				QPSK	Edge_1RB_Right (A3)
33	Default	30				QPSK	Outer_Full (A3)
34	Default	30				QPSK	Edge_1RB_Right (A5)
35	Default	40				QPSK	16@0 (A2)
36	Default	40				QPSK	95@0 (A3)
37	Default	40				QPSK	152@0 (A4)
38	Default	40				QPSK	192@0 (A2)
39	Default	40				QPSK	5@187 (A3)
40	Default	40				QPSK	Outer_Full (A1)
41	Default	50				QPSK	34@0 (A2)
42	Default	50				QPSK	115@0 (A4)
43	Default	50				QPSK	228@0 (A2)
44	Default	50				QPSK	5@223 (A5)
45	Default	50				QPSK	Outer_Full (A1)

46	Default	25				256 QAM	Outer_Full (A3)
47	Default	25				256 QAM	Edge_1RB_Right (A3)
48	Default	30				256 QAM	Outer_Full (A3)
49	Default	30				256 QAM	Edge_1RB_Right (A5)
50	Default	40				256 QAM	16@0 (A2)
51	Default	40				256 QAM	95@0 (A3)
52	Default	40				256 QAM	152@0 (A4)
53	Default	40				256 QAM	192@0 (A2)
54	Default	40				256 QAM	5@187 (A3)
55	Default	40				256 QAM	Outer_Full (A1)
56	Default	50				256 QAM	34@0 (A2)
57	Default	50				256 QAM	115@0 (A4)
58	Default	50				256 QAM	228@0 (A2)
59	Default	50				256 QAM	5@223 (A5)
60	Default	50				256 QAM	Outer_Full (A1)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.							

Table 6.5C.3.3.4-5: Test Configuration Table (network signalling value "NS_49")

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal					
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Low range, High range for SUL carrier Mid range for non-SUL carrier					
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	25 MHz, 30MHz, 40MHz, 50MHz for SUL carrier Lowest for non-SUL carrier					
Test SCS as specified in Table 5.3.5-1	15 kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier					
A-MPR test parameters for NS_49						
Test ID	**F_c (MHz)**	**Ch BW (MHz)**	**Downlink Configuration**	**Uplink Configuration**	**SUL Configuration**	
					Modulation (Note 2)	**RB allocation (Note 1)**
1	Default	25	N/A	N/A	DFT-s-OFDM QPSK	Outer_Full (A3)
2	Default	25			QPSK	Edge_1RB_Right (A3)
3	Default	25			QPSK	Edge_1RB_Left (A3)
4	Default	30			QPSK	20@0 (A1)
5	Default	30			QPSK	36@0 (A5)
6	Default	30			QPSK	80@0 (A3)
7	Default	30			QPSK	120@0 (A4)
8	Default	30			QPSK	Outer_Full (A2)
9	Default	30			QPSK	Edge_1RB_Right (A5)
10	Default	40			QPSK	40@0 (A1)
11	Default	40			QPSK	5@53 (A5)
12	Default	40			QPSK	100@0 (A4)
13	Default	40			QPSK	150@33 (A2)
14	Default	40			QPSK	5@187 (A5)
15	Default	40			QPSK	192@0 (A1)
16	Default	40			QPSK	Outer_Full (A1)
17	Default	50			QPSK	5@75 (A5)
18	Default	50			QPSK	5@215 (A5)
19	Default	50			QPSK	162@45 (A2)
20	Default	50			QPSK	220@0 (A1)
21	Default	50			QPSK	Outer_Full (A1)
22	Default	25			256 QAM	Outer_Full (A3)
23	Default	25			256 QAM	Edge_1RB_Right (A3)
24	Default	25			256 QAM	Edge_1RB_Left (A3)
25	Default	30			256 QAM	20@0 (A1)
26	Default	30			256 QAM	36@0 (A5)
27	Default	30			256 QAM	80@0 (A3)
28	Default	30			256 QAM	120@0 (A4)
29	Default	30			256 QAM	Outer_Full (A2)
30	Default	30			256 QAM	Edge_1RB_Right (A5)
31	Default	40			256 QAM	40@0 (A1)
32	Default	40			256 QAM	5@53 (A5)
33	Default	40			256 QAM	100@0 (A4)
34	Default	40			256 QAM	150@33 (A2)
35	Default	40			256 QAM	5@187 (A5)
36	Default	40			256 QAM	192@0 (A1)
37	Default	40			256 QAM	Outer_Full (A1)
38	Default	50			256 QAM	5@75 (A5)
39	Default	50			256 QAM	5@215 (A5)
40	Default	50			256 QAM	162@45 (A2)
41	Default	50			256 QAM	216@0 (A1)
42	Default	50			256 QAM	Outer_Full (A1)
43	Default	25			CP-OFDM QPSK	Outer_Full (A3)
44	Default	25			QPSK	Edge_1RB_Right (A3)
45	Default	25			QPSK	Edge_1RB_Left (A3)
46	Default	30			QPSK	20@0 (A1)

47	Default	30				QPSK	36@0 (A5)
48	Default	30				QPSK	80@0 (A3)
49	Default	30				QPSK	120@0 (A4)
50	Default	30				QPSK	Outer_Full (A2)
51	Default	30				QPSK	Edge_1RB_Right (A5)
52	Default	40				QPSK	40@0 (A1)
53	Default	40				QPSK	5@53 (A5)
54	Default	40				QPSK	100@0 (A4)
55	Default	40				QPSK	159@33 (A2)
56	Default	40				QPSK	5@187 (A5)
57	Default	40				QPSK	192@0 (A1)
58	Default	40				QPSK	Outer_Full (A1)
59	Default	50				QPSK	5@75 (A5)
60	Default	50				QPSK	5@215 (A5)
61	Default	50				QPSK	175@45 (A2)
62	Default	50				QPSK	216@0 (A1)
63	Default	50				QPSK	Outer_Full (A1)
64	Default	25				256 QAM	Outer_Full (A3)
65	Default	25				256 QAM	Edge_1RB_Right (A3)
66	Default	25				256 QAM	Edge_1RB_Left (A3)
67	Default	30				256 QAM	20@0 (A1)
68	Default	30				256 QAM	36@0 (A5)
69	Default	30				256 QAM	80@0 (A3)
70	Default	30				256 QAM	120@0 (A4)
71	Default	30				256 QAM	Outer_Full (A2)
72	Default	30				256 QAM	Edge_1RB_Right (A5)
73	Default	40				256 QAM	40@0 (A1)
74	Default	40				256 QAM	5@53 (A5)
75	Default	40				256 QAM	100@0 (A4)
76	Default	40				256 QAM	150@33 (A2)
77	Default	40				256 QAM	5@187 (A5)
78	Default	40				256 QAM	192@0 (A1)
79	Default	40				256 QAM	Outer_Full (A1)
80	Default	50				256 QAM	5@75 (A5)
81	Default	50				256 QAM	5@215 (A5)
82	Default	50				256 QAM	175@45 (A2)
83	Default	50				256 QAM	220@0 (A1)
84	Default	50				256 QAM	Outer_Full (A1)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.							

Table 6.5C.3.3.4-6: Test Configuration Table (network signalled value "NS_56")

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Use uplink carrier centre frequency (Fc) as specified in test parameters
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	5 MHz, 10 MHz as specified in test parameters for SUL carrier Lowest for non-SUL carrier
Test SCS as specified in Table 5.3.5-1	15 kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier

A-MPR test parameters for NS_56								
Test ID	**F_c (MHz)**	**ChBw (MHz)**	**Downlink Configuration**	**Uplink Configuration**	**A-MPR**	**Uplink Configuration**		
						Modulation (NOTE 2)		**RB allocation (Note 1)**
								SCS 15 kHz
1	Low	5			14		PI/2 BPSK	Edge_1RB_Left
2	Low	5			6		PI/2 BPSK	Outer_Full
3	Low	5			4		PI/2 BPSK	20@4
4	Low	5			4		PI/2 BPSK	1@4
5	Low	5			14		QPSK	Edge_1RB_Left
6	Low	5			6		QPSK	Outer_Full
7	Low	5			4		QPSK	20@4
8	Low	5			4		QPSK	1@4
9	Low	5			14		16 QAM	Edge_1RB_Left
10	Low	5			6		16 QAM	Outer_Full
11	Low	5			4		16 QAM	20@4
12	Low	5			4		16 QAM	1@4
13	Low	5			14		64 QAM	Edge_1RB_Left
14	Low	5			6		64 QAM	Outer_Full
15	Low	5			4		64 QAM	20@4
16	Low	5			4		64 QAM	1@4
17	Low	5			14		256 QAM	Edge_1RB_Left
18	Low	5			6		256 QAM	Outer_Full
19	Low	5			4		256 QAM	20@4
20	Low	5			4		256 QAM	1@4
21	Low	10			12		PI/2 BPSK	Edge_1RB_Left
22	Low	10			8		PI/2 BPSK	Outer_Full
23	Low	10	N/A for A-MPR testing	N/A	6	DFT-s-OFDM	PI/2 BPSK	1@3
24	Low	10			6		PI/2 BPSK	40@9
25	Low	10			4		PI/2 BPSK	1@35
26	Low	10			2		PI/2 BPSK	16@35
27	Low	10			5		PI/2 BPSK	Edge_1RB_Right
28	Low	10			5		PI/2 BPSK	1@40
29	Low	10			3		PI/2 BPSK	8@44
30	Low	10			12		QPSK	Edge_1RB_Left
31	Low	10			8		QPSK	Outer_Full
32	Low	10			6		QPSK	1@3
33	Low	10			6		QPSK	40@9
34	Low	10			4		QPSK	1@35
35	Low	10			2		QPSK	16@35
36	Low	10			5		QPSK	Edge_1RB_Right
37	Low	10			5		QPSK	1@40
38	Low	10			3		QPSK	8@44
39	Low	10			12		16 QAM	Edge_1RB_Left
40	Low	10			8		16 QAM	Outer_Full
41	Low	10			6		16 QAM	1@3
42	Low	10			6		16 QAM	40@9
43	Low	10			4		16 QAM	1@35
44	Low	10			2		16 QAM	16@35
45	Low	10			5		16 QAM	Edge_1RB_Right

46	Low	10			5		16 QAM	1@40
47	Low	10			3		16 QAM	8@44
48	Low	10			12		64 QAM	Edge_1RB_Left
49	Low	10			8		64 QAM	Outer_Full
50	Low	10			6		64 QAM	1@3
51	Low	10			6		64 QAM	40@9
52	Low	10			4		64 QAM	1@35
53	Low	10			2		64 QAM	16@35
54	Low	10			5		64 QAM	Edge_1RB_Right
55	Low	10			5		64 QAM	1@40
56	Low	10			3		64 QAM	8@44
57	Low	10			12		256 QAM	Edge_1RB_Left
58	Low	10			8		256 QAM	Outer_Full
59	Low	10			6		256 QAM	1@3
60	Low	10			6		256 QAM	40@9
61	Low	10			4		256 QAM	1@35
62	Low	10			2		256 QAM	16@35
63	Low	10			5		256 QAM	Edge_1RB_Right
64	Low	10			5		256 QAM	1@40
65	Low	10			3		256 QAM	8@44
66	Low	5	N/A for A-MPR testing	N/A	14	CP-OFDM	QPSK	Edge_1RB_Left
67	Low	5			6		QPSK	Outer_Full
68	Low	5			4		QPSK	21@4
69	Low	5			4		QPSK	1@4
70	Low	5			14		16 QAM	Edge_1RB_Left
71	Low	5			6		16 QAM	Outer_Full
72	Low	5			4		16 QAM	21@4
73	Low	5			4		16 QAM	1@4
74	Low	5			14		64 QAM	Edge_1RB_Left
75	Low	5			6		64 QAM	Outer_Full
76	Low	5			4		64 QAM	21@4
77	Low	5			4		64 QAM	1@4
78	Low	5			14		256 QAM	Edge_1RB_Left
79	Low	5			6		256 QAM	Outer_Full
80	Low	5			4		256 QAM	21@4
81	Low	5			4		256 QAM	1@4
82	Low	10			12		QPSK	Edge_1RB_Left
83	Low	10			8		QPSK	Outer_Full
84	Low	10			6		QPSK	1@3
85	Low	10			6		QPSK	43@9
86	Low	10			4		QPSK	1@35
87	Low	10			2		QPSK	17@35
88	Low	10			5		QPSK	Edge_1RB_Right
89	Low	10			5		QPSK	1@40
90	Low	10			3		QPSK	8@44
91	Low	10			12		16 QAM	Edge_1RB_Left
92	Low	10			8		16 QAM	Outer_Full
93	Low	10			6		16 QAM	1@3
94	Low	10			6		16 QAM	43@9
95	Low	10			4		16 QAM	1@35
96	Low	10			2		16 QAM	17@35
97	Low	10			5		16 QAM	Edge_1RB_Right
98	Low	10			5		16 QAM	1@40
99	Low	10			3		16 QAM	8@44
100	Low	10			12		64 QAM	Edge_1RB_Left
101	Low	10			8		64 QAM	Outer_Full
102	Low	10			6		64 QAM	1@3
103	Low	10			6		64 QAM	43@9
104	Low	10			4		64 QAM	1@35

105	Low	10			2		64 QAM	17@35
106	Low	10			5		64 QAM	Edge_1RB_Right
107	Low	10			5		64 QAM	1@40
108	Low	10			3		64 QAM	8@44
109	Low	10			12		256 QAM	Edge_1RB_Left
110	Low	10			8		256 QAM	Outer_Full
111	Low	10			6		256 QAM	1@3
112	Low	10			6		256 QAM	43@9
113	Low	10			4		256 QAM	1@35
114	Low	10			2		256 QAM	17@35
115	Low	10			5		256 QAM	Edge_1RB_Right
116	Low	10			5		256 QAM	1@40
117	Low	10			3		256 QAM	8@44
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.								

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND (RF OR RRM), Tables 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, together with exceptions as specified in clause 6.5.3.3.4.3 as appropriate for different NS values.

Table 6.5C.3.3.4-2: Void

6.5C.3.3.5 Test requirement

For SUL operation, the Additional Spurious emission requirement specified in clause 6.5.3.3.5 shall be met for specific NS values.

Table 6.5C.3.3.5-1: Void

6.5C.4 Transmit intermodulation for SUL

6.5C.4.1 Test purpose

To verify that the UE transmit intermodulation does not exceed the described value in the test requirement.

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.5C.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

6.5C.4.3 Minimum conformance requirements

The requirements in subclause 6.5.4 apply to the UE operating on SUL bands

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5.4.

