5. Peak-Average Ratio

5.1. Limit

FCC

- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

IC

- RSS-192 Issue 5

5.5, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

- RSS-199 Issue 4

5.5, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

a. Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.

b. Set the number of counts to a value that stabilizes the measured CCDF curve.

c. Set the measurement interval as follows:

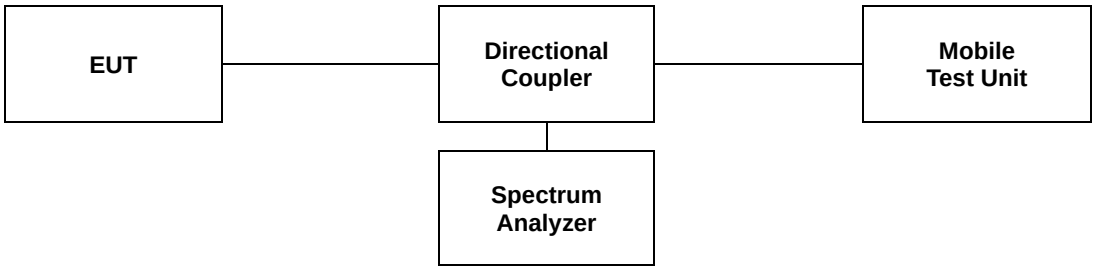
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.

2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.

3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.

d. Record the maximum PAPR level associated with a probability of 0.1 %.

e. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.



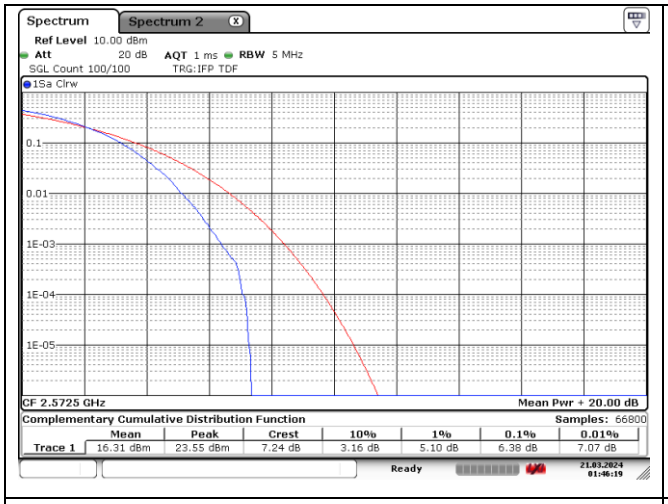
5.3 Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

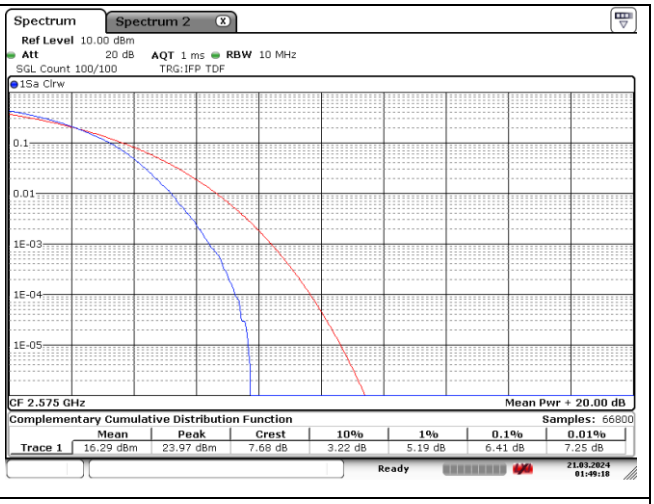
Band	Bandwidth (㎒)	Mode	Frequency (㎒)	PAR (dB)
38	5	256QAM	2 572.5	6.38
			2 595.0	6.38
			2 617.5	6.43
	10		2 575.0	6.41
			2 595.0	6.14
			2 615.0	6.12
	15		2 577.5	6.26
			2 595.0	6.29
			2 612.5	6.26
	20		2 580.0	6.23
			2 595.0	6.29
			2 610.0	6.32
42 Only IC	5	256QAM	3 452.5	6.46
			3 525.0	6.52
			3 597.5	6.49
	10		3 455.0	6.52
			3 525.0	6.58
			3 595.0	6.67
	15		3 457.5	6.55
			3 525.0	6.58
			3 592.5	6.84
	20		3 460.0	6.29
			3 525.0	6.41
			3 590.0	6.64
48 IC	5	256QAM	3 552.5	6.17
			3 625.0	6.38
			3 697.5	6.43
	10		3 555.0	6.20
			3 625.0	6.52
			3 695.0	6.70
	15		3 557.5	6.29
			3 625.0	6.67
			3 692.5	6.64
	20		3 560.0	6.23
			3 625.0	6.46
			3 690.0	6.41

- Test plots

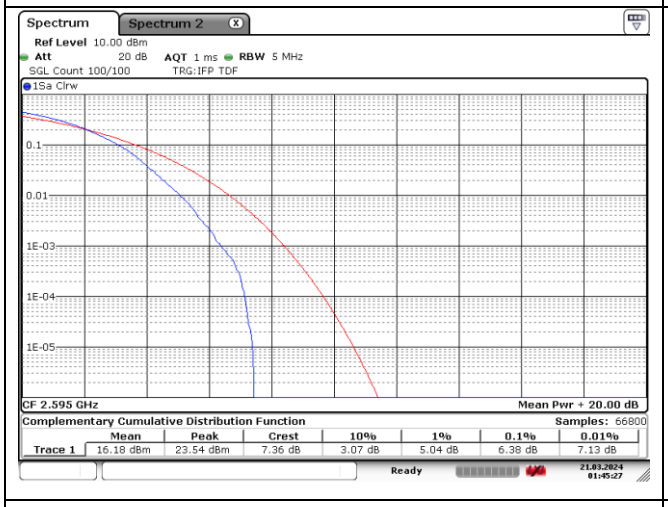
LTE band 38



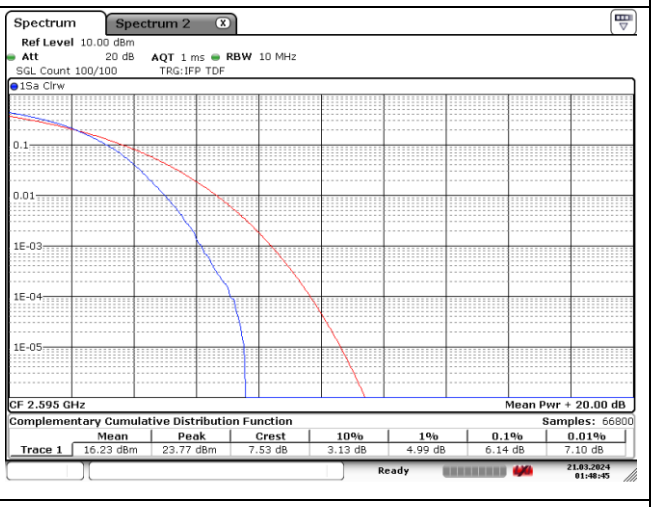
5 ㎒ Low Channel - Full RB



10 ㎒ Low Channel - Full RB



5 ㎒ Middle Channel - Full RB



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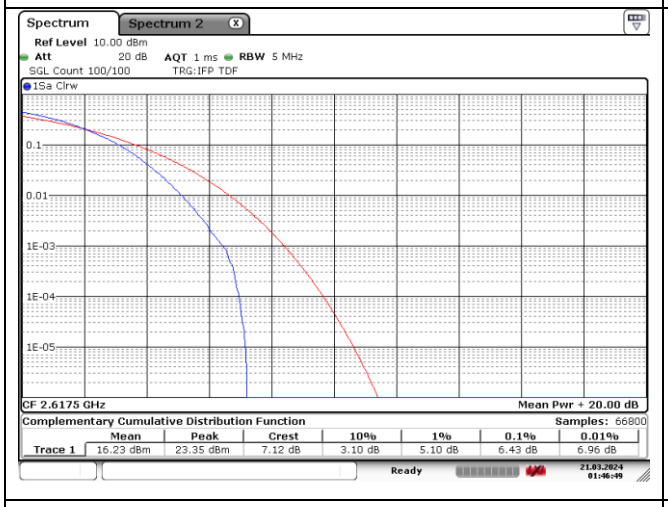
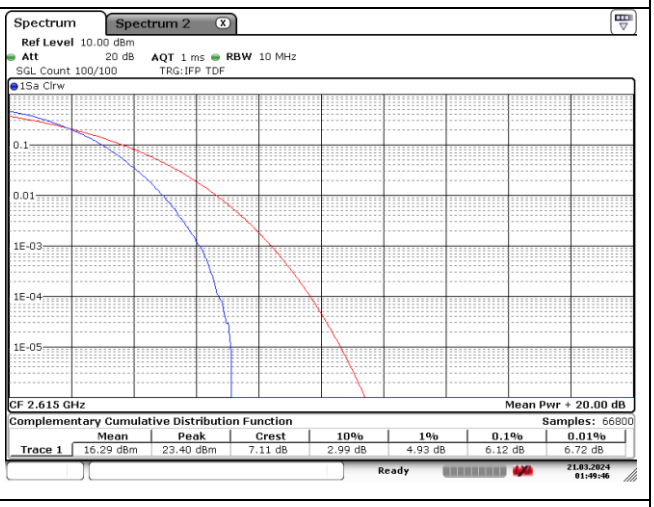
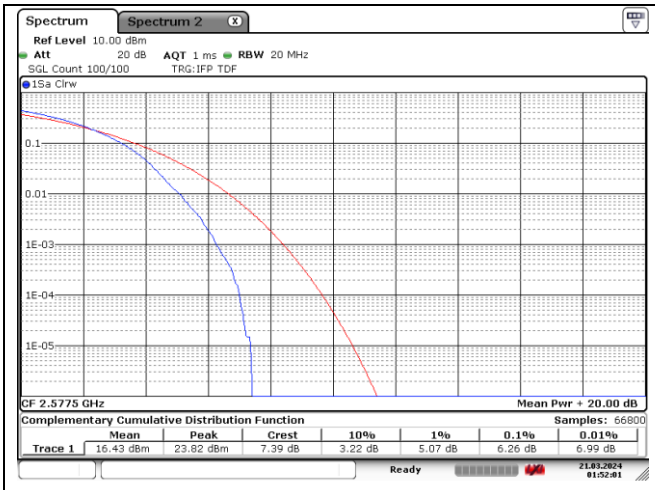