6.5C.4.4 Test description

Same test description as specified in clause 6.2.4.4 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 6.5.4.4.1-1→ use Table 6.5C.4.4-1

Table 6.5C.4.4-1: Test Configuration Table

<table>
<tr><th colspan="5">Initial Conditions</th></tr>
<tr><td colspan="3">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="2">Normal</td></tr>
<tr><td colspan="3">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Mid range for both SUL carrier and Non-SUL carrier</td></tr>
<tr><td colspan="3">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="2">Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="3">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">15kHz for SUL carrier and Lowest supported SCS for Non-SUL carrier</td></tr>
<tr><th colspan="5">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th>UL Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td></td><td rowspan="3">N/A</td><td rowspan="3">N/A</td><td>Modulation</td><td>RB allocation (NOTE 2)</td></tr>
<tr><td>1</td><td>DFT-s-OFDM Pi/2 BPSK</td><td>Inner Full</td></tr>
<tr><td>2</td><td>DFT-s-OFDM QPSK</td><td>Inner Full</td></tr>
<tr><td colspan="5">NOTE 1: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.
NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.3.4 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.
- Instead of table 6.5.4.5-1→ use Table 6.5C.4.5-1
- Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.1-28 with condition SUL AND (RF OR RRM), 4.6.3-14 with condition SUL_SUL for SUL carrier, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

6.5C.4.5 Test requirement

The ratio derived in step 6 and 8, shall not exceed the described value in table 6.5C.4.5-1.

Table 6.5C.4.5-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel centre	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40dBc	
Intermodulation product	< -29dBc	< -35dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCSs for the channel BW as defined in Table 6.5.2.4.1.3-1	
Measurement offset from channel centre	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$

6.5D Output RF spectrum emissions for UL MIMO

6.5D.1 Occupied bandwidth for UL MIMO

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 support UL MIMO.

6.5D.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for occupied bandwidth apply to the sum of the powers from both UE transmit antenna connectors. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in table 6.5.1.3-1. The requirements shall be met with UL MIMO configurations described in sub-clause 6.2D.1.3.

If UE is configured for transmission on single-antenna port by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in subclause 6.5.1.3 apply

The normative reference for this requirement is TS 38.101-1 [2] 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 sub-carrier 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 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range by default, exceptions listed in Table 6.5D.1.4.1-2	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		All	
Test SCS as specified in Table 5.3.5-1		Lowest SCS	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for occupied bandwidth test case	**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.			

Table 6.5D.1.4.1-2: Test frequency exceptions for Occupied Bandwidth

5G NR Band	Test Frequency
n77	Low Range, Mid Range, High Range
n78	Low Range, Mid Range, High Range
n79	Low Range, Mid Range, High Range

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

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 [5] 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 [5] subclause 4.3.6.1.1.2

2. Send continuously power control “up” commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.

3. Measure the power spectrum distribution as the sum of the powers from both UE transmit antenna connectors within two times or more 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). Other methods to measure the power spectrum distribution are allowed. The measuring duration is 1ms over consecutive active uplink slots. For TDD, only slots consisting of only UL symbols are under test.

4. Calculate the total power within the range of all frequencies measured in step 3 and save this value as “Total power”.

5. Sum up the power upward from the lower boundary of the measured frequency range in step 3 and seek the limit frequency point by which this sum becomes 0.5% of “Total power” and save this point as “Lower Frequency”.

6. Sum up the power downward from the upper boundary of the measured frequency range in step 3 and seek the limit frequency point by which this sum becomes 0.5% of “Total power” and save this point as “Upper Frequency”.

7. Calculate the difference “Upper Frequency” – “Lower Frequency” = “Occupied Bandwidth” between the two limit frequencies obtained in step 5 and step 6.

6.5D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO

6.5D.1.5 Test requirement

The measured Occupied Bandwidth in step 7 shall not exceed values in Table 6.5D.1.5-1.

Table 6.5D.1.5-1: Occupied channel bandwidth

	NR channel bandwidth													
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	45 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Occupied channel bandwidth (MHz)	5	10	15	20	25	30	40	45	50	60	70	80	90	100

6.5D.1_1 Void

6.5D.2 Out of band emission for UL MIMO

6.5D.2.1 General

For UE supporting UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified as the sum of the emissions from both UE transmit antenna connectors.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.5.2 apply. The requirements shall be met with UL MIMO configurations described in sub-clause 6.2D.1.3

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in subclause 6.5.2 apply.

6.5D.2.2 Spectrum emission mask for UL MIMO

6.5D.2.2.1 Test purpose

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

6.5D.2.2.2 Test applicability

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

6.5D.2.2.3 Minimum conformance requirements

The sum of power of any UE emission shall not exceed the levels specified in Table 6.5.2.2.3-1 for the specified channel bandwidth from both transmit antenna connectors.

For UE support uplink full power transmission (ULFPTx) for UL MIMO, the requirements in clause 6.5.2.2 shall apply. The requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE's support of uplink full power transmission mode.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 6.5.2.2 apply.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5D.2 and 6.5.2.2

6.5D.2.2.4 Test description

6.5D.2.2.4.1 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, and are shown in tables 6.5D.2.2.4.1-1 to 6.5D.2.2.4.1-3. 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.2.2.4.1-1: Test Configuration Table for power class 3 and power class 2

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1				Low range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1				Lowest, Highest		
Test SCS as specified in Table 5.3.5-1				Lowest and Highest		
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Spectrum Emission Mask test case	**Modulation**	**RB allocation (NOTE 1)**
1	Low				CP-OFDM QPSK	Edge_1RB_Left
2	High				CP-OFDM QPSK	Edge_1RB_Right
3	Default				CP-OFDM QPSK	Outer_Full
4	Low				CP-OFDM 16 QAM	Edge_1RB_Left
5	High				CP-OFDM 16 QAM	Edge_1RB_Right
6	Default				CP-OFDM 16 QAM	Outer_Full
7	Low				CP-OFDM 64 QAM	Edge_1RB_Left
8	High				CP-OFDM 64 QAM	Edge_1RB_Right
9	Default				CP-OFDM 64 QAM	Outer_Full
10	Low				CP-OFDM 256 QAM	Edge_1RB_Left
11	High				CP-OFDM 256 QAM	Edge_1RB_Right
12	Default				CP-OFDM 256 QAM	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.						

Table 6.5D.2.2.4.1-2: Test Configuration Table for power class 3 with supporting ULFPTx

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A for Maximum Power Reduction (MPR) test case	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1[4]	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
2[4]	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
3[4]	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
4[4]	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
5	High		DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default		DFT-s-OFDM QPSK	Outer Full
7	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default		DFT-s-OFDM 16 QAM	Outer Full
10	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 64 QAM	Outer Full
13	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 256 QAM	Outer Full
16	Low		CP-OFDM QPSK	Edge_1RB_Left
17	High		CP-OFDM QPSK	Edge_1RB_Right
18	Default		CP-OFDM QPSK	Outer Full
19	Low		CP-OFDM 16 QAM	Edge_1RB_Left
20	High		CP-OFDM 16 QAM	Edge_1RB_Right
21	Default		CP-OFDM 16 QAM	Outer Full
22	Low		CP-OFDM 64 QAM	Edge_1RB_Left
23	High		CP-OFDM 64 QAM	Edge_1RB_Right
24	Default		CP-OFDM 64 QAM	Outer Full
25	Low		CP-OFDM 256 QAM	Edge_1RB_Left
26	High		CP-OFDM 256 QAM	Edge_1RB_Right
27	Default		CP-OFDM 256 QAM	Outer Full

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.
NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: Test ID 16 ~ 27 with CP-OFDM modulation are not needed if PDCCH DCI format 0_1 indicates ULFPTx_Mode1.
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n41, n77, n78 and n79.

Table 6.5D.2.2.4.1-3: Test Configuration Table for power class 2 with supporting ULFPTx

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A for Maximum Power Reduction (MPR) test case	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
2	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
3	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
4	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
5	High		DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default		DFT-s-OFDM QPSK	Outer Full
7	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default		DFT-s-OFDM 16 QAM	Outer Full
10	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 64 QAM	Outer Full
13	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 256 QAM	Outer Full
16	Low		CP-OFDM QPSK	Edge_1RB_Left
17	High		CP-OFDM QPSK	Edge_1RB_Right
18	Default		CP-OFDM QPSK	Outer Full
19	Low		CP-OFDM 16 QAM	Edge_1RB_Left
20	High		CP-OFDM 16 QAM	Edge_1RB_Right
21	Default		CP-OFDM 16 QAM	Outer Full
22	Low		CP-OFDM 64 QAM	Edge_1RB_Left
23	High		CP-OFDM 64 QAM	Edge_1RB_Right
24	Default		CP-OFDM 64 QAM	Outer Full
25	Low		CP-OFDM 256 QAM	Edge_1RB_Left
26	High		CP-OFDM 256 QAM	Edge_1RB_Right
27	Default		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: Test ID 16 ~ 27 with CP-OFDM modulation are not needed if PDCCH DCI format 0_1 indicates ULFPTx_Mode1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to tables 6.5D.2.2.4.1-1 to 6.5D.2.2.4.1-3.

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 [5] clause 4.5. Message contents are defined in clause 6.5D.2.2.4.3

6.5D.2.2.4.2 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.2.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2
2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the sum of the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2D.2.5-1 or 6.2D.2.5-2 as appropriate. The period of the measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.
4. Measure the sum of power of the transmitted signal from both antenna connectors with a measurement filter of bandwidths according to Table 6.5D.2.2.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.
5. If UE supports ULFPTx, repeat test steps 1~3 with UL RMC according to Table 6.5D.2.2.4.1-2 and Table 6.5D.2.2.4.1-3 as appropriate. The PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode1, ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability. Message contents are according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.5D.2.2.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5D.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.2.2.5 Test requirement

The measured sum of the UE mean power in the channel bandwidth, derived in step 3, shall fulfill requirements in Tables 6.2D.2.5-1, 6.2D.2.5-2, 6.2D.2.5-2a and 6.2D.2.5-2b as appropriate, and the sum of power of any UE emission measured from both antennas in step 4 and step 5 shall fulfill requirements in Table 6.5D.2.2.5-1.

Table 6.5D.2.2.5-1: NR General spectrum emission mask

<table>
<tr><th colspan="15">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>ΔfOOB (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>70 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0-1</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1 % channel bandwidth</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td rowspan="22">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13 + TT</td><td rowspan="2">-13 + TT</td><td rowspan="3">-13 + TT</td><td rowspan="4">-13 + TT</td><td rowspan="5">-13 + TT</td><td rowspan="6">-13 + TT</td><td rowspan="8">-13 + TT</td><td rowspan="10">-13 + TT</td><td rowspan="12">-13 + TT</td><td rowspan="14">-13 + TT</td><td rowspan="16">-13 + TT</td><td rowspan="18">-13 + TT</td><td rowspan="20">-13 + TT</td></tr>
<tr><td>± 6-10</td><td>-25 + TT</td></tr>
<tr><td>± 10-15</td><td></td><td>-25 + TT</td></tr>
<tr><td>± 15-20</td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 20-25</td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 25-30</td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 30-35</td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 35-40</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 40-45</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 45-50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 50-55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 55-60</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 60-65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 65-70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 70-75</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 75-80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-85</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 85-90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 90-95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 95-100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 100-105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td colspan="15">Note 1: The first and last measurement position with a 30 kHz filter is at ΔfOOB equals to 0.015 MHz and 0.985 MHz.
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.
Note 4: TT = 1.5 dB for f ≤ 3GHz, TT = 1.8 dB for 3GHz < f ≤ 4.2GHz, TT = 1.8 dB for 4.2GHz < f ≤ 6.0GHz.</td></tr>
</table>

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.

6.5D.2.3 Additional spectrum emission mask for UL MIMO

Editor's note:

-Test coverage for the NS_XXs other than NS_03, NS_03U, NS_04 and NS_35 is FFS

- Supporting of ULFPTx is only completed for NS_04 in A-MPR

6.5D.2.3.1 Test purpose

To verify that the sum of power of any UE emission from both transmit antennas shall not exceed specified lever for the specified channel bandwidth under the deployment scenarios where additional requirements are specified.

6.5D.2.3.2 Test applicability

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

6.5D.2.3.3 Minimum conformance requirements

The sum of power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3-1 for NS_35, Table 6.5.2.3.3.2-1 for NS_04, and Table 6.5.2.3.3.3 for NS_03 and NS_03U for the specified channel bandwidth from both transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5D.2 and 6.5.2.3

6.5D.2.3.4 Test description

6.5D.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, 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, and are shown in table 6.5D.2.3.4.1-1. 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 6.5D.2.3.4.1-1 to 6.5D.2.3.4.1-3: Void

Table 6.5D.2.3.4.1-2: Test Configuration Table for NS_04 for band n41

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			(See Freq column)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
A-SEM test parameters for NS_04				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
			Modulation	**RB allocation (NOTE 1)**
1	Low	N/A	CP-OFDM QPSK	Edge_1RB_Left
2	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM QPSK	Edge_1RB_Left
3	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM QPSK	Inner Full
4			CP-OFDM QPSK	Outer Full
5	High		CP-OFDM QPSK	Edge_1RB_Right
6	High		CP-OFDM QPSK	Inner Full
7	High		CP-OFDM QPSK	Outer Full
8	Low		CP-OFDM 16 QAM	Edge_1RB_Left
9	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 16 QAM	Edge_1RB_Left
10	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 16 QAM	Inner Full
11			CP-OFDM 16 QAM	Outer Full
12	High		CP-OFDM 16 QAM	Edge_1RB_Right
13	High		CP-OFDM 16 QAM	Inner Full
14	High		CP-OFDM 16 QAM	Outer Full
15	Low		CP-OFDM 64 QAM	Edge_1RB_Left
16	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 64 QAM	Edge_1RB_Left
17	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 64 QAM	Outer Full
18	High		CP-OFDM 64 QAM	Edge_1RB_Right
19	High		CP-OFDM 64 QAM	Outer Full
20	Low		CP-OFDM 256 QAM	Edge_1RB_Left
21	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 256 QAM	Edge_1RB_Left
22	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 256 QAM	Outer Full
23	High		CP-OFDM 256 QAM	Edge_1RB_Right
24	High		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.				

Table 6.5D.2.3.4.1-3: Test Configuration table for NS_03 and NS_03U

Initial Conditions							
Test Environment as specified in TS 38.508-1 [5] subclause 4.1						Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1						Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1						Lowest, Highest	
Test SCS as specified in Table 5.3.5-1						Lowest, Highest	
A-MPR test parameters for NS_03 and NS_03U							
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**		
					Modulation		**RB allocation (Note 1)**
1	Low	Default	Default	N/A for A-MPR test cases	CP- OFDM	QPSK	Edge_1RB_Left
2	High	Default	Default			QPSK	Edge_1RB_Right
3	Default	Default	Default			QPSK	Outer_Full
4	Low	Default	Default			16 QAM	Edge_1RB_Left
5	High	Default	Default			16 QAM	Edge_1RB_Right
6	Default	Default	Default			16 QAM	Outer_Full
7	Low	Default	Default			64 QAM	Edge_1RB_Left
8	High	Default	Default			64 QAM	Edge_1RB_Right
9	Default	Default	Default			64 QAM	Outer_Full
10	Low	Default	Default			256 QAM	Edge_1RB_Left
11	High	Default	Default			256 QAM	Edge_1RB_Right
12	Default	Default	Default			256 QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.							

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Tables 6.5D.2.3.4.1-1 as appropriate for NS_35.

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 [5] clause 4.5. Message contents are defined in clause 6.5D.2.3.4.3.

6.5D.2.3.4.2 Test procedure

Same test procedure as defined in clause 6.5D.2.2.4.2 with the following exceptions:

- Instead of Table 6.2D.2.5-1, test requirements in clause 6.2D.3.5 are applied in step 3;
- Instead of Table 6.5D.2.2.5-1, test requirements in clause 6.5D.2.2.5 are applied in step 4;
- Instead of Table 6.5D.2.2.4.1-2 and Table 6.5D.2.2.4.1-3, test configurations for ULFPTx in clause 6.2D.3 are applied in step 5;

6.5D.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and exceptions listed in clause 6.2D.3.4.3.

6.5D.2.3.5 Test requirement

The measured sum of the UE mean power in the channel bandwidth, derived in step 3 and step 5 shall fulfill the requirements as specified in clause 6.2D.3.5 for NS_35, NS_04, NS_03 and NS_03U as appropriate, and the sum of power of any UE emission measured from both antennas in step 4 and step 5 shall fulfill requirements in current subclause.

Table 6.5D.2.3.5-1: Additional requirements for “NS_35”

Spectrum emission limit (dBm) / Channel bandwidth					
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth (unless otherwise stated)
± 0-0.1	-15 + TT	-18 + TT	-20 + TT	-21 + TT	30 kHz
± 0.1-6	-13 + TT	-13 + TT	-13 + TT	-13 + TT	100 kHz
± 6-10	-25[1] + TT	-13 + TT	-13 + TT	-13 + TT	100 kHz
± 10-15		-25[1] + TT	-13 + TT	-13 + TT	100 kHz
± 15-20			-25[1] + TT	-13 + TT	100 kHz
± 20-25				-25 + TT	1 MHz
NOTE 1: The measurement bandwidth shall be 1 MHz; NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5D.2.3.5-2					

Table 6.5D.2.3.5-2: Test Tolerance (Spectrum Emission Mask)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 6.0GHz
BW ≤ 100MHz	1.5 dB	1.8 dB	1.8 dB

Table 6.5D.2.3.5-3: Additional requirements for “NS_04”

<table>
<tr><th></th><th colspan="10">Spectrum emission limit (dBm) / measurement bandwidth for each channel bandwidth</th></tr>
<tr><th>Δf_{OOB} MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td rowspan="2">± 0 - 1</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td colspan="5"></td><td>2 % channel bandwidth</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="5">-10 + TT</td><td>1 MHz</td></tr>
<tr><td>± 1 - 5</td><td colspan="9">-10 + TT</td><td rowspan="3">1 MHz</td></tr>
<tr><td>± 5 - X</td><td colspan="9">-13 + TT</td></tr>
<tr><td>± X - (BW_{Channel} + 5 MHz)</td><td colspan="9">-25 + TT</td></tr>
<tr><td colspan="11">NOTE 1: X is defined in Table 6.5D.2.3.5-3a for CP-OFDM
NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.5D.2.3.5-2.</td></tr>
</table>

Table 6.5D.2.3.5-3a: n41 maximum transmission bandwidths (MHz) for CP-OFDM

SCS (kHz)	Channel bandwidths (MHz)								
	10	15	20	40	50	60	80	90	100
15	9.36	14.22	19.08	38.88	48.6	N/A	N/A	N/A	N/A
30	8.64	13.68	18.36	38.16	47.88	58.32	78.12	88.02	98.28
60	7.92	12.96	17.28	36.72	46.8	56.88	77.04	87.12	97.20

Table 6.5D.2.3.5-4: Additional requirements for "NS_03 and NS_03U"

Δf_{OOB} MHz	Channel bandwidth (MHz) / Spectrum emission limit (dBm)							Measurement bandwidth
	5	10	15	20	25	30	40	
± 0-1	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 % of channel BW
± 1-6	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 6-10	-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 10-15		-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 15-20			-25 + TT	-13 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 20-25				-25 + TT	-13 + TT	-13 + TT	-13 + TT	1 MHz
± 25-30					-25 + TT	-13 + TT	-13 + TT	1 MHz
± 30-35						-25 + TT	-13 + TT	1 MHz
± 35-40							-13 + TT	1 MHz
± 40-45							-25 + TT	1 MHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.3.5-1.								

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.

6.5D.2.4 Adjacent channel leakage ratio for UL MIMO

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.

6.5D.2.4.1 NR ACLR for UL MIMO

6.5D.2.4.1.1 Test purpose

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

6.5D.2.4.1.2 Test applicability

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

6.5D.2.4.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters is defined as the sum of the emissions from both UEtransmit antenna connectors.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.5.2.4.2.3 apply. The requirements shall be met with UL MIMO configurations described in clause 6.2D.1.3.

For UE support uplink full power transmission (ULFPTx) for UL MIMO, the requirements in clause 6.5.2.4.2.3 shall apply. The requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE's support of uplink full power transmission mode.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 6.5.2.4.2.3 apply.

The normative reference for this requirement is TS 38.101-1 [2] clauses and 6.5D.2 and 6.5.2.4.1.

6.5D.2.4.1.4 Test description

6.5D.2.4.1.4.1 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 sub-carrier spacing, are shown in the test configuration tables in clause 6.2D.2. 4.1. 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.2.4.1.4.1-1: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2D.2.4.1.
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 [5] clause 4.5. Message contents are defined in clause 6.5D.2.4.1.4.3 (If UE supports ULFPTx. The PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode1, ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.)

6.5D.2.4.1.4.2 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 the test configuration tables in clause 6.2D.2. 4.1. 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 [5] subclause 4.3.6.1.1.2
2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the sum of the mean power of the UE at from both antenna connectors in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2D.2.4.2,which shall meet the requirements described in clauses 6.2D.2.5 as appropriate.

4. Measure the sum of the rectangular filtered mean power for the assigned NR channel at each antenna connector of UE.
5. Measure the sum of rectangular filtered mean power of the first NR adjacent channel at each antenna connector of UE on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR at each antenna connector of UE, respectively.
7. If UE supports ULFPTx, repeat test steps 1~6 with UL RMC according to Table 6.2D.2.4.1-1a. The PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode1, ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.

6.5D.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.2.4.1.5 Test requirement

The measured UE mean total power derived in step 3, shall fulfil requirements in Clause 6.2D.2.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6 for each antenna connector, shall be higher than the limits in Table 6.5D.2.4.1.5-2.

Table 6.5D.2.4.1.5-1: Void

Table 6.5D.2.4.1.5-2: NR ACLR requirement

	Power class 1	Power class 2	Power class 3
NR ACLR		31 - TT dB	30 - TT dB
NOTE 1: TT = 0.8 dB			

6.5D.2.4.2 UTRA ACLR for UL MIMO

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

- Test point analysis for NS_05Uand NS_100 is FFS

6.5D.2.4.2.1 Test purpose

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

6.5D.2.4.2.2 Test applicability

This test case applies for NS_03U, NS_05U, and NS_100 to all types of NR UE release 15 and forward that supports UL MIMO.

6.5D.2.4.2.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters is defined as the sum of the emissions from both UEtransmit antenna connectors.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.5.2.4.2.3 apply. The requirements shall be met with UL MIMO configurations described in clause 6.2D.1.3.

For UE support uplink full power transmission (ULFPTx) for UL MIMO, the requirements in clause 6.5.2.4.2.3 shall apply. The requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE's support of uplink full power transmission mode.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 6.5.2.4.2.3 apply.

The normative reference for this requirement is TS 38.101-1 [2] clauses 6.5D.2 and 6.5.2.4.2.

6.5D.2.4.2.4 Test description

6.5D.2.4.2.4.1 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 6.5D.2.4.2.4.1-1. 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 6.5D.2.4.2.4.1-1: Test Configuration Table for NS_03U

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1				Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1				Low range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1				Lowest, Highest		
Test SCS as specified in Table 5.3.5-1				Lowest, Highest		
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Adjacent Channel Leakage Ratio test case	**Modulation**	**RB allocation (NOTE 1)**
1	Low				CP-OFDM QPSK	Edge_1RB_Left
2	High				CP-OFDM QPSK	Edge_1RB_Right
3	Default				CP-OFDM QPSK	Outer_Full
4	Low				CP-OFDM 16 QAM	Edge_1RB_Left
5	High				CP-OFDM 16 QAM	Edge_1RB_Right
6	Default				CP-OFDM 16 QAM	Outer_Full
7	Low				CP-OFDM 64 QAM	Edge_1RB_Left
8	High				CP-OFDM 64 QAM	Edge_1RB_Right
9	Default				CP-OFDM 64 QAM	Outer_Full
10	Low				CP-OFDM 256 QAM	Edge_1RB_Left
11	High				CP-OFDM 256 QAM	Edge_1RB_Right
12	Default				CP-OFDM 256 QAM	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.						

Table 6.5D.2.4.2.4.1-2: Test Configuration Table for NS_03U for UEs supporting ULFPTx

Initial Conditions							
Test Environment as specified in TS 38.508-1 [5] subclause 4.1						Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1						Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1						Lowest, Highest	
Test SCS as specified in Table 5.3.5-1						Lowest, Highest	
Test parameters for NS_03U							
Test ID	**Freq**	ChBw	SCS	**Downlink Configuration**	**Uplink Configuration**		
					Modulation (Note 2)		**RB allocation (Note 1)**
1	Low	Default	Default	N/A	DFT-s OFDM	PI/2 BPSK	Edge_1RB_Left
2	High	Default	Default			PI/2 BPSK	Edge_1RB_Right
3	Default	Default	Default			PI/2 BPSK	Outer_Full
4	Low	Default	Default			QPSK	Edge_1RB_Left
5	High	Default	Default			QPSK	Edge_1RB_Right
6	Default	Default	Default			QPSK	Outer_Full
7	Low	Default	Default			16 QAM	Edge_1RB_Left
8	High	Default	Default			16 QAM	Edge_1RB_Right
9	Default	Default	Default			16 QAM	Outer_Full
10	Low	Default	Default			64 QAM	Edge_1RB_Left
11	High	Default	Default			64 QAM	Edge_1RB_Right
12	Default	Default	Default			64 QAM	Outer_Full
13	Low	Default	Default			256 QAM	Edge_1RB_Left
14	High	Default	Default			256 QAM	Edge_1RB_Right
15	Default	Default	Default			256 QAM	Outer_Full
16	Low	Default	Default		CP-s OFDM	QPSK	Edge_1RB_Left
17	High	Default	Default			QPSK	Edge_1RB_Right
18	Default	Default	Default			QPSK	Outer_Full
19	Low	Default	Default			16 QAM	Edge_1RB_Left
20	High	Default	Default			16 QAM	Edge_1RB_Right
21	Default	Default	Default			16 QAM	Outer_Full
22	Low	Default	Default			64 QAM	Edge_1RB_Left
23	High	Default	Default			64 QAM	Edge_1RB_Right
24	Default	Default	Default			64 QAM	Outer_Full
25	Low	Default	Default			256 QAM	Edge_1RB_Left
26	High	Default	Default			256 QAM	Edge_1RB_Right
27	Default	Default	Default			256 QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: Void. NOTE 4: Void							

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.5D.2.4.2.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.5D.2.4.2.4.3

6.5D.2.4.2.4.2 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.2.4.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2
2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the sum of the mean power of the UE at each antenna connector in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in clause 6.2D.3.5 as appropriate. The period of the measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.
4. Measure the sum of the rectangular filtered mean power for the assigned NR channel at each antenna connector of UE.
5. Measure the sum of the RRC filtered mean power of the first and the second UTRA adjacent channel at each antenna connector of UE on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratio of the power between the values measured in step 4 over step 5 for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$ for both lower an upper side of the assigned NR channel, respectively.
7. If UE supports ULFPTx, repeat test steps 1~6 with UL RMC according to Table 6.2D.4.4.1-2. The PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode1, ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.

6.5D.2.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and with the exception specified in Table 6.5D.2.4.2.4.3 - 1

Table 6.5D.2.4.2.4.3-1: *AdditionalSpectrumEmission*: UTRA ACLR test requirement for "NS_XX"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 AdditionalSpectrumEmission from SIB1			
Information Element	**Value/remark**	**Comment**	**Condition**
AdditionalSpectrumEmission	1(NS_100)	NS_100 for band n1, n2, n3, n5, n8, n20, n25, n66, n80, n81, n82, n84 NOTE1	
	3(NS_03U)	NS_03U for n2, n25, n66, n86 NS_05U for n1, n84 NS_43U for n8, n81	
NOTE 1: This NS can be signalled for NR bands that have UTRA services deployed			

6.5D.2.4.2.5 Test requirement

UTRA ACLR requirement is applicable when signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission*.

The measured UE mean total power in the channel bandwidth at all the antenna connectors, derived in step 3, shall fulfil requirements in [Clause 6.2D.3.5] as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured UTRA ACLR, derived in step 6 for each antenna connector, shall be higher than the limits in Table 6.5D.2.4.2.5-1.

Table 6.5D.2.4.2.5-1: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB - TT
$UTRA_{ACLR2}$	36 dB - TT
NOTE 1: TT = 0.8 dB	

6.5D.2_1 Void

6.5D.3 Spurious emissions for UL MIMO

For UE supporting UL MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements specified in subclause 6.5.3 apply to each transmit antenna connector. The requirements shall be met with the UL MIMO configurations described in sub-clause 6.2D.1.3.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.5.3 apply.

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

6.5D.3.1 General spurious emissions for UL MIMO

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 that support UL MIMO.

6.5D.3.1.3 Minimum conformance requirements

The general spurious emission requirement specified in clause 6.5.3.1.3 applies to each antenna connector of the UE.

The normative reference for this requirement is TS 38.101-1 [2] subclauses 6.5D.3 and 6.5.3.1.

6.5D.3.1.4 Test description

6.5D.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 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 6.5D.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 6.5D.3.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1.		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1.		Lowest, Mid, Highest	
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	N/A for Spurious Emissions testing	CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex [A, Figure A.3.1.2.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, and G.3.0.
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 [5] clause 4.5. Message contents are defined in clause 6.5D.3.1.4.3.

6.5D.3.1.4.2 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.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. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the power of the transmitted signal at each antenna connector with a measurement filter of bandwidths according to table 6.5D.3.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 6.5D.3.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5D.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.3.1.5 Test requirement

The measured average power of spurious emission at each antenna connector, derived in step 3, shall not exceed the described value in Table 6.5D.3.1.5-1.