5 ㎒ High Channel - Full RB



10 ㎒ High Channel - Full RB

LTE band 38



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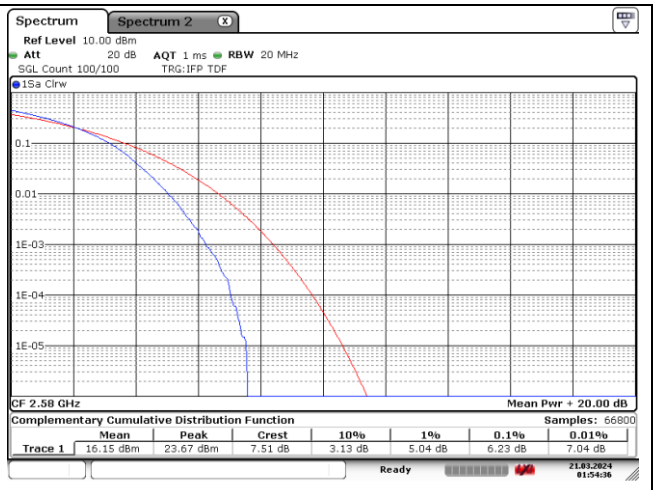
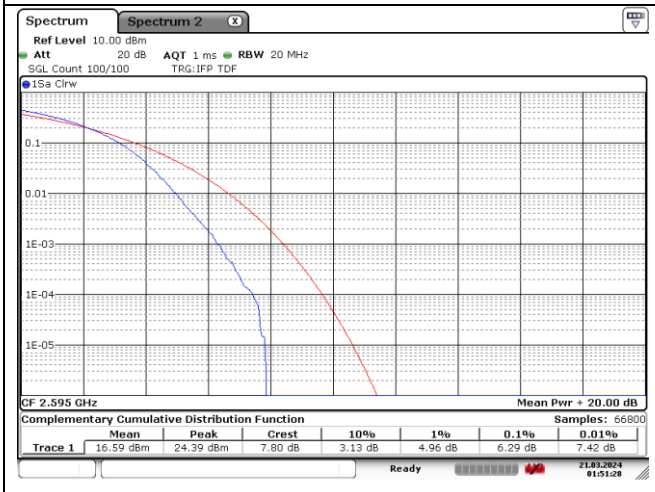


20 ㎒ Low Channel - Full RB



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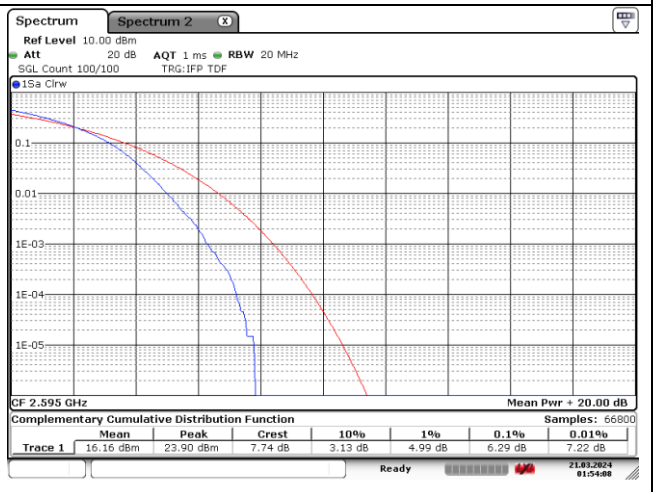

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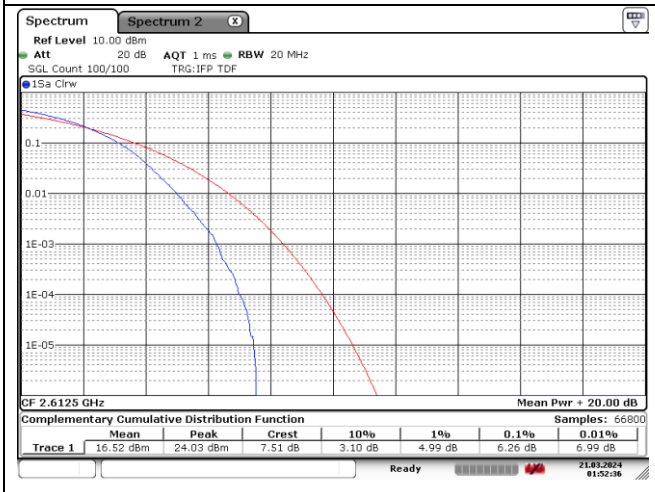
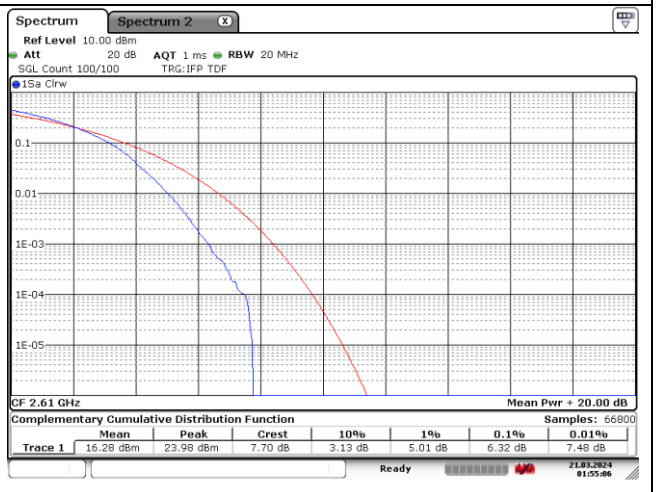
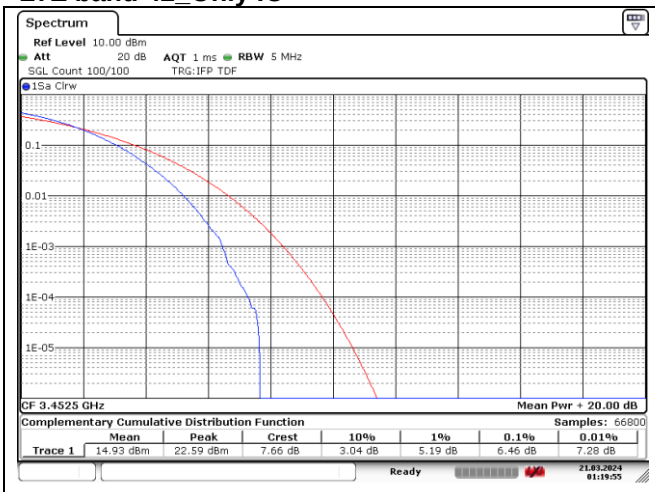


15 ㎒ High Channel - Full RB

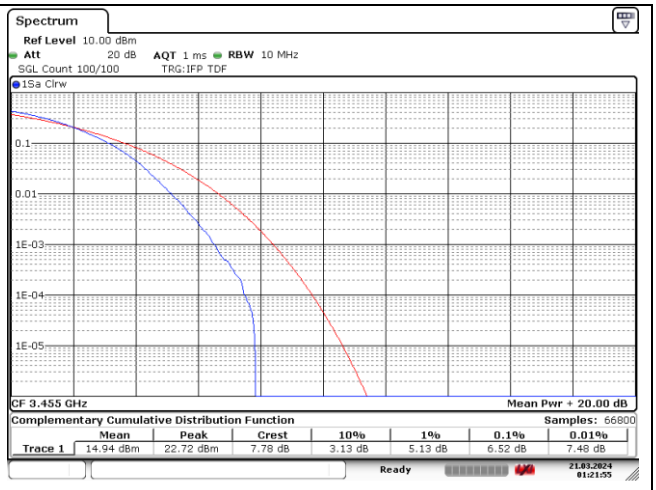


20 ㎒ High Channel - Full RB

LTE band 42_Only IC



5 ㎒ Low Channel - Full RB



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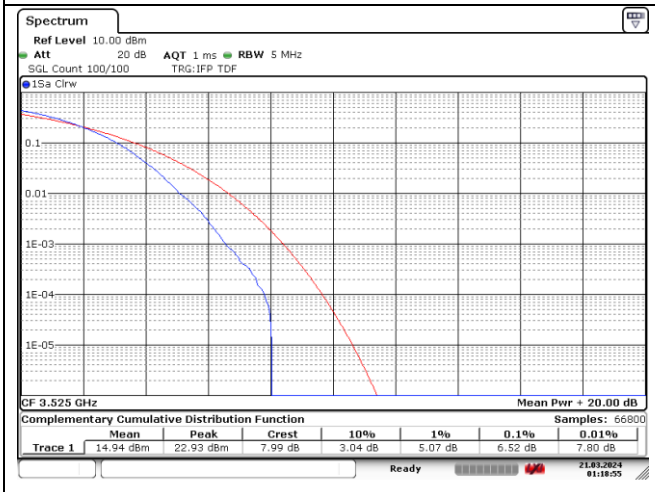

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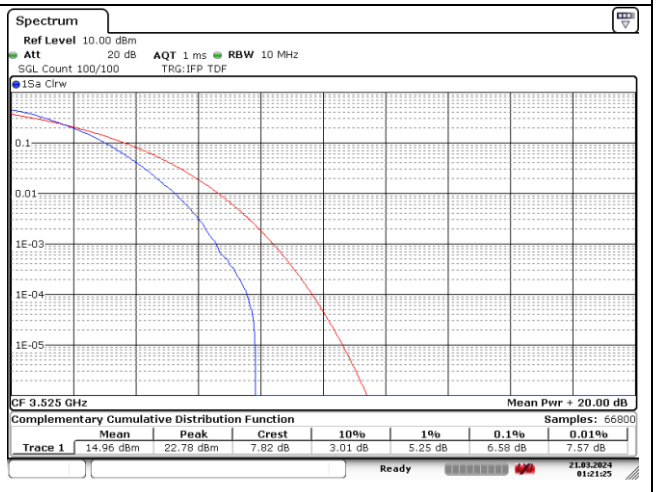

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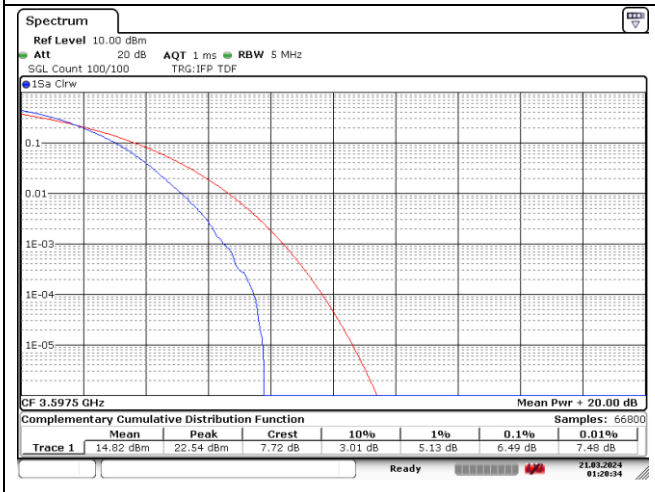