The spurious emission limits apply for the frequency ranges that are more than ΔfOOB (MHz) in Table 6.5.3.1.3-1from the edge of the channel bandwidth.

Table 6.5D.3.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band that the upper frequency edge of the UL Band more than 2.69 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz			

6.5D.3.2 Spurious emissions for UE co-existence for UL MIMO

6.5D.3.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements 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 that support UL MIMO.

6.5D.3.2.3 Minimum conformance requirements

The requirements for NR bands for coexistence with protected bands specified in subclause 6.5.3.2.3 apply to each UE transmit antenna connector

The normative reference for this requirement is TS 38.101-1 [2] subclauses 6.5.3.2 and 6.5D.3.

6.5D.3.2.4 Test description

6.5D.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 sub-carrier spacing, are shown in table 6.5D.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 6.5D.3.2.4.1-1: Test Configuration Table

<table>
<tr><th colspan="4">Initial Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1.</td><td colspan="2">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.</td><td colspan="2">Low range, Mid range, High range</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1.</td><td colspan="2">Lowest, Mid, Highest</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="2">Lowest</td></tr>
<tr><th colspan="4">Test Parameters</th></tr>
<tr><th>Test ID</th><th>Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><td></td><td rowspan="4">N/A for Spurious Emissions testing</td><td>Modulation</td><td>RB allocation (NOTE 1)</td></tr>
<tr><td>1</td><td>CP-OFDM QPSK</td><td>Outer_Full</td></tr>
<tr><td>2</td><td>CP-OFDM QPSK</td><td>Edge_1RB_Left</td></tr>
<tr><td>3</td><td>CP-OFDM QPSK</td><td>Edge_1RB_Right</td></tr>
<tr><td colspan="4">NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.2.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [6] subclause 4.4.3..
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5D.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 [5] clause 4.5. Message contents are defined in clause 6.5D.3.2.4.3.

6.5D.3.2.4.2 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.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. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the power of the transmitted signal at each UE antenna connector with a measurement filter of bandwidths according to table 6.5.3.2.3-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 6.5.3.2.3-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5D.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.3.2.5 Test requirement

The measured average power of spurious emission, derived in step 3 at each UE antenna connector, shall not exceed the described value in Table 6.5.3.2.3-1.

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:

- There are NS-XXs other than NS_04, NS_21 and NS_47 that are FFS:

6.5D.3.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions under the deployment scenarios where additional requirements are specified.

6.5D.3.3.2 Test applicability

This test case applies to all types of NR UE release 15 that support UL MIMO.

6.5D.3.3.3 Minimum conformance requirements

The additional spurious emission requirements specified in 6.5.3.3.3 apply to each UE antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clauses 6.5D.3 and 6.5.3.3

6.5D.3.3.4 Test description

6.5D.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, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 6.5D.3.3.4.1-1 through Table 6.5D.3.3.4.1-4. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5D.3.3.4.1-1: Test Configuration Table (network signalling value "NS_04")

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		(See Freq column)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Additional spurious emissions test parameters for NS_04			
		Downlink Configuration	**Uplink Configuration**	
Test ID	**Freq**	**N/A for A-MPR testing**	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1	Low		CP-OFDM QPSK	Edge_1RB_Left
2	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM QPSK	Edge_1RB_Left
4	2496 + $BW_{Channel}$ /2 +		CP-OFDM QPSK	Inner Full
4	MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM QPSK	Outer Full
5	High		CP-OFDM QPSK	Edge_1RB_Right
6	High		CP-OFDM QPSK	Inner Full
7	High		CP-OFDM QPSK	Outer Full
8	Low		CP-OFDM 16 QAM	Edge_1RB_Left
9	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 16 QAM	Edge_1RB_Left
10	2496 + $BW_{Channel}$ /2 +		CP-OFDM 16 QAM	Inner Full
11	MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 16 QAM	Outer Full
12	High		CP-OFDM 16 QAM	Edge_1RB_Right
13	High		CP-OFDM 16 QAM	Inner Full
14	High		CP-OFDM 16 QAM	Outer Full
15	Low		CP-OFDM 64 QAM	Edge_1RB_Left
16	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 64 QAM	Edge_1RB_Left
17	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 64 QAM	Outer Full
18	High		CP-OFDM 64 QAM	Edge_1RB_Right
19	High		CP-OFDM 64 QAM	Outer Full
20	Low		CP-OFDM 256 QAM	Edge_1RB_Left
21	2496 + 3/2 × $BW_{Channel}$ – 6 MHz		CP-OFDM 256 QAM	Edge_1RB_Left
22	2496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0.25 × $BW_{Channel}$)		CP-OFDM 256 QAM	Outer Full
23	High		CP-OFDM 256 QAM	Edge_1RB_Right
24	High		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.				

Table 6.5D.3.3.4.1-2: Test Configuration table for NS_47 power class 3 (contiguous allocation)

Initial Conditions									
Test Environment as specified in TS 38.508-1 [5] subclause 4.1							Normal		
Test Frequencies							As specified in Table 6.2.3.4.1-19 and 6.2.3.4.1-20		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1							30 MHz		
Test SCS as specified in Table 5.3.5-1							Lowest		
A-MPR test parameters for NS_47									
Test ID	**Fc (MHz)**	**Ch BW (MHz)**	**SCS (kHz)**		**Uplink Configuration**				
					Modulation (Note 2)		**RB allocation (Note 1)**		
							SCS 15 kHz	**SCS 30 kHz**	**SCS 60 kHz**
43	Default	30	Default	Downlink Configuration	CP-OFDM	QPSK	Edge_1RB_Left (A1)		
44	Default	30	Default			QPSK	1@29 (A2)	1@15 (A2)	1@8 (A2)
45	Default	30	Default			QPSK	Edge_1RB_Right (A3)		
46	Default	30	Default			QPSK	Outer_Full (A2)		
47	Default	30	Default			QPSK	108@0 (A4)	54@0 (A4)	27@0 (A4)
48	Default	30	Default			QPSK	80@0 (A4)	40@0 (A4)	20@0 (A4)
49	Default	30	Default			QPSK	54@0 (A2)	27@0 (A2)	12@0 (A2)
50	Default	30	Default			16 QAM	Edge_1RB_Left (A1)		
51	Default	30	Default			16 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
52	Default	30	Default			16 QAM	Edge_1RB_Right (A3)		
53	Default	30	Default			16 QAM	Outer_Full (A2)		
54	Default	30	Default			16 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
55	Default	30	Default			16 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
56	Default	30	Default			16 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
57	Default	30	Default			64 QAM	Edge_1RB_Left (A1)		
58	Default	30	Default			64 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
59	Default	30	Default			64 QAM	Edge_1RB_Right (A3)		
60	Default	30	Default			64 QAM	Outer_Full (A2)		
61	Default	30	Default			64 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
62	Default	30	Default			64 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
63	Default	30	Default			64 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
64	Default	30	Default			256 QAM	Edge_1RB_Left (A1)		
65	Default	30	Default			256 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
66	Default	30	Default			256 QAM	Edge_1RB_Right (A3)		
67	Default	30	Default			256 QAM	Outer_Full (A2)		
68	Default	30	Default			256 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
69	Default	30	Default			256 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
70	Default	30	Default			256 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and the IE *powerBoostPi2BPSK* is set to 1 for bands n41.
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n41, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n41.
NOTE 5: Void

Table 6.5D.3.3.4.1-3: Test Configuration table for NS_47 power class 3 (almost contiguous allocation)

Initial Conditions							
Test Environment as specified in TS 38.508-1 [5] subclause 4.1					Normal		
Test Frequencies					As specified in Table 6.2.3.4.1-19 and 6.2.3.4.1-20		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1					30 MHz		
Test SCS as specified in Table 5.3.5-1					Lowest		
A-MPR test parameters for NS_47							
Test ID	**F_c (MHz)**	**Ch BW (MHz)**	**SCS (kHz)**	**Downlink Configuration**	**Uplink Configuration**		
					Modulation		**RB allocation (Note 1)**
1	Default	30	Default		CP-OFDM	QPSK	Outer_Full (A2)
2	Default	30	Default			16 QAM	Outer_Full (A2)
3	Default	30	Default			64 QAM	Outer_Full (A2)
4	Default	30	Default			256 QAM	Outer_Full (A2)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.2.2.4.1-4. NOTE 2: Void.							

Table 6.5D.3.3.4.1-4: Test Configuration table for NS_47 power class 2 (contiguous allocation)

Initial Conditions									
Test Environment as specified in TS 38.508-1 [5] subclause 4.1					Normal				
Test Frequencies					As specified in Table 6.2.3.4.1-19 and 6.2.3.4.1-20				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1					30 MHz				
Test SCS as specified in Table 5.3.5-1					Lowest				
A-MPR test parameters for NS_47									
Test ID	F_c (MHz)	Ch BW (MHz)	SCS (kHz)	Downlink Configuration	Uplink Configuration				
					Modulation (Note 2)		RB allocation (Note 1)		
							SCS 15 kHz	SCS 30 kHz	SCS 60 kHz
36	Default	30	Default		CP-OFDM	QPSK	Edge_1RB_Left (A1)		
37	Default	30	Default			QPSK	1@29 (A2)	1@15 (A2)	1@8 (A2)
38	Default	30	Default			QPSK	Edge_1RB_Right (A3)		
39	Default	30	Default			QPSK	Outer_Full (A2)		
40	Default	30	Default			QPSK	108@0 (A4)	54@0 (A4)	27@0 (A4)
41	Default	30	Default			QPSK	80@0 (A4)	40@0 (A4)	20@0 (A4)
42	Default	30	Default			QPSK	54@0 (A2)	27@0 (A2)	12@0 (A2)
43	Default	30	Default			16 QAM	Edge_1RB_Left (A1)		
44	Default	30	Default			16 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
45	Default	30	Default			16 QAM	Edge_1RB_Right (A3)		
46	Default	30	Default			16 QAM	Outer_Full (A2)		
47	Default	30	Default			16 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
48	Default	30	Default			16 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
49	Default	30	Default			16 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
50	Default	30	Default			64 QAM	Edge_1RB_Left (A1)		
51	Default	30	Default			64 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
52	Default	30	Default			64 QAM	Edge_1RB_Right (A3)		
53	Default	30	Default			64 QAM	Outer_Full (A2)		
54	Default	30	Default			64 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
55	Default	30	Default			64 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
56	Default	30	Default			64 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
57	Default	30	Default			256 QAM	Edge_1RB_Left (A1)		
58	Default	30	Default			256 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
59	Default	30	Default			256 QAM	Edge_1RB_Right (A3)		
60	Default	30	Default			256 QAM	Outer_Full (A2)		
61	Default	30	Default			256 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
62	Default	30	Default			256 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
63	Default	30	Default			256 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: Void

Table 6.5D.3.3.4.1-5: Test Configuration table for NS_21

Initial Conditions								
Test Environment as specified in TS 38.508-1 [5] subclause 4.1						Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1						Low range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1						Lowest, Highest		
Test SCS as specified in Table 5.3.5-1						Lowest		
A-MPR test parameters for NS_21								
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**			
					Modulation (Note 2)		**RB allocation (Note 1)**	
							SCS 15 kHz	**SCS 30 kHz**
26	Low	Default	Default	N/A for A-MPR test cases	CP-s OFDM	QPSK	Edge_1RB_Left	
27	High	Default	Default			QPSK	Edge_1RB_Right	
28	Default	Default	Default			QPSK	Outer_Full	
29	Default	10 MHz	Default			QPSK	4@0	2@0
30	Default	10 MHz	Default			QPSK	4@48	2@22
31	Low	Default	Default			16 QAM	Edge_1RB_Left	
32	High	Default	Default			16 QAM	Edge_1RB_Right	
33	Default	Default	Default			16 QAM	Outer_Full	
34	Default	10 MHz	Default			16 QAM	4@0	2@0
35	Default	10 MHz	Default			16 QAM	4@48	2@22
36	Low	Default	Default			64 QAM	Edge_1RB_Left	
37	High	Default	Default			64 QAM	Edge_1RB_Right	
38	Default	Default	Default			64 QAM	Outer_Full	
39	Default	10 MHz	Default			64 QAM	4@0	2@0
40	Default	10 MHz	Default			64 QAM	4@48	2@22
41	Low	Default	Default			256 QAM	Edge_1RB_Left	
42	High	Default	Default			256 QAM	Edge_1RB_Right	
43	Default	Default	Default			256 QAM	Outer_Full	
44	Default	10 MHz	Default			256 QAM	4@0	2@0
45	Default	10 MHz	Default			256 QAM	4@48	2@22
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.								

1. Connect the SS to the UE to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A Figure A.3.1.2.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.5D.3.3.4.1-1 for NS_04 and to Table 6.5D.3.3.4.1-2 to 6.5D.3.3.4.1-4 for NS_47.

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 [5] clause 4.5. Message contents are defined in clause 6.5D.3.3.4.3.

6.5D.3.3.4.2 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 6.5D.3.3.4.1-1 as appropriate for NS_04. Since the UE has no payload

data to send, the UE transmits 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 [5] subclause 4.3.6.1.1.2.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the sum of the mean power at each UE antenna connector in the channel bandwidth of the radio access mode, which shall meet the requirements described in Clauses from 6.2D.2.5, or 6.2D.3.5 as appropriate for NS_04 and NS_47. The period of measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

4. Measure the power of the transmitted signal at each UE antenna connector with a measurement filter of bandwidths according to Tables 6.5.3.3.5.1-1 as appropriate for NS_04, Table 6.5.3.3.3.151 as appropriate for NS_47, and Table 6.5.3.3.3.12-1 as appropriate for NS_21. The centre frequency of the filter shall be stepped in contiguous steps according to the same table the measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5D.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and same exceptions listed in clause 6.5.3.3.4.3

6.5D.3.3.5 Test requirement

The measured power at each UE antenna connector derived in step 4 shall meet the requirements for the specified NR band for an additional spurious emission requirement with protected bands as indicated in clause 6.5.3.3.5 for different NS values.

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.

6.5D.3_1 Spurious emissions for UL MIMO (Rel-16 onward)

6.5D.3_1.1 General spurious emissions for UL MIMO (Rel-16 onward)

6.5D.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.

6.5D.3_1.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support UL MIMO.

6.5D.3_1.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products is defined as the sum of the emissions from both UE transmit antenna connectors.

The general spurious emission requirements specified in clause 6.5.3.1.3 apply. For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements shall be met with the UL MIMO configurations described in clause 6.2D.1. For UEs supporting ULFPTx for UL MIMO, the requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE’s support of uplink full power transmission mode.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 6.5.3 apply.

The normative reference for this requirement is TS 38.101-1 [2] subclauses 6.5D.3 and 6.5.3.1.

6.5D.3_1.1.4 Test description

6.5D.3_1.1.4.1 Initial conditions

Same initial conditions as in clause 6.5D.3.1.4.1.

6.5D.3_1.1.4.2 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.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. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the sum of transmitted power at each antenna connector with a measurement filter of bandwidths according to table 6.5D.3_1.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 6.5D.3_1.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4. If UE supports ULFPTx Mode-2 or Mode-full power, repeat test steps 1~3 with the exception that the PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.

6.5D.3_1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 ensuring Table 4.6.3-182 with the condition 2TX_UL_MIMO.

6.5D.3_1.1.5 Test requirement

The measured average power of spurious emission, derived in step 3 or step 4, shall not exceed the described value in Table 6.5D.3_1.1.5-1.

The spurious emission limits apply for the frequency ranges that are more than ΔfOOB (MHz) in Table 6.5.3.1.3-1from the edge of the channel bandwidth.

Table 6.5D.3_1.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band that the upper frequency edge of the UL Band more than 2.69 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz			

6.5D.3_1.2 Spurious emission for UE co-existence for UL MIMO (Rel-16 onward)

6.5D.3_1.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions.

6.5D.3_1.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support UL MIMO.

6.5D.3_1.2.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products is defined as the sum of the emissions from both UE transmit antenna connectors.

The spurious emission for UE co-existence requirements specified in clause 6.5.3.2.3 apply. For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements shall be met with the UL MIMO configurations described in clause 6.2D.1. For UEs supporting ULFPTx for UL MIMO, the requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE’s support of uplink full power transmission mode.

The normative reference for this requirement is TS 38.101-1 [2] subclauses 6.5.3.2 and 6.5D.3.

6.5D.3_1.2.4 Test description

6.5D.3_1.2.4.1 Initial conditions

Same initial conditions as in clause 6.5D.3.2.4.1.

6.5D.3_1.2.4.2 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.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. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the sum of transmitted power at each UE antenna connector with a measurement filter of bandwidths according to table 6.5.3.2.3-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 6.5.3.2.3-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4. If UE supports ULFPTx Mode-2 or Mode-full power, repeat test steps 1~3 with the exception that the PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.

6.5D.3_1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 ensuring Table 4.6.3-182 with the condition 2TX_UL_MIMO.

6.5D.3_1.2.5 Test requirement

The measured average power of spurious emission, derived in step 3 or step 4 from both UE antenna connectors, shall not exceed the described value in Table 6.5.3.2.3-1.

6.5D.3_1.3 Additional spurious emissions for UL MIMO (Rel-16 onward)

6.5D.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 under the deployment scenarios where additional requirements are specified.

6.5D.3_1.3.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support UL MIMO.

6.5D.3_1.3.3 Minimum conformance requirements

For UE supporting UL MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products is defined as the sum of the emissions from both UE transmit antenna connectors.

The additional spurious emission requirements specified in clause 6.5.3.3.3 apply. For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements shall be met with the UL MIMO configurations described in clause 6.2D.1. For UEs supporting ULFPTx for UL MIMO, the requirements shall be met with the PUSCH configurations specified in Table 6.2D.1.3-3, based upon UE's support of uplink full power transmission mode.

The normative reference for this requirement is TS 38.101-1 [2] clauses 6.5D.3 and 6.5.3.3

6.5D.3_1.3.4 Test description

6.5D.3_1.3.4.1 Initial conditions

Same initial conditions as in clause 6.5D.3.3.4.1 together with tables 6.5D.3_1.3.4-1 to 6.5D.3_1.3.4-3.

Table 6.5D.3_1.3.4.1-1: Test Configuration table for NS_05

Same test configuration as listed in Table 6.2.3.4.1-4 shall be used with the following exceptions:

- Test SCS shall be: [Lowest].
- Only Test IDs 66 to 115 shall be tested.

Table 6.5D.3_1.3.4.1-2: Test Configuration table for NS_48

Same test configuration as listed in Table 6.2.3.4.1-19 shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, and 50 MHz
- Test SCS shall be: Lowest.
- Only Test IDs 31 to 60 shall be tested.

Table 6.5D.3_1.3.4.1-3: Test Configuration table for NS_49

Same test configuration as listed in Table 6.2.3.4.1-29 shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, and 50 MHz
- Test SCS shall be: Lowest.
- Only Test IDs 43 to 84 shall be tested.

Table 6.5D.3_1.3.4.1-4: Test Configuration table for NS_46

Same test configuration as listed in Table 6.2.3.4.1-25 shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 11 to 22 shall be tested.

Table 6.5D.3_1.3.4.1-5: Test Configuration table for NS_21

Same test configuration as listed in Table 6.2.3.4.1-27 shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 26 to 45 shall be tested.

Table 6.5D.3_1.3.4.1-6: Test Configuration table for NS_44

Same test configuration as listed in Table 6.2.3.4.1-26 shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 23 to 44 shall be tested.

Table 6.5D.3_1.3.4.1-7: Test Configuration table for NS_27

Same test configuration as listed in Table 6.2.3.4.1-13 shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 141 to 252 shall be tested.

6.5D.3_1.3.4.2 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 tables in clause 6.5D.3_1.3.4.1 as appropriate. Since the UE has no payload data to send, the UE transmits 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 [5] subclause 4.3.6.1.1.2.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the sum of the mean power at each UE antenna connector in the channel bandwidth of the radio access mode according to the test configurations in clause 6.5D.3_1.3.4.1, which shall meet the requirements described in clauses 6.2D.3.5 as appropriate for each network signalling. The period of measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

4. Measure the sum of transmitted power at each UE antenna connector with a measurement filter of bandwidths according to clauses 6.5.3.3.3.1 to 6.5.3.3.3.25 as appropriate. The centre frequency of the filter shall be stepped in contiguous steps according to the same table the measured power shall be verified for each step. The measurement period shall capture the active time slots.

5. If UE supports ULFPTx Mode-2 or Mode-full power, repeat test steps 1~4 with the exception that the PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode2 or ULFPTx_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability.

6.5D.3_1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and same exceptions listed in clause 6.5.3.3.4.3.

6.5D.3_1.3.5 Test requirement

The measured power from both UE antenna connector derived in step 4 or step 5 shall meet the requirements for the specified NR band for an additional spectrum emission requirement with protected bands as indicated in clause 6.5.3.3.5.

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.

6.5D.4 Transmit intermodulation for UL MIMO

6.5D.4.1 Test purpose

To verify that the UE transmit intermodulation does not exceed the described value in the test requirement.

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.5D.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.5D.4.3 Minimum conformance requirements

For UE supporting UL MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements specified in subclause 6.5.4 apply to each transmit antenna connector. The requirements shall be met with the UL MIMO configurations described in sub-clause 6.2D.1.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.5.4 apply.

The normative reference for this requirement is TS 38.101-1 [2] clauses 6.5D.4 and 6.5.4.

6.5D.4.4 Test description

6.5D.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, and are shown in table 6.5D.4.4.1-1. 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.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for transmit intermodulation test case	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.3.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5D.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 [5] clause 4.5. Message contents are defined in clause 6.5D.4.4.3.

6.5D.4.4.2 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.4.4.1-1. Since the UE 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 [5] subclause 4.3.6.1.1.2
2. Send continuously uplink power control "up" commands to the UE until the UE transmits at its P_{UMAX} level.
3. Measure the rectangular filtered mean power at each antenna connector of the UE. For TDD, only slots consisting of only UL symbols are under test.
4. Set the interference signal frequency below the UL carrier frequency using the first offset in table 6.5D.4.5-1.
5. Set the interference CW signal level according to table 6.5D.4.5-1.
6. Search the intermodulation product signals below and above the UL carrier frequency at each UE antenna connector, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios for each UE antenna connector with the power measured in step 3.
7. Set the interference signal frequency above the UL carrier frequency using the first offset in table 6.5D.4.5-1.
8. Search the intermodulation product signals below and above the UL carrier frequency at each UE antenna connector, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios for each UE antenna with the power measured in step 3.
9. Repeat the measurement using the second offset in table 6.5D.4.5-1.
10. Repeat step 3) until 9) for each of transmit antenna of the UE.

6.5D.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

6.5D.4.5 Test requirement

The ratio derived in step 6 and 8, shall not exceed the described value in table 6.5D.4.5-1.

Table 6.5D.4.5-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel centre	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40dBc	
Intermodulation product	< -29dBc	< -35dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCSs for the channel BW as defined in Table 6.5.2.4.1.5-1	
Measurement offset from channel centre	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$

6.5E Output RF spectrum emissions for V2X

6.5E.1 Occupied bandwidth for V2X

6.5E.2 Out of band emission for V2X

6.5E.2.1 General

When UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions for NR V2X operating bands specified in Table 5.2E.1-1, the requirements in clause 6.5E.2 apply for NR V2X sidelink transmission.

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with SL MIMO configurations described in clause 6.2D.1.

6.5E.2.2 Spectrum emission mask for V2X

6.5E.2.2.1 Spectrum emission mask for V2X / non-concurrent operation

Editor's Note: This clause is incomplete for PSFCH and PSBCH measurement. The following aspects are either missing or not yet determined:

- Measurement period of PSFCH and PSBCH is FFS.

6.5E.2.2.1.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth when UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions.

6.5E.2.2.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.5E.2.2.1.3 Minimum conformance requirements

For NR V2X UE, the existing NR general spectrum emission mask in clause 6.5.2.2 applied for all supporting NR V2X channel bandwidths. The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. For frequencies greater than (Δf_{OOB}), the power of any UE emission shall not exceed the levels specified in Table 6.5.2.2.3-1 for the specified channel bandwidth for NR V2X operating bands in Table 5.2E.1-1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.2.2.

6.5E.2.2.1.4 Test description

6.5E.2.2.1.4.1 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 operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.2.2.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexe A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.5E.2.2.1.4.1-1: Test Configuration Table for contiguous PSCCH and PSSCH allocation

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.8		Low range, High range	
Test Channel Bandwidths as specified TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Freq**	**V2X Configuration to Transmit**	
		Modulation	**PSSCH RB allocation (Note 1)**
1	Default	QPSK	Outer_Full
2	Default	QPSK	Inner_Full
3	Default	16QAM	Outer_Full
4	Default	16QAM	Inner_Full
5	Default	64QAM	Outer_Full
6	Default	256QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1E-1.			

Table 6.5E.2.2.1.4.1-2: Test Configuration Table for PSFCH

Initial Conditions		
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.8		Low range, High range
Test Channel Bandwidths as specified TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest
Test SCS as specified in Table 5.3.5-1		Lowest, Highest
Test Parameters for Channel Bandwidths		
Test ID	**Freq**	**V2X Configuration to Transmit**
		PSFCH RB allocation (Note 1)
1	Low range	PSFCH_1RB_Left
2	High range	PSFCH_1RB_Right
3	Low range	PSFCH_2RB_Left
4	High range	PSFCH_2RB_Right
5	Default	PSFCH_Max_Gap
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1E-2.		

Table 6.5E.2.2.1.4.1-3: Test Configuration Table for S-SSB

Initial Conditions		
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1.8		Low range, High range
Test Channel Bandwidths as specified TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest
Test SCS as specified in Table 5.3.5-1		Lowest, Highest
Test Parameters for Channel Bandwidths		
Test ID	**Freq**	**V2X Configuration to Transmit**
		S-SSB RB allocation (Note 1)
1	Low range	S-SSB_Low
2	High range	S-SSB_High
3	Default	S-SSB_Mid
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1E-3.		

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.5E.2.2.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.2.2.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.

6.5E.2.2.1.4.2 Test procedure

Subtest 1: PSCCH/PSSCH

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.
2. The UE starts to perform the NR sidelink communication according to *SL-PreconfigurationNR*. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the NR sidelink RMC.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration from Table 6.5E.2.2.1.4.1-1, which shall meet the requirements described in Table 6.2E.2.1.5-1 for Power Class 3 UEs. The period of measurement shall be at least continuous duration of one active sub-frame (1ms) excluding guard symbols.
4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.2.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

Subtest 2: PSFCH

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Cast type *Unicast*, Test Loop Function *On* with UE test loop mode E closed for *Receive Mode* according to TS 38.508-1 [5] clause 4.5.
2. The UE starts to perform the NR sidelink reception according to *SL-PreconfigurationNR*.
3. The UE's PSFCH transmission occasion is on slot n according to Table 6.5E.2.2.1.4.1-2. SS transmits PSSCH on combination of slot and subchannel as below:

a) Test ID 1: slot n-6, Lowest sub-channel

b) Test ID 2: slot n-3, Highest sub-channel

c) Test ID 3: slot n-6 and n-5, Lowest sub-channel

d) Test ID 4: slot n-4 and n-3, Highest sub-channel

e) Test ID 5: slot n-6, Highest sub-channel and slot n-3, Highest sub-channel

4. Measure the mean power of the UE on slot n in the channel bandwidth according to the test configuration from Table 6.5E.2.2.1.4.1-2, which shall meet the requirements described in Table 6.2E.2.1.5-2 for Power Class 3 UEs. The period of measurement is FFS.

5. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.2.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

Subtest 3: S-SSB

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On* according to TS 38.508-1 [5] clause 4.5. The UE is synchronized to GNSS,

2. The UE transmits PSBCH according *SL-PreconfigurationNR*.

3. Measure the mean power of the S-SSB in the channel bandwidth according to the test configuration from Table 6.5E.2.2.1.4.1-3, which shall meet the requirements described in Table 6.2E.2.1.5-3 for Power Class 3 UEs. The period of measurement is FFS.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.2.1.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

6.5E.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10.

6.5E.2.2.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 4 of Subtest 1, step 5 of Subtest 2 and step 4 of Subtest 3, shall fulfil requirements in Table 6.2E.2.2.1.5-1 as appropriate, and the power of any UE emission shall fulfil requirements in Table 6.5E.2.2.1.5-1.

Table 6.5E.2.2.1.5-1: General NR spectrum emission mask for V2X / non-concurrent operation

<table>
<tr><th></th><th colspan="13">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>ΔfOOB (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0-1</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td></td><td></td><td></td><td></td><td></td><td>1 % channel bandwidth</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td rowspan="20">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13 + TT</td><td rowspan="2">-13 + TT</td><td rowspan="3">-13 + TT</td><td rowspan="4">-13 + TT</td><td rowspan="5">-13 + TT</td><td rowspan="6">-13 + TT</td><td rowspan="8">-13 + TT</td><td rowspan="10">-13 + TT</td><td rowspan="12">-13 + TT</td><td rowspan="14">-13 + TT</td><td rowspan="16">-13 + TT</td><td rowspan="18">-13 + TT</td></tr>
<tr><td>± 6-10</td><td>-25 + TT</td></tr>
<tr><td>± 10-15</td><td></td><td>-25 + TT</td></tr>
<tr><td>± 15-20</td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 20-25</td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 25-30</td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 30-35</td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 35-40</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 40-45</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 45-50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 50-55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 55-60</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 60-65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 65-80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-85</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 85-90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 90-95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 95-100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 100-105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td colspan="14">Note 1: The first and last measurement position with a 30 kHz filter is at ΔfOOB equals to 0.015 MHz and 0.985 MHz.
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.
Note 4: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.2.1.5-2.</td></tr>
</table>

Table 6.5E.2.2.1.5-2: Test Tolerance

FFS

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.