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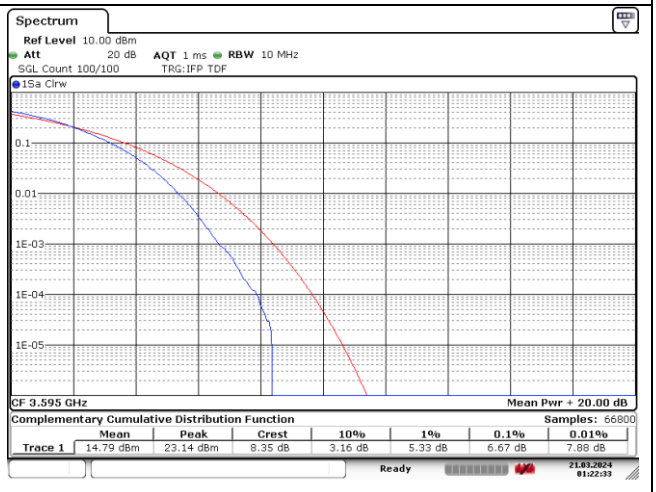
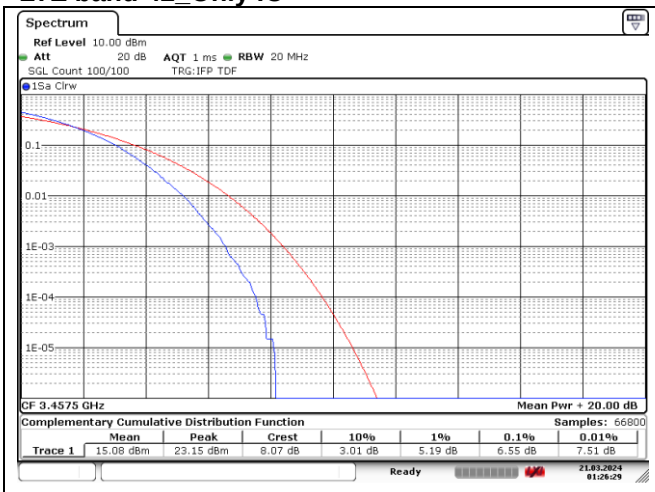
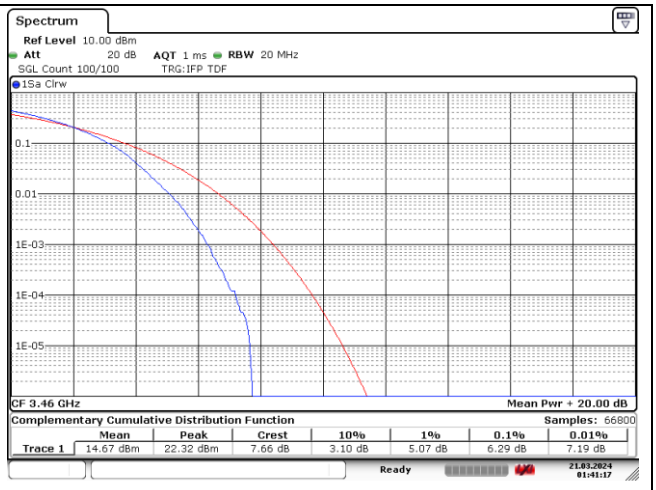


10 ㎒ High Channel - Full RB

LTE band 42_Only IC



15 ㎒ Low Channel - Full RB



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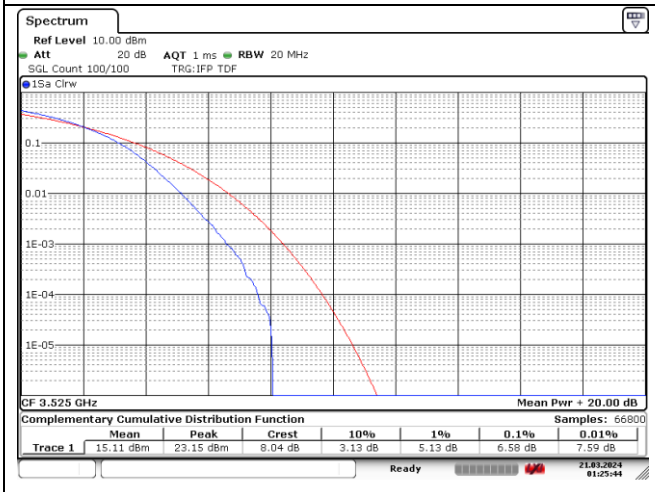
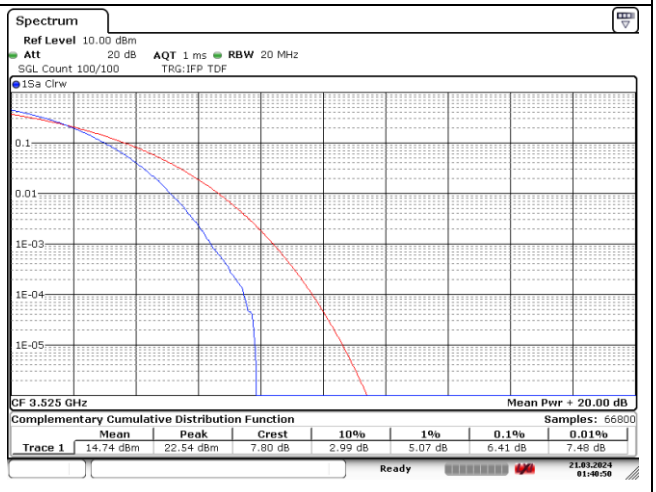
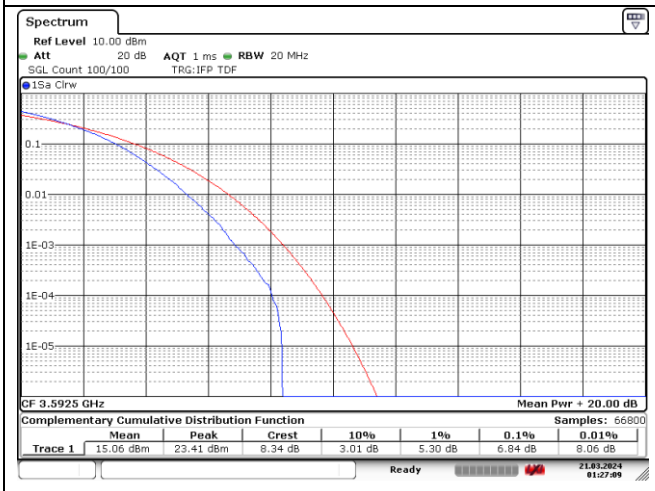


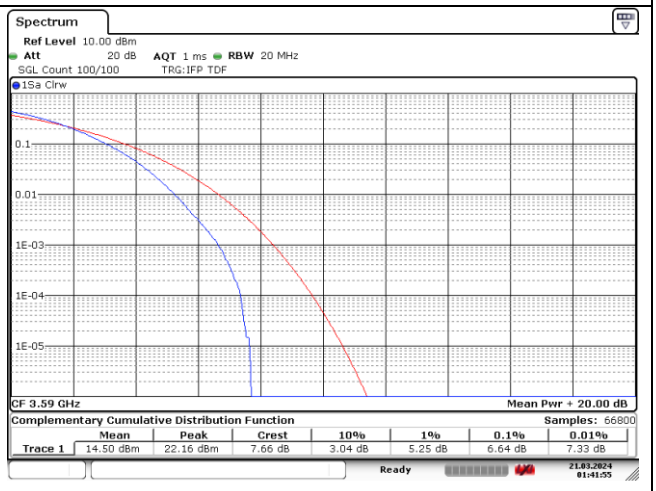
15 ㎒ Middle Channel - Full RB



20 ㎒ Middle Channel - Full RB

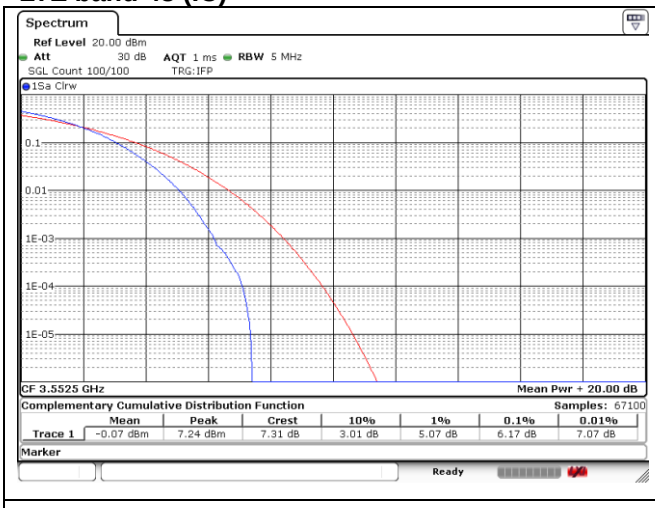


15 ㎒ High Channel - Full RB

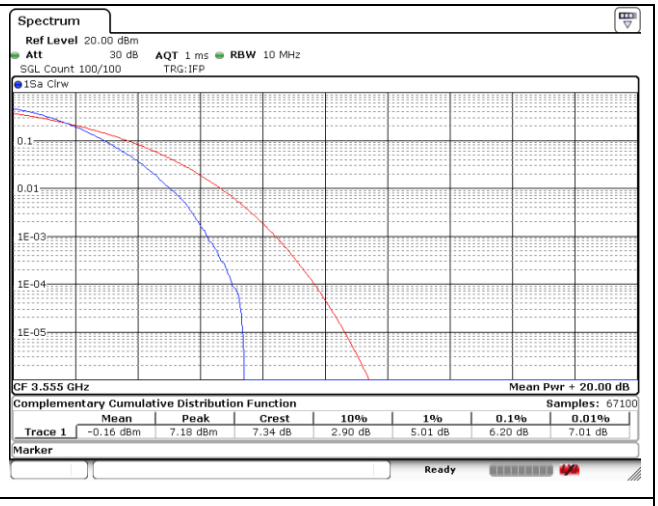


20 ㎒ High Channel - Full RB

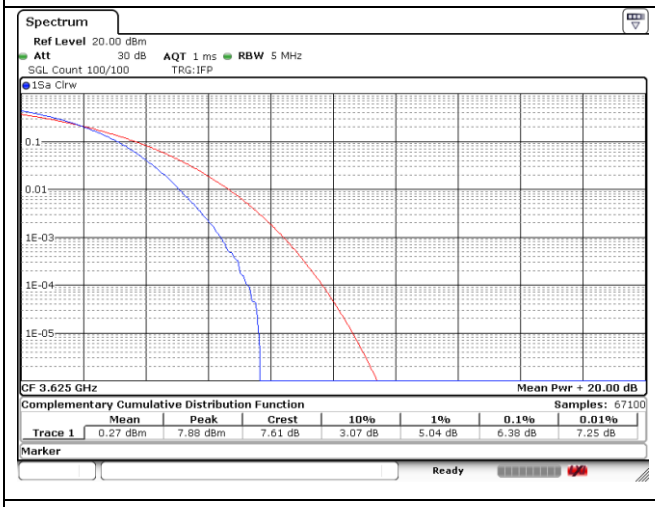
LTE band 48 (IC)