6.5E.2.2.1D Spectrum emission mask for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- Test config table is FFS

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.5E.2.2.1D.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth when UE is configured for NR V2X sidelink MIMO transmissions non-concurrent with NR uplink transmissions.

6.5E.2.2.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

6.5E.2.2.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with SL MIMO configurations described in clause 6.2D.1.

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

6.5E.2.2.1D.4 Test description

6.5E.2.2.1D.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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.2.2.1D.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.5E.2.2.1D.4.1-1: Test Configuration Table

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause TBD. Message content exceptions are defined in clause 6.5E.2.2.1D.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.2.2.1D.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS36.508 [25] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state TBD.

6.5E.2.2.1D.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-V2X-Preconfiguration* which is in line with the test configuration in Table 6.5E.2.2.1D.4.1-1.

2. Measure the sum of mean power of each antenna connector in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in [TBD] for Power Class 3 UEs. The period of the measurement shall be at least the continuous duration of one sub-frame (1ms). For TDD slots with transient periods are not under test.

3. Measure the power of each antenna connector of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.2.1D.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

6.5E.2.2.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4.

6.5E.2.2.1D.5 Test requirement

The measured sum of mean power of each antenna connector in the channel bandwidth, derived in step 2, shall fulfil requirements in [TBD] as appropriate, and the power of any UE emission at each antenna connector shall fulfil requirements in Table 6.5E.2.2.1D.5-1.

Table 6.5E.2.2.1D.5-1: General NR spectrum emission mask for V2X / non-concurrent operation / SL-MIMO

<table>
<tr><th></th><th colspan="13">Spectrum emission limit (dBm) / Channel bandwidth</th></tr>
<tr><th>ΔfOOB (MHz)</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th><th>Measurement bandwidth</th></tr>
<tr><td>± 0-1</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td>-13 + TT</td><td></td><td></td><td></td><td></td><td></td><td>1 % channel bandwidth</td></tr>
<tr><td>± 0-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>-24 + TT</td><td>30 kHz</td></tr>
<tr><td>± 1-5</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td>-10 + TT</td><td rowspan="20">1 MHz</td></tr>
<tr><td>± 5-6</td><td>-13 + TT</td><td rowspan="2">-13 + TT</td><td rowspan="3">-13 + TT</td><td rowspan="4">-13 + TT</td><td rowspan="5">-13 + TT</td><td rowspan="6">-13 + TT</td><td rowspan="8">-13 + TT</td><td rowspan="10">-13 + TT</td><td rowspan="12">-13 + TT</td><td rowspan="14">-13 + TT</td><td rowspan="16">-13 + TT</td><td rowspan="18">-13 + TT</td></tr>
<tr><td>± 6-10</td><td>-25 + TT</td></tr>
<tr><td>± 10-15</td><td></td><td>-25 + TT</td></tr>
<tr><td>± 15-20</td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 20-25</td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 25-30</td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 30-35</td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 35-40</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 40-45</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 45-50</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 50-55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 55-60</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 60-65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 65-80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-85</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 85-90</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 90-95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td>± 95-100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 100-105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-25 + TT</td></tr>
<tr><td colspan="14">Note 1: The first and last measurement position with a 30 kHz filter is at ΔfOOB equals to 0.015 MHz and 0.985 MHz.
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.
Note 4: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.2.5-2.</td></tr>
</table>

Table 6.5E.2.2.1D.5-2: Test Tolerance

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6.5E.2.3 Additional Spectrum emission mask for V2X

6.5E.2.3.1 Additional Spectrum emission mask for V2X / non-concurrent operation

Editor's Note:

- Test config table is FFS

6.5E.2.3.1.1 Test purpose

To verify that the power of NR V2X UE emission shall not exceed specified level for the specified channel bandwidth under the deployment scenarios where additional requirements are specified.

6.5E.2.3.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.5E.2.3.1.3 Minimum conformance requirements

6.5E.2.3.1.3.1 Requirements for network signalling value "NS_33"

The additional spectrum mask in Table 6.5E.2.3.1.3.1-1 applies for NR V2X UE within 5 855 MHz to 5 950 MHz according to ETSI EN 302 571. Additional spectrum 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.

When "NS_33" is indicated in the cell or pre-configured radio parameters, the power of any V2X UE emission shall not exceed the levels specified in Table 6.5E.2.3.1.3.1-1.

Table 6.5E.2.3.1.3.1-1: Additional spectrum mask requirements for 10MHz channel bandwidth

Spectrum emission limit (dBm EIRP)/ Channel bandwidth		
Δf_{OOB} (MHz)	10 MHz	Measurement bandwidth
± 0-0.5	$[-13-12\left(\|\Delta fOOB\|/_{MHz}\right)]$	100 kHz
± 0.5-5	$[-19-\frac{16}{9}\left(\|\Delta fOOB\|/_{MHz}-0.5\right)]$	100 kHz
± 5-10	$[-27-2\left(\|\Delta fOOB\|/_{MHz}-5.0\right)]$	100 kHz

NOTE 1: 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.

NOTE 2: Additional SEM for NR V2X overrides any other requirements in frequency range 5855-5950MHz.

NOTE 3: The EIRP requirement is converted to conducted requirement depend on the supported post antenna connector gain $G_{post\ connector}$ declared by the UE following the principle described in annex I in [11].

6.5E.2.3.1.3.2 Requirements for network signalling value "NS_52"

The additional spectrum mask in Table 6.5E.2.3.1.3.2-1 applies for NR V2X UE within 5 765 MHz to 6 005 MHz according to FCC regulation. Additional spectrum 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.

When "NS_52" is indicated in the cell or pre-configured radio parameters, the power of any V2X UE emission shall not exceed the levels specified in Table 6.5E.2.3.1.3.2-1.

Table 6.5E.2.3.1.3.2-1: Additional spectrum mask requirements for 40MHz channel bandwidth (fc = 5885MHz)

Δf_{OOB} (MHz)	Emission Limit (dBm)	Measurement Bandwidth
±0-2	-32	100kHz
±2-10	-36	100kHz
±10-20	-38	100kHz
±20-40	-43	100kHz
±40-100	-50	100kHz

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.2.3.

6.5E.2.3.1.4 Test description

6.5E.2.3.1.4.1 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 operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.2.3.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexe A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.5E.2.3.1.4.1-1: Test Configuration Table

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.5E.2.3.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.2.3.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.5E.2.3.1.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.5E.2.3.1.4.1-1.
2. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.2E.2.1.5-1 for Power Class 3 UEs. The period of the measurement shall be at least the continuous duration of one sub-frame (1ms). For TDD slots with transient periods are not under test.
3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.3.1.5.1-1 or Table 6.5E.2.3.1.5.2-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

6.5E.2.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10 with following exceptions.

6.5E.2.3.1.4.3.1 Message contents exceptions (network signalling value “NS_33”)

Table 6.5E.2.3.1.4.3.1-1: Network signalling value "NS_33"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_33)		

6.5E.2.3.1.4.3.2 Message contents exceptions (network signalling value “NS_52”)

Table 6.5E.2.3.1.4.3.2-1: Network signalling value "NS_52"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_52)		

6.5E.2.3.1.5 Test requirement

Table 6.5E.2.3.1.5-1: Test Tolerance (Additional spectrum emission mask)

FFS

6.5E.2.3.1.5.1 Requirements for network signalling value "NS_33"

When "NS_33" is indicated in the cell, the power of any NR V2X UE emission shall fulfil requirements in Table 6.5E.2.3.1.5.1-1.

Table 6.5E.2.3.1.5.1-1: Additional spectrum mask requirements for 10MHz channel bandwidth

Spectrum emission limit (dBm EIRP)/ Channel bandwidth		
Δf_{OOB} (MHz)	**10 MHz**	**Measurement bandwidth**
± 0-0.5	$[-13-12\left(\|\Delta fOOB\|/_{MHz}\right)]$+TT	100 kHz
± 0.5-5	$[-19-\frac{16}{9}\left(\|\Delta fOOB\|/_{MHz}-0.5\right)]$+TT	100 kHz
± 5-10	$[-27-2\left(\|\Delta fOOB\|/_{MHz}-5.0\right)]$+TT	100 kHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.3.1.5-1.		

6.5E.2.3.1.5.2 Requirements for network signalling value "NS_52"

When "NS_52" is indicated in the cell, the power of any NR V2X UE emission shall fulfil requirements in Table 6.5E.2.3.1.5.2-1.

Table 6.5E.2.3.1.5.2-1: Additional spectrum mask requirements for 40MHz channel bandwidth (fc = 5885MHz)

Δf_{OOB} (MHz)	Emission Limit (dBm)	Measurement Bandwidth
±0-2	-32+TT	100kHz
±2-10	-36+TT	100kHz
±10-20	-38+TT	100kHz
±20-40	-43+TT	100kHz
±40-100	-50+TT	100kHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.3.1.5-1.		

6.5E.2.3.1D Additional Spectrum emission mask for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- Test config table is FFS
- Uplink RMC is TBD in RAN4
- Connection diagram is TBD
- Preconfiguration is TBD in 38.508-1
- Test state and generic procedure are TBD in 38.508-1

6.5E.2.3.1D.1 Test purpose

To verify that the power of NR V2X UE emission shall not exceed specified level for the specified channel bandwidth under the deployment scenarios where additional requirements are specified.

6.5E.2.3.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

6.5E.2.3.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier described in clause 6.5E.2.3.1.3 shall apply to each transmit antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.2.2.

6.5E.2.3.1D.4 Test description

6.5E.2.3.1D.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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.2.3.1D.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.5E.2.3.1D.4.1-1: Test Configuration Table

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause TBD. Message content exceptions are defined in clause 6.5E.2.3.1D.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.2.3.1D.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS36.508 [25] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state TBD.

6.5E.2.3.1D.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-V2X-Preconfiguration* which is in line with the test configuration in Table 6.5E.2.3.1.4.1-1.
2. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in [TBD] for Power Class 3 UEs. The period of the measurement shall be at least the continuous duration of one sub-frame (1ms). For TDD slots with transient periods are not under test.
3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.2.3.1.5.1-1 or Table 6.5E.2.3.1.5.2-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

6.5E.2.3.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4.

6.5E.2.3.1D.5 Test requirement

Table 6.5E.2.3.1D.5-1: Test Tolerance

FFS

6.5E.2.3.1D.5.1 Requirements for network signalling value "NS_33"

When "NS_33" is indicated in the cell, the power of any NR V2X UE emission at each antenna connector shall fulfil requirements in Table 6.5E.2.3.1D.5.1-1.

Table 6.5E.2.3.1D.5.1-1: Additional spectrum mask requirements for 10MHz channel bandwidth

Spectrum emission limit (dBm EIRP)/ Channel bandwidth		
Δf_{OOB} (MHz)	**10 MHz**	**Measurement bandwidth**
± 0-0.5	$[-13-12\left(^{\lvert\Delta fOOB\rvert}/_{MHz}\right)]$+TT	100 kHz
± 0.5-5	$[-19-\frac{16}{9}\left(^{\lvert\Delta fOOB\rvert}/_{MHz}-0.5\right)]$+TT	100 kHz
± 5-10	$[-27-2\left(^{\lvert\Delta fOOB\rvert}/_{MHz}-5.0\right)]$+TT	100 kHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.3.1D.5-1.		

6.5E.2.3.1D.5.2 Requirements for network signalling value "NS_52"

When "NS_52" is indicated in the cell, the power of any NR V2X UE emission at each antenna connector shall fulfil requirements in Table 6.5E.2.3.1D.5.2-1.

Table 6.5E.2.3.1D.5.2-1: Additional spectrum mask requirements for 40MHz channel bandwidth (fc = 5885MHz)

Δf_{OOB} (MHz)	Emission Limit (dBm)	Measurement Bandwidth
±0-2	-32+TT	100kHz
±2-10	-36+TT	100kHz
±10-20	-38+TT	100kHz
±20-40	-43+TT	100kHz
±40-100	-50+TT	100kHz
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.3.1D.5-1.		

6.5E.2.4 Adjacent channel leakage ratio for V2X

6.5E.2.4.1 Adjacent channel leakage ratio for V2X / non-concurrent operation

Editor's Note: This clause is incomplete for PSFCH and PSBCH measurement. The following aspects are either missing or not yet determined:

- Measurement period of PSFCH and PSBCH is FFS.

6.5E.2.4.1.1 Test purpose

To verify that V2X UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage Power Ratio (ACLR) when UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions.

6.5E.2.4.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.5E.2.4.1.3 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.

For NR V2X UE, the existing ACLR requirement for NR uplink transmission in clause 6.5.2.4 are applied for NR V2X UE for NR V2X operating bands in 5.2E.1-1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.2.4.

6.5E.2.4.1.4 Test description

6.5E.2.4.1.4.1 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 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in the test configuration tables in clause 6.2E.2.1.4. The details of the V2X reference measurement channels (RMCs) are specified in Annexe A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.5E.2.4.1.4.1-1: Void

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.

2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.5E.2.4.1.4.3.
3. The V2X Reference Measurement Channel is set according to the test configuration tables in clause 6.2E.2.1.4.1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.

6.5E.2.4.1.4.2 Test procedure

Subtest 1: PSCCH/PSSCH

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.
2. The UE starts to perform the NR sidelink communication according to *SL-PreconfigurationNR*. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the NR sidelink RMC.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration from Table 6.2E.2.1.4.1-1, which shall meet the requirements described in Table 6.2E.2.1.5-1 for Power Class 3 UEs. The period of measurement shall be at least continuous duration of one active sub-frame (1ms) excluding guard symbols.
4. Measure the rectangular filtered mean power for assigned NR V2X sidelink.
5. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR V2X sidelink channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR_{ACLR}.

Subtest 2: PSFCH

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Cast type *Unicast*, Test Loop Function *On* with UE test loop mode E closed for *Receive Mode* according to TS 38.508-1 [5] clause 4.5.
2. The UE starts to perform the NR sidelink reception according to *SL-PreconfigurationNR*.
3. The UE's PSFCH transmission occasion is on slot n according to Table 6.2E.2.1.4.1-2. SS transmits PSSCH on combination of slot and subchannel as below:
   a) Test ID 1: slot n-6, Lowest sub-channel
   b) Test ID 2: slot n-3, Highest sub-channel
   c) Test ID 3: slot n-6 and n-5, Lowest sub-channel
   d) Test ID 4: slot n-4 and n-3, Highest sub-channel
   e) Test ID 5: slot n-6, Highest sub-channel and slot n-3, Highest sub-channel
4. Measure the mean power of the UE on slot n in the channel bandwidth according to the test configuration from Table 6.2E.2.1.4.1-2, which shall meet the requirements described in Table 6.2E.2.1.5-2 for Power Class 3 UEs. The period of measurement is FFS.
5. Measure the rectangular filtered mean power for assigned NR V2X sidelink.
6. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR V2X sidelink channel, respectively.
7. Calculate the ratios of the power between the values measured in step 5 over step 6 for lower and upper NR_{ACLR}.