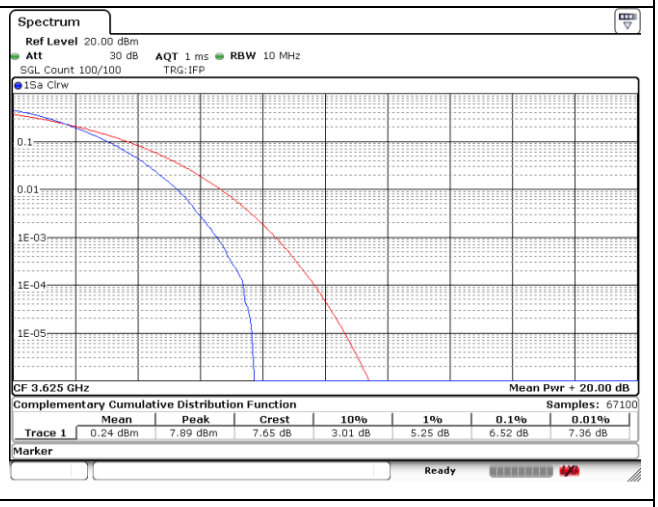
5 ㎒ Low Channel - Full RB



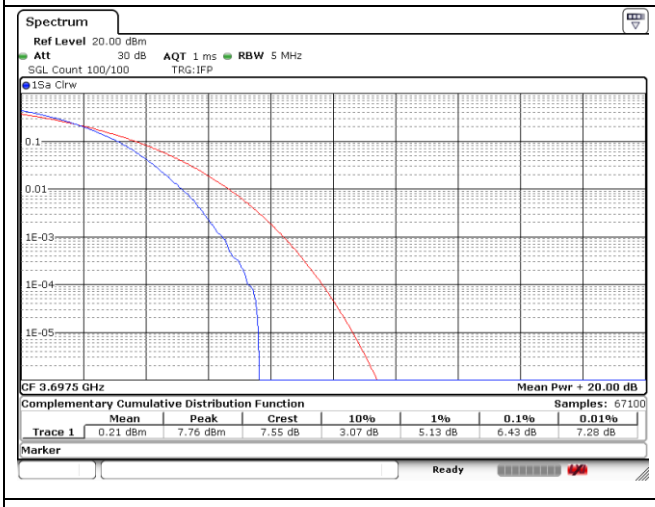
10 ㎒ Low Channel - Full RB



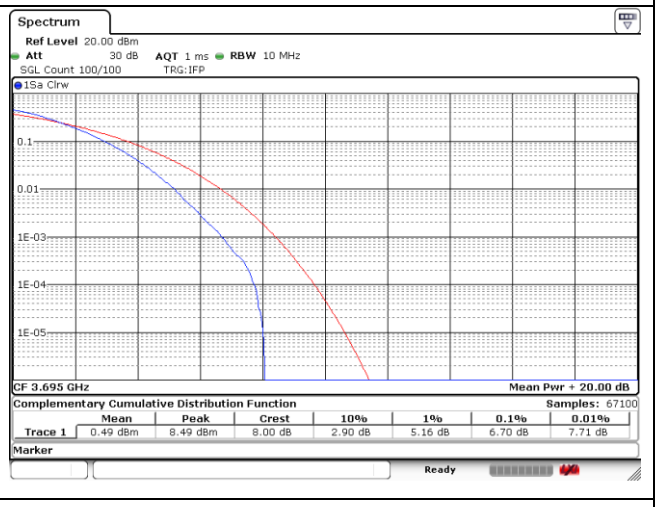
5 ㎒ Middle Channel - Full RB



10 ㎒ Middle Channel - Full RB

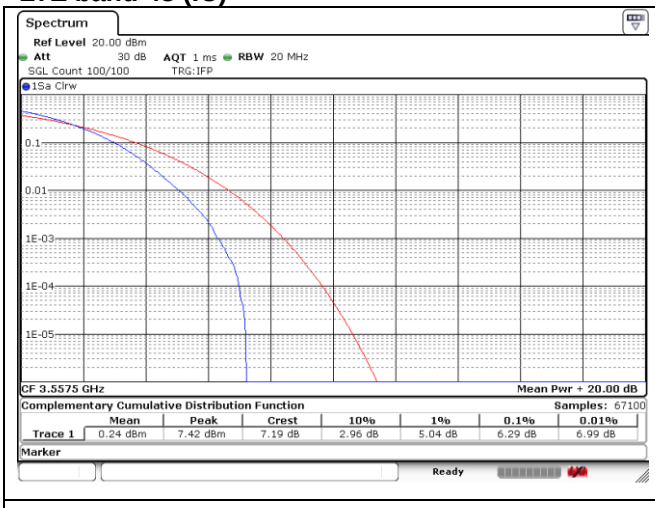


5 ㎒ High Channel - Full RB

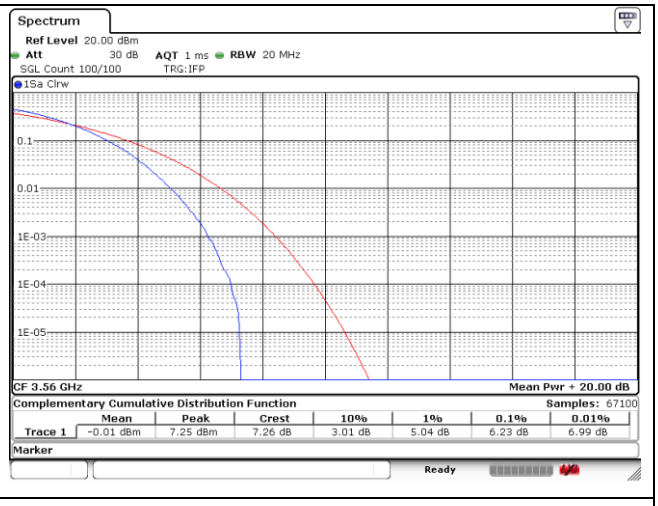


10 ㎒ High Channel - Full RB

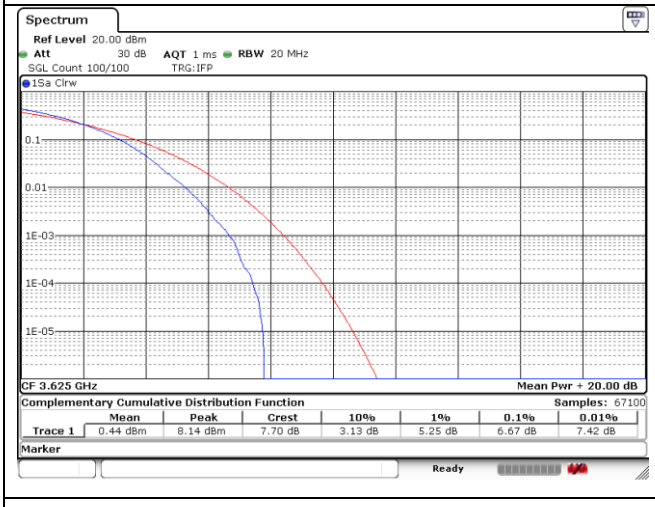
LTE band 48 (IC)



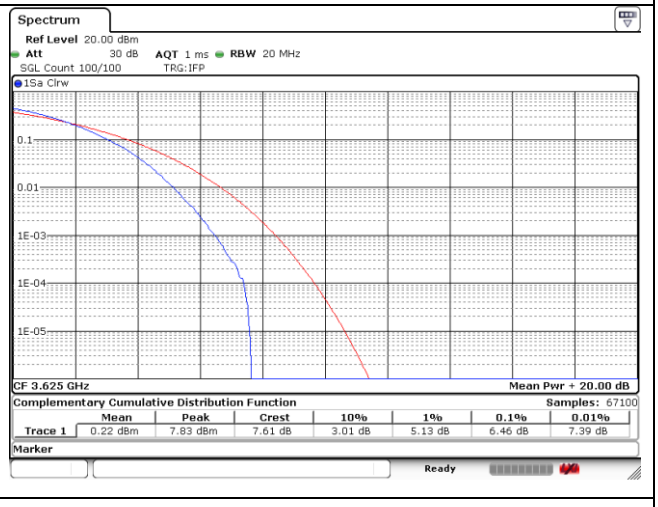
15 ㎒ Low Channel - Full RB



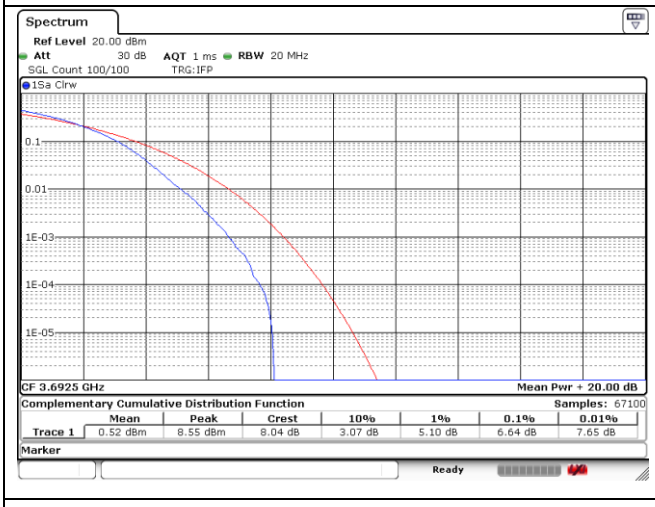
20 ㎒ Low Channel - Full RB



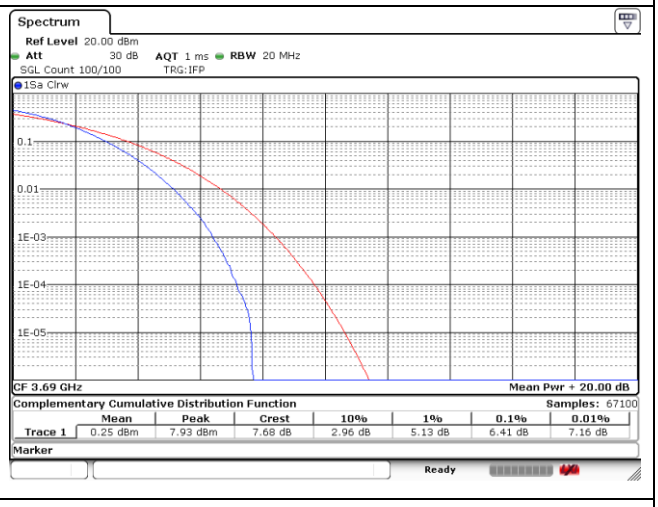
15 ㎒ Middle Channel - Full RB



20 ㎒ Middle Channel - Full RB



15 ㎒ High Channel - Full RB



20 ㎒ High Channel - Full RB

6. Spurious Emissions at Antenna Terminal

6.1. Limit

FCC

- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㏈ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㏈ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㏈ on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 $\log_{10}$ (P) ㏈ on all frequencies between 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 $\log_{10}$ (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

IC

- RSS-192 Issue 5

5.6, unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.
Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.
If the transmitter is designed for multi-carrier operation, the tests shall be carried out using both the maximum and minimum number of carriers intended for the equipment.