Subtest 3: S-SSB

1. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On* according to TS 38.508-1 [5] clause 4.5. The UE is synchronized to GNSS,
2. The UE transmits PSBCH according *SL-PreconfigurationNR*.
3. Measure the mean power of the S-SSB in the channel bandwidth according to the test configuration from Table 6.2E.2.1.4.1-3, which shall meet the requirements described in Table 6.2E.2.1.5-3 for Power Class 3 UEs. The period of measurement is FFS.
4. Measure the rectangular filtered mean power for assigned NR V2X sidelink.
5. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR V2X sidelink channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR_{ACLR}.

6.5E.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10.

6.5E.2.4.1.5 Test requirement

The measured mean power of V2X UE in the channel bandwidth, derived in step 6 of Subtest 1, step 7 of Subtest 2 and step 6 of Subtest 3, shall fulfil requirements in clause 6.2E.2.1.5, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 5, shall be higher than the limits in Table 6.5E.2.4.1.5-2.

Table 6.5E.2.4.1.5-1: Measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth												
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
NR ACLR measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	78.15	88.23	98.31

Table 6.5E.2.4.1.5-2: NR ACLR requirement for V2X / non-concurrent operation

	Power class 1	Power class 2	Power class 3
NR ACLR			30 - TT dB
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.4.1.5-3.			

Table 6.5E.2.4.1.5-3: Test Tolerance

FFS

6.5E.2.4.1D Adjacent channel leakage ratio for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- Test config table is FFS
- Uplink RMC is TBD in RAN4
- Connection diagram is TBD
- Preconfiguration is TBD in 38.508-1
- Test state and generic procedure are TBD in 38.508-1

6.5E.2.4.1D.1 Test purpose

To verify that V2X UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage Power Ratio (ACLR) when UE is configured for NR V2X sidelink MIMO transmissions non-concurrent with NR uplink transmissions.

6.5E.2.4.1D.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

6.5E.2.4.1D.3 Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with SL MIMO configurations described in clause 6.2D.1.

If V2X UE transmits on one antenna connector at a time, the requirements specified for single carrier shall apply to the active antenna connector.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.2.4.

6.5E.2.4.1D.4 Test description

6.5E.2.4.1D.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 test channel bandwidth and sub-carrier spacing, and are shown in the test configuration tables in clause 6.2E.2.1D.4.1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.5E.2.4.1D.4.1-1: Void

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.
2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause TBD. Message content exceptions are defined in clause 6.5E.2.4.1.4.3.
3. The V2X Reference Measurement Channel is set according to the test configuration tables in clause 6.2E.2.1D.4.1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS36.508 [25] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state TBD.

6.5E.2.4.1D.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-V2X-Preconfiguration* which is in line with the test configuration in the test configuration tables in clause 6.2E.2.1D.4.1;
2. Measure the sum of mean power of the UE at both antenna connector in the channel bandwidth of the radio access mode according to the test configuration, as measured in 6.2E.2.1D.4.2, which shall meet the requirements in clause 6.2E.2.1D.5 as appropriate.
3. Measure the rectangular filtered mean power for assigned NR V2X sidelink at each antenna connector.

4. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR V2X sidelink channel at each antenna connector, respectively.

5. Calculate the ratios of the power between the values measured in step 3 over step 4 for lower and upper NR_{ACLR} for each antenna connector.

6.5E.2.4.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4.

6.5E.2.4.1D.5 Test requirement

The measured sum of mean power of V2X UE at both antenna connector in the channel bandwidth, derived in step 2, shall fulfil requirements in clause 6.2E.2.1D.5, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR for each antenna connector, derived in step 5, shall be higher than the limits in Table 6.5E.2.4.1D.5-2.

Table 6.5E.2.4.1D.5-1: Measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth												
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
NR ACLR measurement bandwidth	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	78.15	88.23	98.31

Table 6.5E.2.4.1D.5-2: NR ACLR requirement for V2X / non-concurrent operation / SL-MIMO

	Power class 1	Power class 2	Power class 3
NR ACLR			30 - TT dB
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5E.2.4.1D.5-3.			

Table 6.5E.2.4.1D.5-3: Test Tolerance

FFS

6.5E.3 Spurious emissions for V2X

6.5E.3.1 General spurious emissions for V2X

6.5E.3.2 Spurious emissions for UE co-existence for V2X

6.5E.3.2.1 Spurious emissions for UE co-existence for V2X / non-concurrent operation

Editor's Note:

- Test config table is FFS

6.5E.3.2.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions.

6.5E.3.2.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.5E.3.2.1.3 Minimum conformance requirements

When UE is configured for NR V2X sidelink transmissions non-concurrent with NR uplink transmissions for NR V2X operating bands specified in Table 5.2E.1-1, the requirements in clause 6.5.3.2 shall apply for NR V2X sidelink transmission.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.3.2.

6.5E.3.2.1.4 Test description

6.5E.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, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.3.2.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.5E.3.2.1.4.1-1: Test Configuration Table

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.5E.3.2.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.3.2.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.5E.3.2.1.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.5E.3.2.1.4.1-1.
2. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.2.3-2. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.2.3-2. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5E.3.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10.

6.5E.3.2.1.5 Test requirement

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than Δf_{OOB} (MHz) in Tables 6.5.3.2.3-2 from the edge of the channel bandwidth. The spurious emission limits in Tables 6.5.3.2.3-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

The measured average power of spurious emission, derived in step 2, shall not exceed the described value in Table 6.5.3.2.3-2.

6.5E.3.2.1D Spurious emissions for UE co-existence for V2X / non-concurrent operation / SL-MIMO

Editor's Note:

- Test config table is FFS

- Uplink RMC is TBD in RAN4

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

6.5E.3.2.1.1D Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions.

6.5E.3.2.1.2D Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink MIMO communication with non-concurrent operation.

6.5E.3.2.1.3D Minimum conformance requirements

For NR V2X UE with two transmit antenna connectors, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with the SL MIMO configurations described in clause 6.2D.1.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.3.2.

6.5E.3.2.1D.4 Test description

6.5E.3.2.1D.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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.3.2.1D.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes TBD.

Table 6.5E.3.2.1D.4.1-1: Test Configuration Table

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.

2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause TBD. Message content exceptions are defined in clause 6.5E.3.2.1D.4.3.

3. The V2X Reference Measurement Channel is set according to Table 6.5E.3.2.1D.4.1-1.

4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS36.508 [25] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.

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

6. Ensure the UE is in state TBD.

6.5E.3.2.1D.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-V2X-Preconfiguration* which is in line with the test configuration in Table 6.5E.3.2.1D.4.1-1.

2. Measure the power of the transmitted signal at each antenna connector with a measurement filter of bandwidths according to Table 6.5.3.2.3-2. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.2.3-2. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5E.3.2.1D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4.

6.5E.3.2.1D.5 Test requirement

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than Δf_{OOB} (MHz) in Tables 6.5.3.2.3-2 from the edge of the channel bandwidth. The spurious emission limits in Tables 6.5.3.2.3-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

The measured average power of spurious emission at each antenna connector, derived in step 2, shall not exceed the described value in Table 6.5.3.2.3-2.

6.5E.3.3 Additional spurious emissions requirements for V2X

6.5E.3.3.1 Additional spurious emissions requirements for V2X / non-concurrent operation

Editor's Note:

- Test config table is FFS

6.5E.3.3.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions under the deployment scenarios where additional requirements are specified.

6.5E.3.3.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication with non-concurrent operation.

6.5E.3.3.1.3 Minimum conformance requirements

Table 6.5E.3.3.1.3-1: Additional requirements for "NS_33"

Protected band	Frequency range (MHz)			Maximum Level (EIRP[2])	MBW (MHz)	NOTE
Frequency range	5925	-	5950	-30	1	1
Frequency range	5815	-	5855	-30	1	3
NOTE 1: In the frequency range x-5950MHz, SE requirement of -30dBm/MHz should be applied; where x = max (5925, fc + 15), where fc is the channel centre frequency. NOTE 2: The EIRP requirement is converted to conducted requirement depend on the supported post antenna connector gain $G_{post\ connector}$ declared by the UE following the principle described in annex I in [11]. NOTE 3: Resolution BW is 10% of the measurement BW and the result should be integrated to achieve the measurement bandwidth. The sweep time shall be set larger than (symbol length)*(number of points in sweep) to improve the measurement accuracy.						

When "NS_33" is configured from pre-configured radio parameters or the cell, and the indication from upper layers has indicated that the UE is within the protection zone of CEN DSRC devices or HDR DSRC devices, the power of any NR V2X UE emission shall fulfil either one of the two sets of conditions.

Table 6.5E.3.3.1.3-2: Requirements for spurious emissions to protect CEN DSRC for V2X UE

	Maximum Transmission Power (dBm EIRP)	Emission Limit in Frequency Range 5795-5815 (dBm/MHz EIRP)
Condition 1	10	-65
Condition 2	10	-45

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5E.3.4.

6.5E.3.3.1.4 Test description

6.5E.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, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2E.1-1 and Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.5E.3.3.1.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexes A.7.5 and the GNSS configuration in TS 38.508-1 [5] subclause 4.11.

Table 6.5E.3.3.1.4.1-1: Test Configuration Table for "NS_33"

FFS

1. Connect the SS and GNSS simulator to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.9.1 for TE diagram and section A.3.2.7 for UE diagram.
2. The parameter settings for the NR sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause 4.10. Message content exceptions are defined in clause 6.5E.3.3.1.4.3.
3. The V2X Reference Measurement Channel is set according to Table 6.5E.3.3.1.4.1-1.
4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 38.508-1 [5] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state Out_of_Coverage with generic procedure parameters Sidelink *On*, Test Loop Function *On* with UE test loop mode E closed for *Transmit Mode* according to TS 38.508-1 [5] clause 4.5.

6.5E.3.3.1.4.2 Test procedure

1. The V2X UE schedules the V2X RMC with transmission power at P_{UMAX} level according to *SL-PreconfigurationNR* which is in line with the test configuration in Table 6.5E.3.3.1.4.1-1.
2. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5E.3.3.1.3-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5E.3.3.1.3-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5E.3.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.10 with following exceptions.

Table 6.5E.3.3.1.4.3-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_33"

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_33)		

6.5E.3.3.1.5 Test requirement

6.5E.3.3.1.5.1 Message contents exceptions (network signalling value "NS_33")

The transmitted spurious emission power derived in step 2 should be converted to EIRP value depend on the supported post antenna connector gain $G_{post\ connector}$ declared by the UE following the principle described in annex I in [11]. The EIPR value should not exceed test requirements in Table 6.5E.3.3.1.5.1-1.

Table 6.5E.3.3.1.5.1-1: Test requirements for "NS_33"

Protected band	Frequency range (MHz)			Maximum Level (EIRP[2])	MBW (MHz)
Frequency range	5925	-	5950	-30	1
Frequency range	5815	-	5855	-30	1

6.5F Output RF spectrum emissions for shared spectrum channel access

6.5F.1 Occupied bandwidth for shared spectrum channel access

FFS

6.5F.2 Out of band emission for shared spectrum channel access

6.5F.2.1 General

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.

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.

6.5F.2.2 Spectrum emission mask for operation with shared spectrum channel access

Editor's Note:

- Test config table is FFS

- Message content is TBD

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 Δf_{OOB}, the spurious requirements in subclause 6.5.3 are applicable.

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.

6.5F.2.2.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth when UE is operating with shared spectrum channel access.

6.5F.2.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.5F.2.2.3 Minimum conformance requirements

Instead of the general spectrum emission mask requirement in clause 6.5.2.2, when operating with shared spectrum channel access the relative power of any UE emission shall not exceed the levels specified in Table 6.5F.2.2.3-1 for the specified channel bandwidth or -30 dBm/MHz whichever is the greatest. The spectrum emission mask for operation with shared spectrum channel access is defined relative to the maximum power density in a 1 MHz measurement bandwidth within the channel bandwidth.

The spectrum emission mask for operation with shared spectrum channel access applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned channel bandwidth. For frequencies offset greater than Δf_{OOB}, the spurious requirements in clause 6.5.3 are applicable.

Table 6.5F.2.2.3-1: Spectrum emission mask for operation with shared spectrum channel access

<table>
<tr><th colspan="7">Spectrum emission limit (dBr) / Channel bandwidth</th></tr>
<tr><th>Δf_{OOB} (MHz)</th><th>10 MHz</th><th>20 MHz</th><th>40 MHz</th><th>60 MHz</th><th>80 MHz</th><th>Measurement bandwidth (MBW)</th></tr>
<tr><td>± 0-1</td><td colspan="5">$-\mathbf{20}\ |\Delta \boldsymbol{f_{OOB}}|$</td><td>[100kHz]³</td></tr>
<tr><td>± 1-5</td><td>NOTE 1</td><td rowspan="2">NOTE 1</td><td rowspan="3">NOTE 1</td><td rowspan="4">NOTE 1</td><td rowspan="5">NOTE 1</td><td rowspan="11">1 MHz</td></tr>
<tr><td>± 5-10</td><td>NOTE 2</td></tr>
<tr><td>± 10-20</td><td>-40</td><td>NOTE 2</td></tr>
<tr><td>± 20-30</td><td></td><td>-40</td><td rowspan="2">NOTE 2</td></tr>
<tr><td>± 30-40</td><td></td><td></td><td rowspan="3">NOTE 2</td></tr>
<tr><td>± 40-50</td><td></td><td></td><td>-40</td><td rowspan="4">NOTE 2</td></tr>
<tr><td>± 50-60</td><td></td><td></td><td></td></tr>
<tr><td>± 60-70</td><td></td><td></td><td></td><td>-40</td></tr>
<tr><td>± 70-80</td><td></td><td></td><td></td><td></td></tr>
<tr><td>± 80-100</td><td></td><td></td><td></td><td></td><td>-40</td></tr>
<tr><td colspan="7">NOTE 1: Given as: $-20-\left(8/\boldsymbol{A}\right)|\Delta \boldsymbol{f_{OOB}}-1|$ where $\boldsymbol{A}=\left(Channel\ Bandwidth/2\right)-1$
NOTE 2: Given as: $-16-\left(12/\boldsymbol{B}\right)|\Delta \boldsymbol{f_{OOB}}|$ where $\boldsymbol{B}=\left(Channel\ Bandwidth/2\right)$
NOTE 3: The measured value shall be scaled by a factor equal to the ratio of the reference bandwidth (1 MHz) to the measurement bandwidth before the emission limit (dBr) is applied.
NOTE 4: The carrier leakage exceptions from Table 6.4F.2.3-1 apply and carrier leakage contribution shall be removed prior to setting the 0dBr level of the mask, the reported carrier frequency location in txDirectCurrentLocation field of the UplinkTxDirectCurrentBWP can be used to cancel the carrier leakage contribution. If txDirectCurrentLocation is not available or is reported with value 3300 or 3301, a carrier frequency location at the centre of the channel shall be assumed.</td></tr>
</table>

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.