5.6.3, subscriber equipment shall have the TRP or conducted power (per antenna),where applicable, of unwanted emission not exceeding the following:
a. the limits in table 6
b. a limit of -30 ㏈m/㎒ in the frequency range greater than (B+5) ㎒ from the edge of the frequency band

Table 6: Unwanted emission limits for subscriber equipment

Frequency block group (B)	Offset frequency from the edge of the frequency block group (㎒)			
	0-1	1-5	5-B	>B
10 ㎒, 20 ㎒, 30 ㎒ and 40 ㎒	-13 ㏈m/1% of B	-10 ㏈m/㎒	-13 ㏈m/㎒	-25 ㏈m/㎒
> 40 ㎒	-13 ㏈m/400 ㎑	-10 ㏈m/㎒	-13 ㏈m/㎒	-25 ㏈m/㎒

- RSS-199 Issue 4
5.6, unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 ㎒ band immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for fixed stations, base stations, and fixed subscriber equipment, and 2 % for subscriber equipment other than fixed subscriber equipment. Beyond this 1 ㎒ band, a resolution bandwidth of 1 ㎒ shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 ㎒, or 1 % or 2 % of the occupied bandwidth, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in the tables below.

Table 4: Unwanted emission limits for fixed station, base station and fixed subscriber equipment

Offset from the edge of the frequency block or frequency block group (㎒)	Unwanted emission limit
≤1	-13 ㏈m/(1% of OB*)
>1	-13 ㏈m/㎒

* OB is the occupied bandwidth

Table 5: Unwanted emission limits for subscriber equipment other than fixed subscriber equipment

Offset from the edge of the frequency block or frequency block group (㎒)	Unwanted emission limit
0-1	-10 ㏈m/(2% of OB*)
1-5	-10 ㏈m/㎒
5-X**	-13 ㏈m/㎒
≥X	-25 ㏈m/㎒

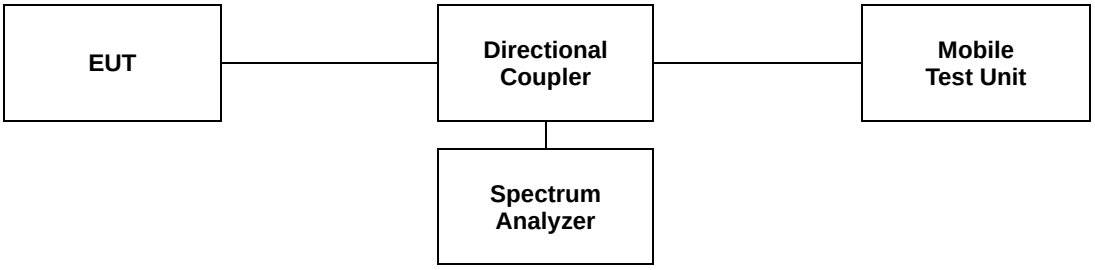
* OB is the occupied bandwidth
** X is 6 ㎒ or the equipment occupied bandwidth, whichever is greater

In addition to complying with the limits in table 5, subscriber equipment other than fixed subscriber equipment shall not exceed -13 ㏈m/㎒ on all frequencies between 2 490.5 ㎒ and 2 496 ㎒,and -25 ㏈m/㎒ at or below 2 490.5 ㎒.

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 ㎑ and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = RMS.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 ㎑ to 40 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

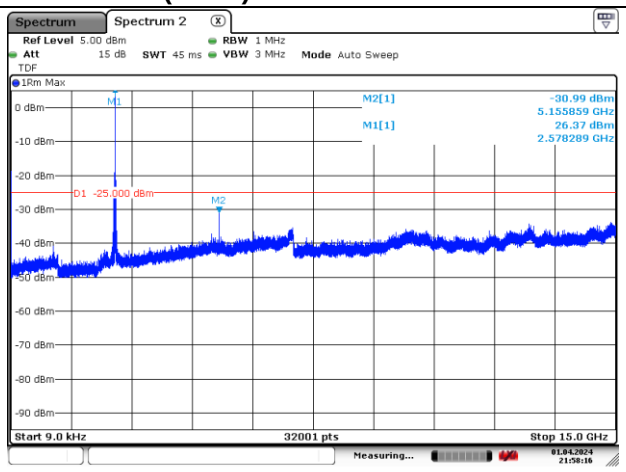
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 ㏈ below the transmitter power.

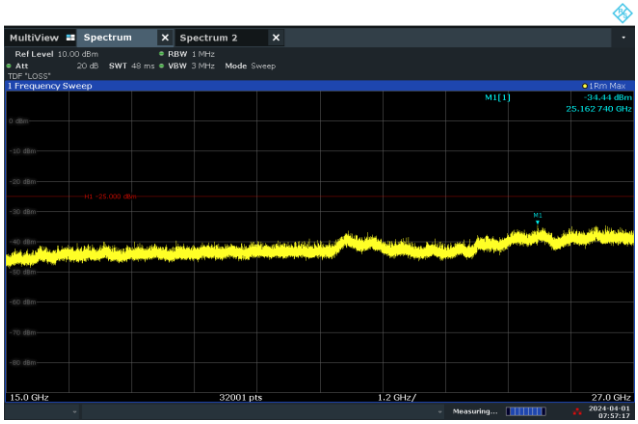
6.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

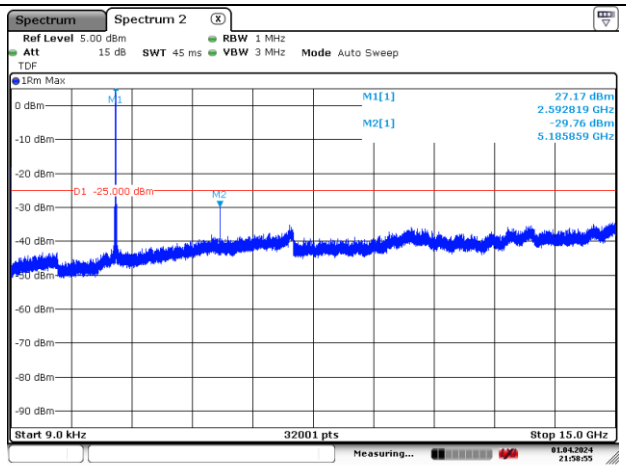
- Test plots

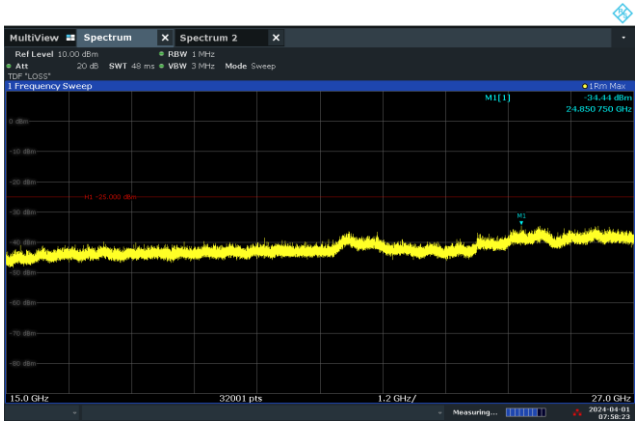
LTE band 38 (20 ㎒)