6.5F.2.2.3.1 Spectrum emission mask for non-transmitted channels

In the case of non-transmitted 20 MHz channel(s) on the edges of an assigned channel bandwidth the spectrum emission mask for operation with shared spectrum channel access, specified in Table 6.5F.2.2.3-1, is applied by using the total bandwidth of the remaining transmitted channels. The spectrum emission mask for non-transmitted channels is floored at -28dBr.

The relative power of any UE emission shall not exceed the most stringent levels given by the spectrum emission mask for operation with shared spectrum channel access with full channel bandwidth and the spectrum emission mask for non-transmitted channels with the channel bandwidth of the transmitted channels in the case of non-transmitted channels at the edge of an assigned channel bandwidth.

An exception to the spectrum emission mask for non-transmitted channels allows a single [2] MHz bandwidth to extend to [-28] dBc relative to total transmit power, or [-20] dBm, whichever is the greatest.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5F.2.2.

6.5F.2.2.4 Test description

6.5F.2.2.4.1 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 with shared spectrum channel access 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 6.5F.2.2.4.1-1. 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 6.5F.2.2.4.1-1: Test Configuration Table

<table>
<tr><th colspan="7">Default Conditions</th></tr>
<tr><td colspan="4">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal</td></tr>
<tr><td colspan="4">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">FFS</td></tr>
<tr><td colspan="4">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">FFS</td></tr>
<tr><td colspan="4">Test SCS as specified in Table 5.3.5-1</td><td colspan="3">FFS</td></tr>
<tr><th colspan="7">Test Parameters for Channel Bandwidths</th></tr>
<tr><th>Test ID</th><th>Freq</th><th>ChBw</th><th>SCS</th><th>Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><td></td><td></td><td>Default</td><td>Default</td><td>N/A for Spectrum Emission Mask test case</td><td>Modulation</td><td>RB allocation</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.5F.2.2.4.1-1.

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 [5] clause 4.5. Message contents are defined in clause 6.5F.2.2.4.3

6.5F.2.2.4.2 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 6.5F.2.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously power control “up” commands to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.2F.1.5-1. The period of the measurement shall be at least the continuous duration of 1ms over consecutive active uplink slots.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 6.5F.2.2.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.5F.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5F.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with the following exceptions:

FFS

6.5F.2.2.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Table 6.2F.1.5-1, and the power of any UE emission shall fulfil requirements in Table 6.5F.2.2.5-1.

Table 6.5F.2.2.5-1: General NR spectrum emission mask

FFS

Table 6.5F.2.2.5-2: Test Tolerance (Spectrum Emission Mask)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 6.0GHz	6.0GHz < f ≤ 7.125GHz
BW ≤ 100MHz	1.5 dB	1.8 dB	1.8 dB	TBD

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.

6.5F.2.4 Adjacent channel leakage ratio for operation with shared spectrum channel access

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.

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.

6.5F.2.4.1 Shared spectrum channel access ACLR

Editor's Note: The following aspects are not yet determined:

- The referred test case MPR(6.2F.2) is TBD

- Test configuration and TP analysis are TBD

- MU and TT for >6GHz (band n96) are TBD.

- RMC in Annex A.

- Test coverage for UL-MIMO

- Message exceptions

- Test state and generic procedure are TBD in 38.508-1

6.5F.2.4.1.1 Test purpose

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

6.5F.2.4.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone operation with shared spectrum channel access.

6.5F.2.4.1.3 Minimum conformance requirements

The Adjacent Channel Leakage power Ratio 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 channel power and adjacent channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.5.2.4.1.3-1.

Instead of the general ACLR requirement in clause 6.5.2.4, if the measured adjacent channel power is greater than –47 dBm then the ACLR shall be higher than the value specified in Table 6.5F.2.4.1.3-1.

Table 6.5F.2.4.1.3-1: Shared spectrum channel access ACLR requirement

	Power class 5
ACLR	27 dB

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5F.2.4.1.

6.5F.2.4.1.4 Test description

6.5F.2.4.1.4.1 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 sub-carrier spacing, are shown in the test configuration tables in clause 6.2F.2.4.1[TBD]. 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 6.5F.2.4.1.4.1-1: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2F.2.4.1[TBD].
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 [5] clause 4.5. Message contents are defined in clause 6.5F.2.4.1.4.3.

6.5F.2.4.1.4.2 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 the test configuration tables in clause 6.2F.2.4.1[TBD]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously power control “up” commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2F.2.4.2[TBD], which shall meet the requirements in clause 6.2F.2.5[TBD] as appropriate.
4. Measure the rectangular filtered mean power for the assigned NR channel.
5. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2F.2.4.1[TBD], send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5F.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

FFS

6.5F.2.4.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in clause 6.2F.2.5[TBD], and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6, shall be higher than the limits in Table 6.5F.2.4.1.5-2.

Table 6.5F.2.4.1.5-1: NR ACLR measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth													
	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
NR ACLR measurement bandwidth (MHz)	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.15	88.23	98.31

Table 6.5.2.4.1.5-2: NR ACLR requirement

	Power class 5
NR ACLR	27 - TT dB
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5.2.4.1.5-3.	

Table 6.5.2.4.1.5-3: Test Tolerance (TT) (NR ACLR)

	f ≤ 3.0GHz	3.0GHz < f ≤ 4.2GHz	4.2GHz < f ≤ 5.925GHz	5.925GHz < f ≤ 7.125GHz
BW ≤ 100MHz	0.8 dB	0.8 dB	0.8 dB	TBD

6.5F.3 Spurious emissions for shared spectrum channel access

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 unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with SM.329 [9] and NR operating band requirement to address UE co-existence.

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.

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.

6.5F.3.1 General spurious emissions

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

- Test configuration table is FFS

- TP analysis is TBD

- Test state and generic procedure are TBD in 38.508-1

6.5F.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.

6.5F.3.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR standalone shared spectrum channel access.

6.5F.3.1.3 Minimum conformance requirements

The requirements for general spurious emission requirements in clause 6.5.3.1 apply.

The normative reference for this requirement is TS 38.101-1 [2] subclause 6.5F.3.1.

6.5F.3.1.4 Test description

6.5F.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 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 6.5F.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 6.5F.3.1.4.1-1: Test Configuration Table

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement channels are set according to Table 6.5F.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 [5] clause 4.5. Message contents are defined in clause 6.5F.3.1.4.3.

6.5F.3.1.4.2 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 6.5F.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.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 6.5F.3.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 6.5F.3.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5F.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

6.5F.3.1.5 Test requirement

This clause specifies the requirements for the specified NR standalone shared spectrum channel access for Transmitter Spurious emissions requirement with frequency range as indicated in table 6.5F.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 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5F.3.1.5-1 apply for all transmitter band configurations (NRB) and channel bandwidths for shared spectrum channel access.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5F.3.1.5-1.

Table 6.5F.3.1.5-1: General spurious emissions test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	4
	-25 dBm	1 MHz	3
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band that the upper frequency edge of the UL Band more than 2.69 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz			

6.5F.3.2 Spurious emissions for UE co-existence

Spurious emissions requirements for UE coexistence are not applicable to bands restricted to stand-alone operation with shared spectrum channel access as identified in Table 5.2-1

6.5G Output RF spectrum emissions for Tx Diversity

6.5G.1 Occupied bandwidth for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.5G.1.1 Test purpose

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

6.5G.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.5G.1.3 Minimum conformance requirements

For UE supporting Tx diversity, the requirements for occupied bandwidth apply to the transmitted spectrum as measured as the sum of the power from all UE transmit antenna connectors. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

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

6.5G.1.4 Test description

Same test description as specified in clause 6.5.1.4 with following exceptions:

Step 3 of Test procedure as in 6.5.1.4.2 is replaced by:

3. Measure the power spectrum distribution as the sum of the power from all UE transmit antenna connectors within two times or more 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). Other methods to measure the power spectrum distribution are allowed. The measuring duration is at least 1ms over consecutive active uplink slots.

6.5G.1.5 Test requirement

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

6.5G.2

6.5G.2.1

6.5G.2.2

6.5G.2.3 Adjacent channel leakage ratio for Tx Diversity

If UE indicates IE [*txDiversity-r16*], Adjacent Channel Leakage power Ratio (ACLR) is defined as the ratio of sum of the filtered mean power at each antenna connector centred on the assigned channel frequency to sum of the filtered mean power at each antenna connector centred on an adjacent channel frequency.

6.5G.2.3.1 NR ACLR for Tx Diversity

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

- The test points for Power Class 1.5 FWA UEs are TBD.

- Tests for Power Class 3 are FFS.

6.5G.2.3.1.1 Test purpose

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

6.5G.2.3.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5, Power Class 2 reporting TxD UE release 15 and forward.

6.5G.2.3.1.3 Minimum conformance requirements

NR adjacent channel leakage power ratio (NR_{ACLR}) is the ratio of sum of the filtered mean power at each antenna connector centred on the assigned NR channel frequency to sum of the filtered mean power at each antenna connector centred on an adjacent NR 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 6.5G.2.3.1.3-1.

If the measured adjacent channel power is greater than –50dBm then the NR_{ACLR} shall be higher than the value specified in Table 6.5G.2.3.1.3-2.

Table 6.5G.2.3.1.3-1: NR ACLR measurement bandwidth

Channel bandwidth	(MHz)	5,10,15,20,25,30,35,40,45,50	60,70,80,90,100
REF_SCS	(kHz)	15	30
NR ACLR measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000	

Table 6.5G.2.3.1.3-2: NR ACLR requirement

	Power class 1.5	Power class 2
NR ACLR	31 dB	31 dB

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5G.2.3.1.

6.5G.2.3.1.4 Test description

6.5G.2.3.1.4.1 Initial conditions

Same initial conditions as 6.2G.2.4.1.

6.5G.2.3.1.4.2 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 the test configuration tables in clause 6.2.2.4.1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously power control “up” commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200ms for the UE to reach P_{UMAX} level.
3. Measure the sum of the mean power of the UE at each antenna connector in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2G.2.4.2, which shall meet the requirements described in clause 6.2G.2.5 as appropriate.
4. Measure the sum of the rectangular filtered mean power at each antenna connector for the assigned NR channel.
5. Measure the sum of the rectangular filtered mean power at each antenna connector of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2.2.4.1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5G.2.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4 with the following exceptions:

Table 6.5G.2.3.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

6.5G.2.3.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in clause 6.2G.2.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6, shall be higher than the limits in Table 6.5G.2.3.1.5-2 with TT applying for the sum of power at each of UE antenna connector.

Table 6.5G.2.3.1.5-1: NR ACLR measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth													
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
NR ACLR measurement bandwidth (MHz)	4.515	9.375	14.235	19.095	23.955	28.815	38.895	48.615	58.35	68.07	78.15	88.23	98.31

Table 6.5G.2.3.1.5-2: NR ACLR requirement for Tx Diversity

	Power class 1.5	**Power class 2**
NR ACLR	31 - TT dB	31 - TT dB
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.5G.2.3.1.5-3. NOTE 2: TT for the sum of power at each of UE antenna connector.		

Table 6.5G.2.3.1.5-3: Test Tolerance (NR ACLR)

	f ≤ 3.0GHz	**3.0GHz < f ≤ 4.2GHz**	**4.2GHz < f ≤ 6.0GHz**
BW ≤ 100MHz	0.8 dB	0.8 dB	0.8 dB

6.5G.3 Spurious emission for Tx Diversity

6.5G.3.1 General spurious emissions for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.5G.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.

6.5G.3.1.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.5G.3.1.3 Minimum conformance requirements

For UE supporting Tx diversity, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products apply to the sum of the emissions from all UE transmit antenna connectors.

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

6.5G.3.1.4 Test description

Same test description as specified in clause 6.5.3.1.4 with following exceptions:

Step 3 of Test procedure as in 6.5.3.1.4.2 is replaced by:

3. Measure the sum power of the transmitted signal at all antenna connectors with a measurement filter of bandwidths according to Table 6.5G.3.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5G.3.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5G.3.1.5 Test requirement

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5G.3.1.5-1.

Table 6.5G.3.1.5-1: General spurious emissions for Tx Diversity test requirements

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	4
	-25 dBm	1 MHz	3
12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12.75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band for which the upper frequency edge of the UL Band is greater than 2.55 GHz and less than or equal to 5.2 GHz NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5.2 GHz NOTE 3: Applies for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in sub-clause 5.2B of 38.101-3 [4] when NS_04 is signalled. NOTE 4: Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in subclause 5.2B of TS 38.101-3 [4] when NS_04 is signalled.			

6.5G.4 Transmit intermodulation for Tx Diversity

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

- Tests for Power Class 3 are FFS.

6.5G.4.1 Test purpose

To verify that the UE transmit intermodulation for Tx Diversity does not exceed the described value in the test requirement.

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.5G.4.2 Test applicability

This test case applies to all types of NR Power Class 1.5 UE, Power Class 2 UE reporting Tx diversity release 15 and forward.

6.5G.4.3 Minimum conformance requirements

For UE supporting Tx diversity, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power from all UE transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 6.5G.4.

6.5G.4.4 Test description

Same test description as specified in clause 6.5.4.4 with following exceptions:

Test procedure as in 6.5.4.4.2 is replaced by:

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 6.5.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands to the UE until the UE transmits at its P_{UMAX} level.
3. Measure the rectangular filtered mean power at each antenna connector of the UE. For TDD, only slots consisting of only UL symbols are under test for the wanted signal and for the intermodulation product.
4. Set the interference signal frequency below the UL carrier frequency using the first offset in table 6.5.4.5-1.
5. Set the interference CW signal level according to table 6.5.4.5-1.
6. Search the intermodulation product signals below and above the UL carrier frequency at each UE antenna connector, then measure the rectangular filtered mean power at each antenna connector of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.
7. Set the interference signal frequency above the UL carrier frequency using the first offset in table 6.5.4.5-1.
8. Search the intermodulation product signals below and above the UL carrier frequency at each UE antenna connector, then measure the rectangular filtered mean power at each antenna connector of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.
9. Repeat the measurement using the second offset in table 6.5.4.5-1.
10. Repeat step 3) until 9) for each of transmit antenna of the UE.

6.5G.4.5 Test requirement

The ratio derived in step 6 and 8, shall not exceed the described value in table 6.5.4.5-1.