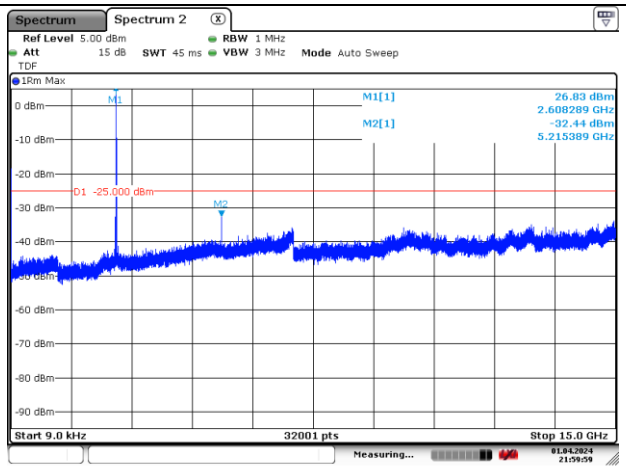


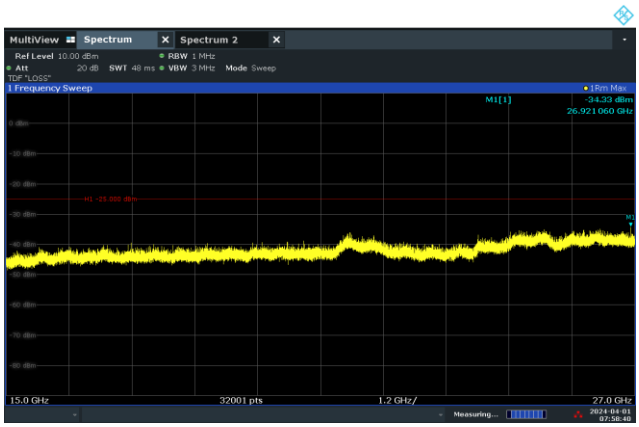
QPSK Low Channel - 1 RB





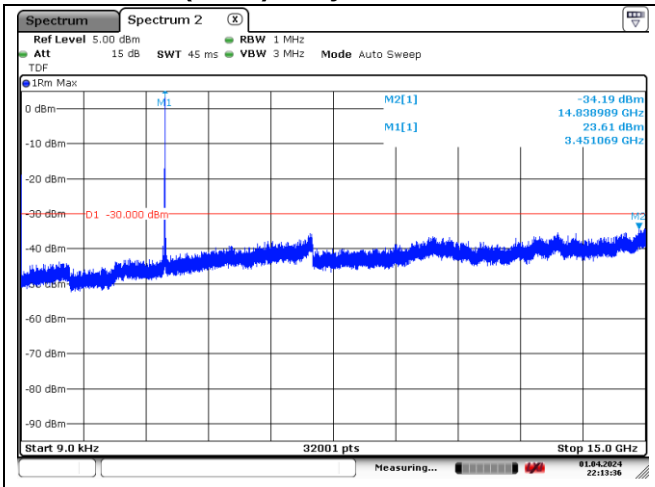
QPSK Middle Channel - 1 RB

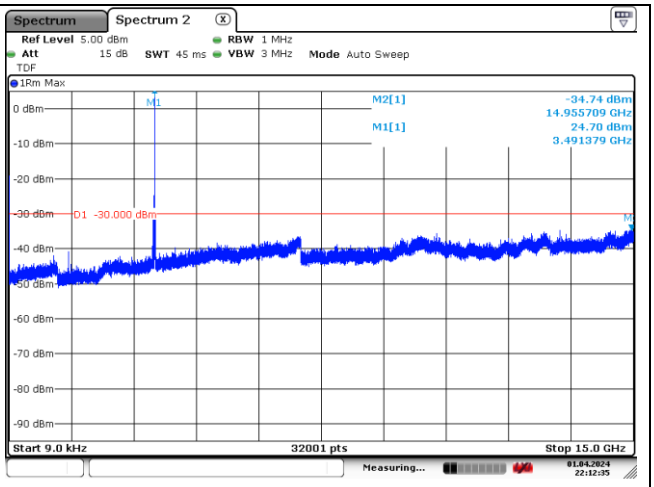


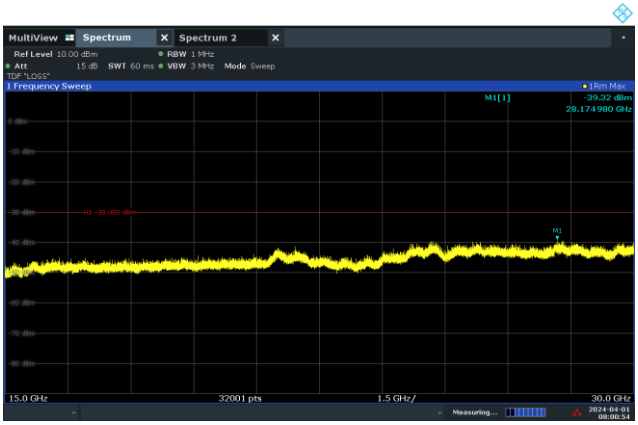


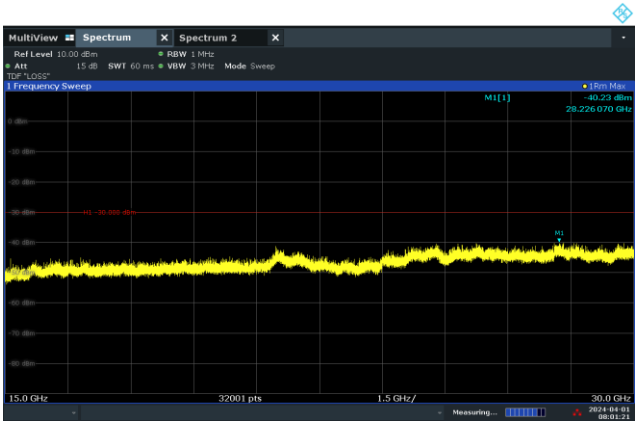
QPSK High Channel - 1 RB

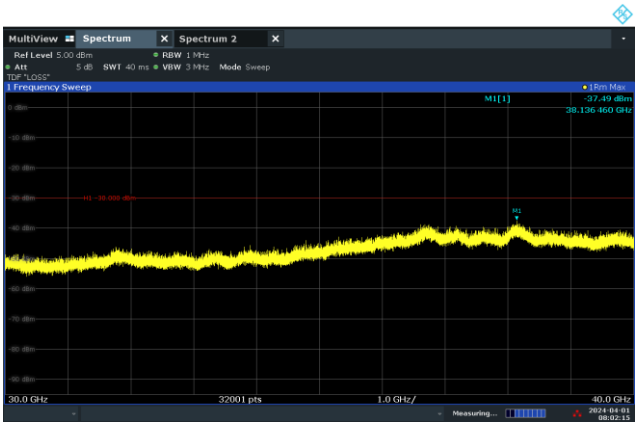
LTE band 42 (20 ㎒)_Only IC

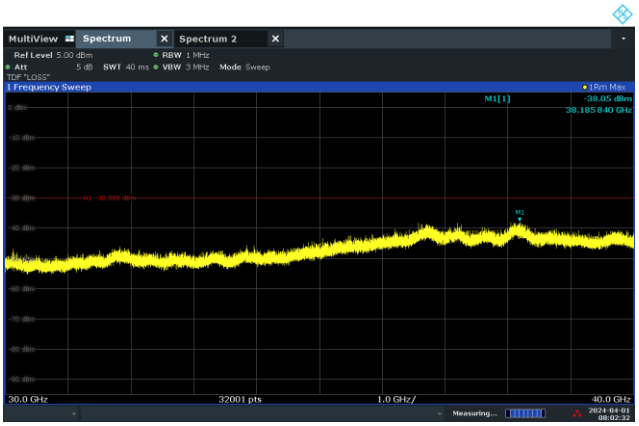






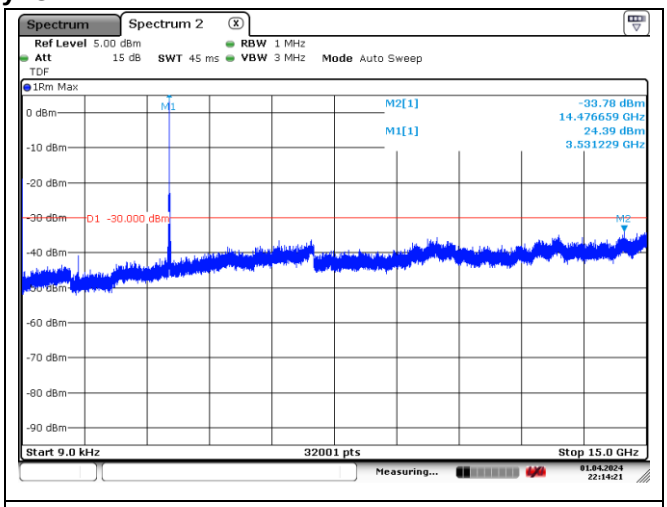


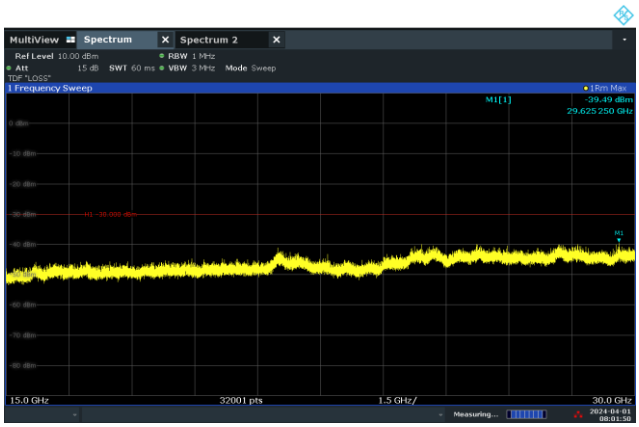


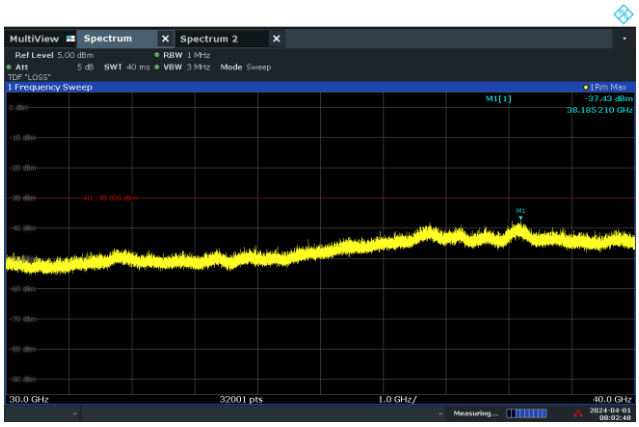


QPSK Low Channel - 1 RB	QPSK Middle Channel - 1 RB

LTE band 42 (20 ㎒)_Only IC

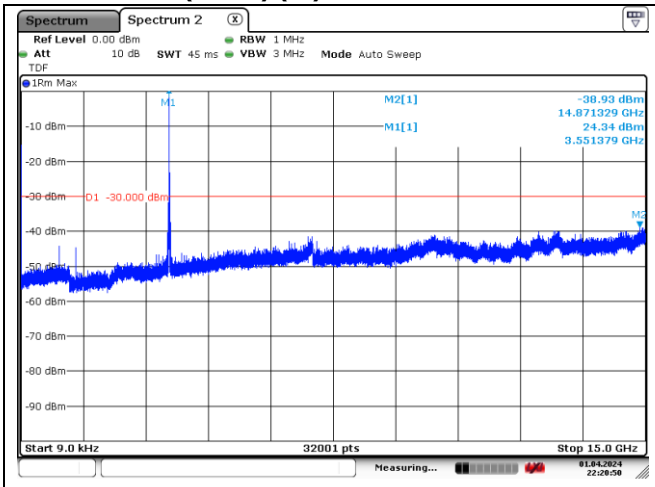


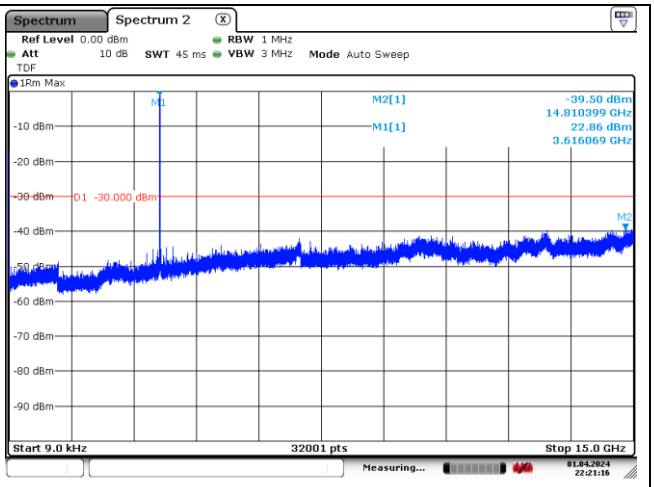


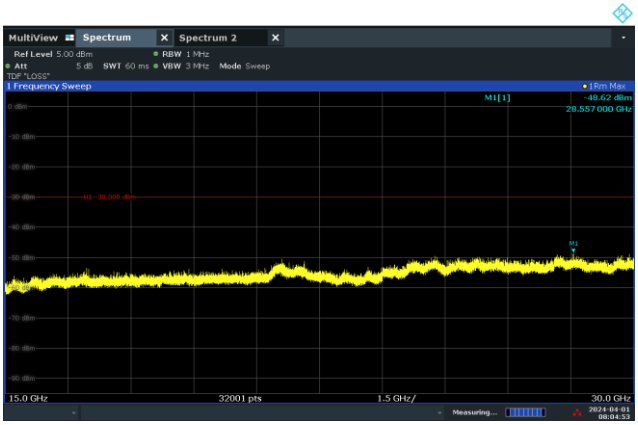


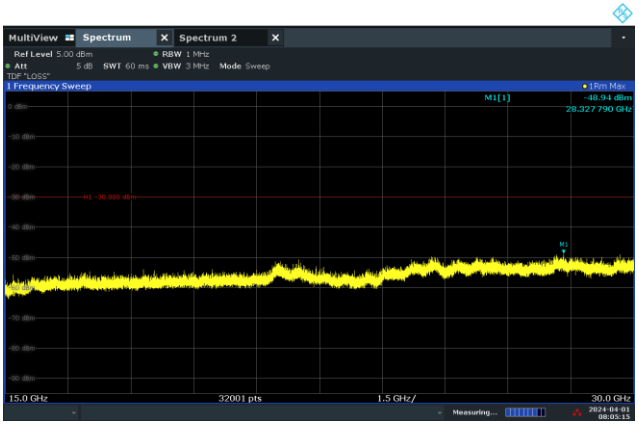
QPSK High Channel - 1 RB

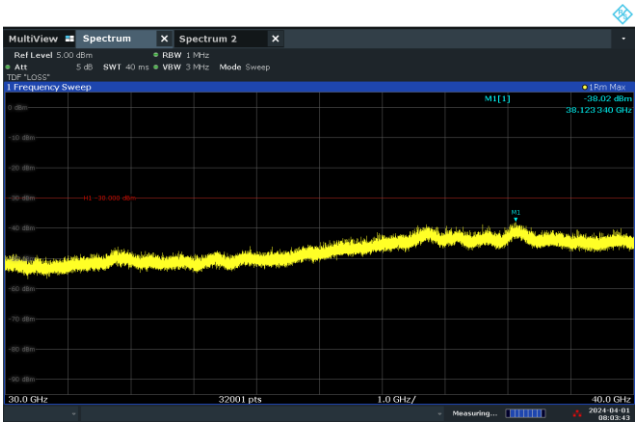
LTE band 48 (20 ㎒) (IC)

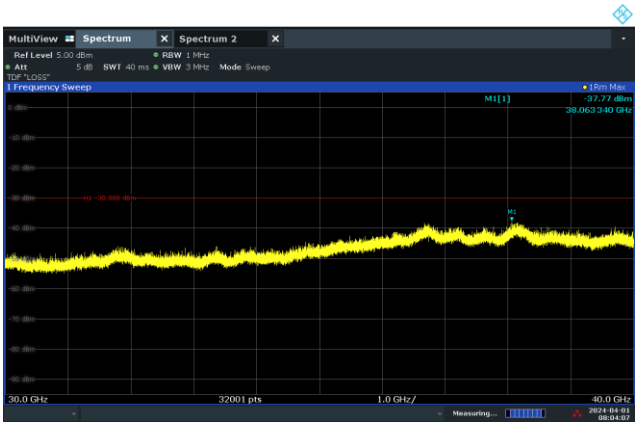






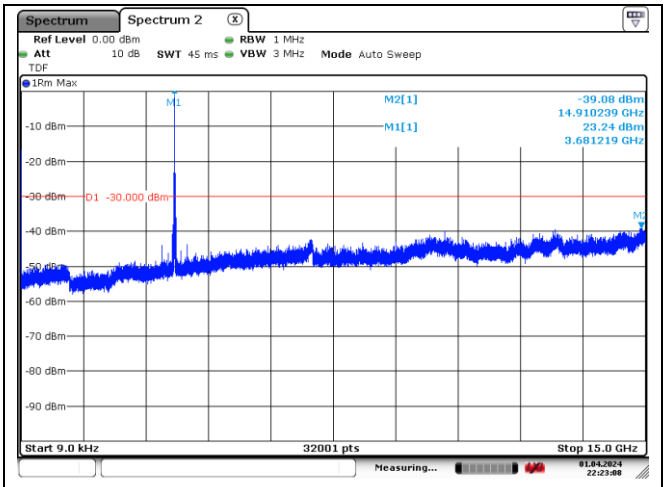


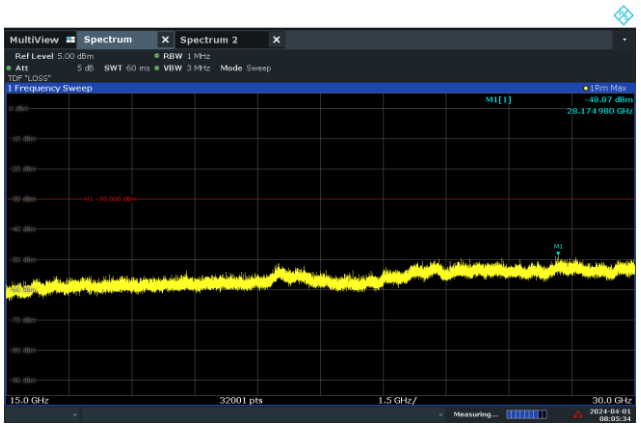


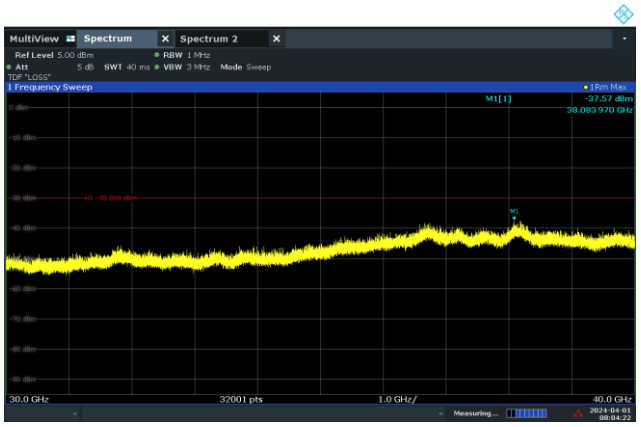


QPSK Low Channel - 1 RB	QPSK Middle Channel - 1 RB

LTE band 48 (20 ㎒) (IC)







QPSK High Channel - 1 RB

7. Band Edge and Emission Mask

7.1. Limit

FCC

- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㏈ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㏈ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㏈ on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 $\log_{10}$ (P) ㏈ on all frequencies between 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 $\log_{10}$ (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

IC

- RSS-192 Issue 5

5.6, unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.
Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.
If the transmitter is designed for multi-carrier operation, the tests shall be carried out using both the maximum and minimum number of carriers intended for the equipment.

5.6.3, subscriber equipment shall have the TRP or conducted power (per antenna),where applicable, of unwanted emission not exceeding the following:
a. the limits in table 6
b. a limit of -30 ㏈m/㎒ in the frequency range greater than (B+5) ㎒ from the edge of the frequency band

Table 6: Unwanted emission limits for subscriber equipment

Frequency block group (B)	Offset frequency from the edge of the frequency block group (㎒)			
	0-1	1-5	5-B	>B
10 ㎒, 20 ㎒, 30 ㎒ and 40 ㎒	-13 ㏈m/1% of B	-10 ㏈m/㎒	-13 ㏈m/㎒	-25 ㏈m/㎒
> 40 ㎒	-13 ㏈m/400 ㎑	-10 ㏈m/㎒	-13 ㏈m/㎒	-25 ㏈m/㎒

- RSS-199 Issue 4
5.6, unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 ㎒ band immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for fixed stations, base stations, and fixed subscriber equipment, and 2 % for subscriber equipment other than fixed subscriber equipment. Beyond this 1 ㎒ band, a resolution bandwidth of 1 ㎒ shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 ㎒, or 1 % or 2 % of the occupied bandwidth, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in the tables below.

Table 4: Unwanted emission limits for fixed station, base station and fixed subscriber equipment

Offset from the edge of the frequency block or frequency block group (㎒)	Unwanted emission limit
≤1	-13 ㏈m/(1% of OB*)
>1	-13 ㏈m/㎒

* OB is the occupied bandwidth

Table 5: Unwanted emission limits for subscriber equipment other than fixed subscriber equipment

Offset from the edge of the frequency block or frequency block group (㎒)	Unwanted emission limit
0-1	-10 ㏈m/(2% of OB*)
1-5	-10 ㏈m/㎒
5-X**	-13 ㏈m/㎒
≥X	-25 ㏈m/㎒

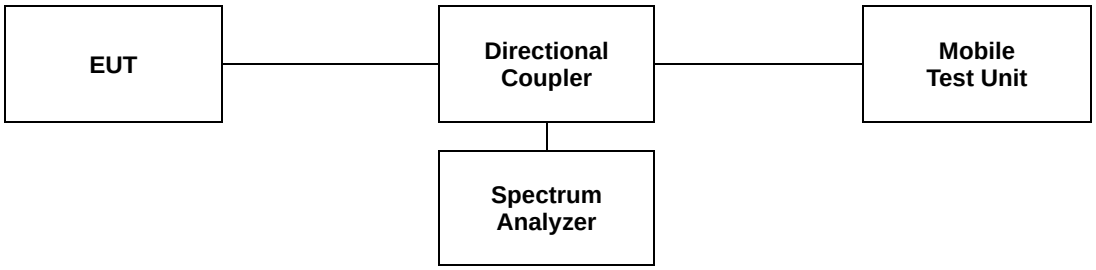
* OB is the occupied bandwidth
** X is 6 ㎒ or the equipment occupied bandwidth, whichever is greater

In addition to complying with the limits in table 5, subscriber equipment other than fixed subscriber equipment shall not exceed -13 ㏈m/㎒ on all frequencies between 2 490.5 ㎒ and 2 496 ㎒,and -25 ㏈m/㎒ at or below 2 490.5 ㎒.

7.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

a. Span was set large enough so as to capture all out of band emissions near the band edge.
b. RBW ≥ 1 % of OBW
c. VBW ≥ 3 x RBW.
d. Detector = RMS.
e. Trace mode = Average.
f. Sweep time = Auto.
g. The trace was allowed to stabilize.
h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.



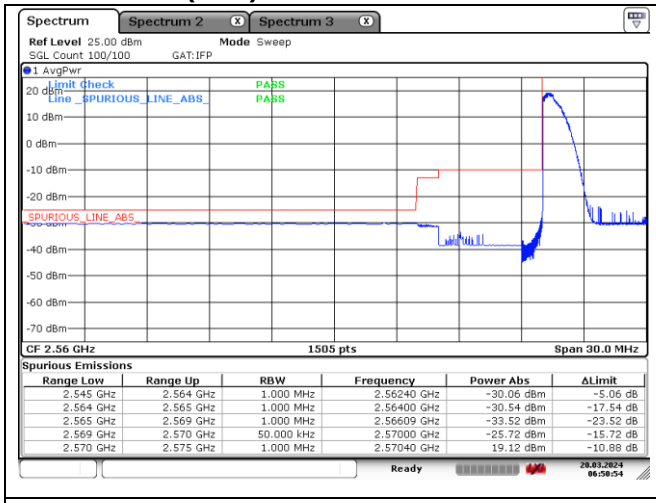
7.3. Test Results

Ambient temperature : (23 ± 1) ℃

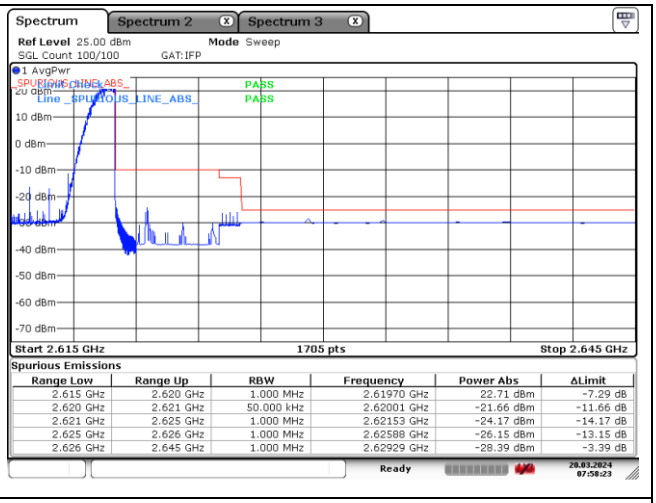
Relative humidity : 47 % R.H.

- Test plots

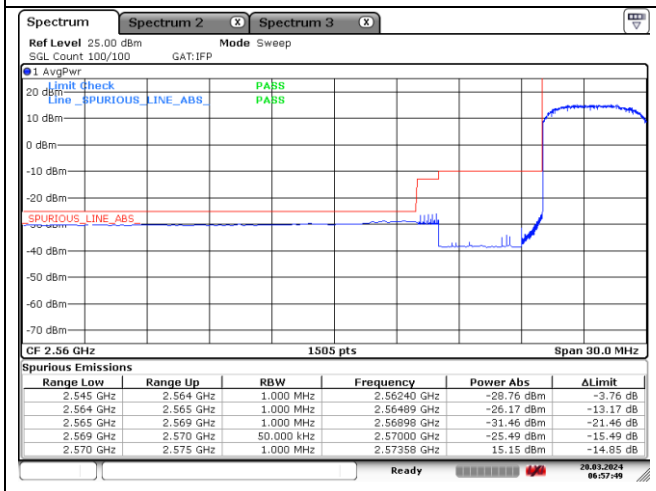
LTE band 38 (5 ㎒)



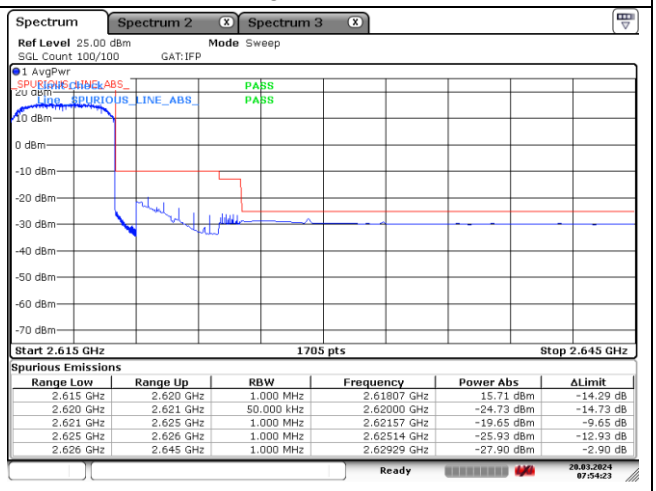
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

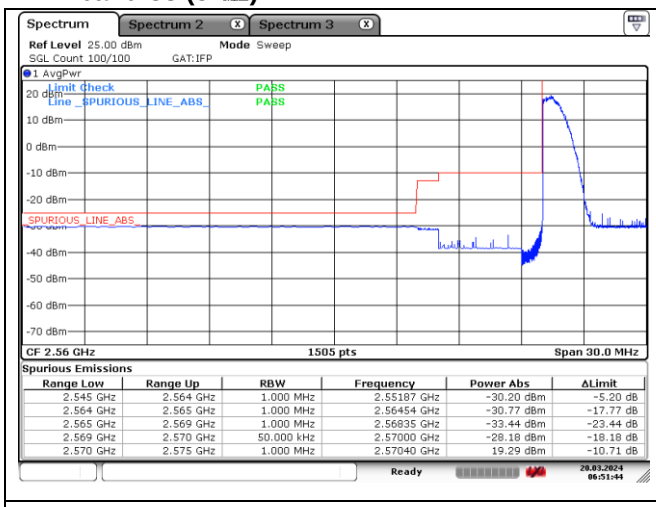


QPSK Low Channel - Full RB

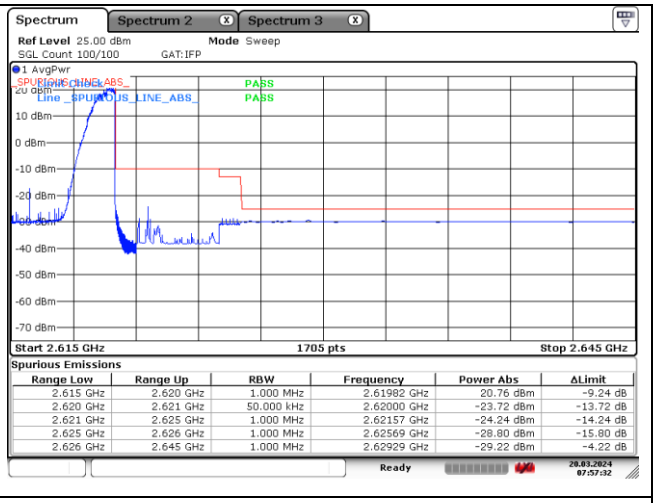


QPSK High Channel - Full RB

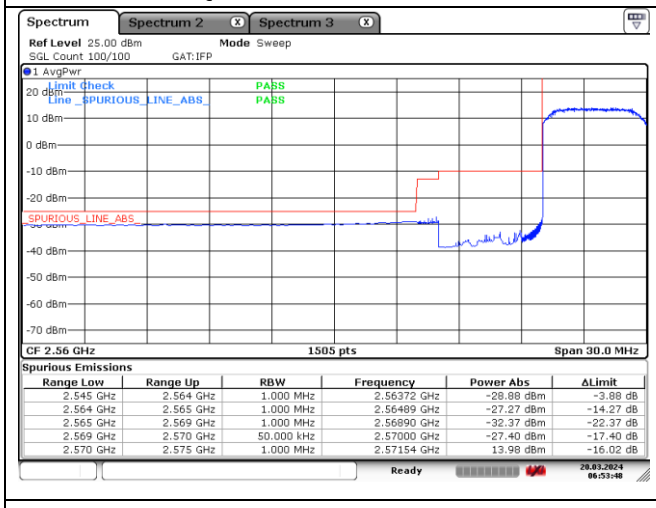
LTE band 38 (5 ㎒)



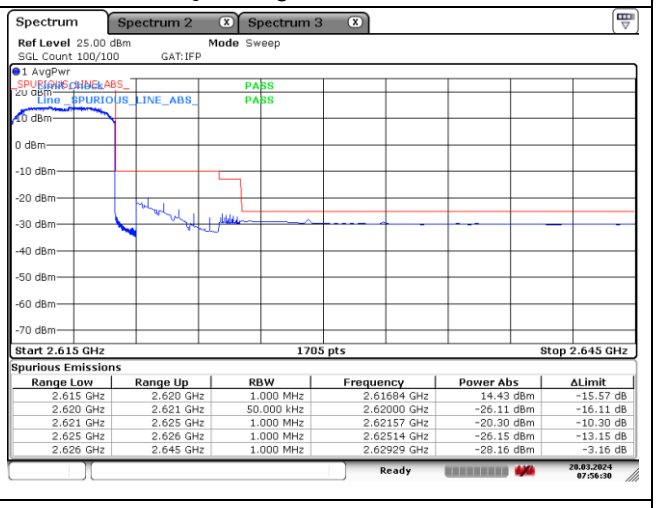
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

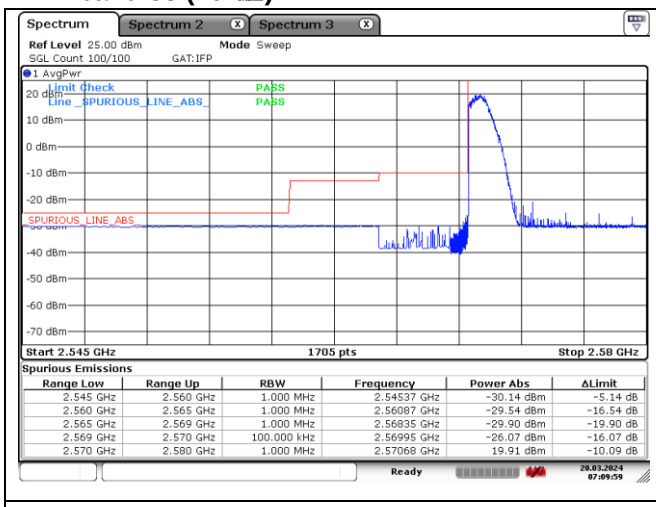


16QAM Low Channel - Full RB

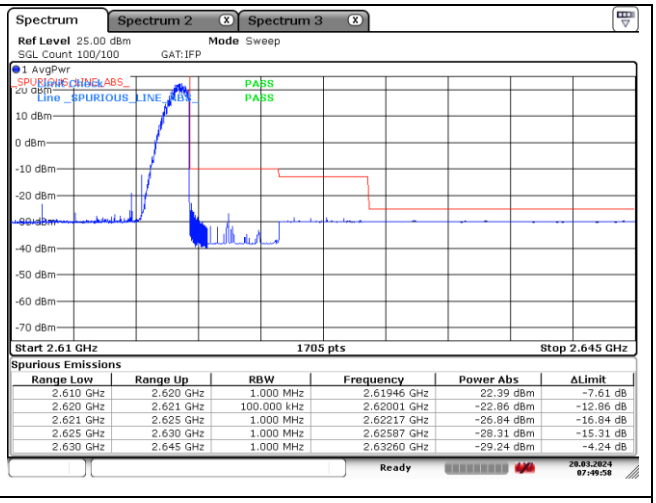


16QAM High Channel - Full RB

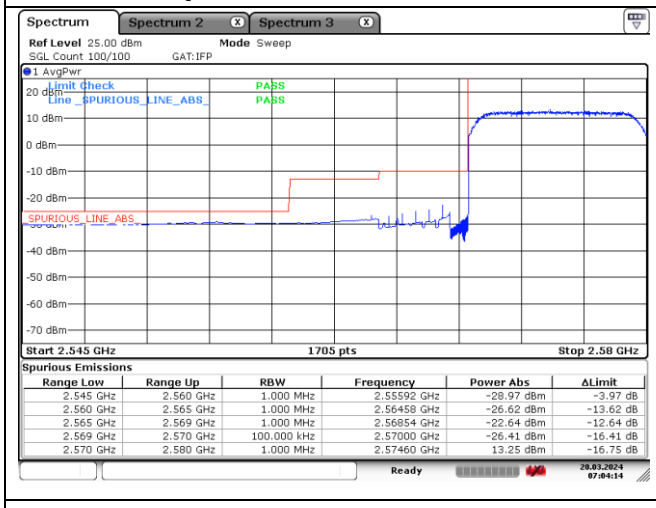
LTE band 38 (10 ㎒)



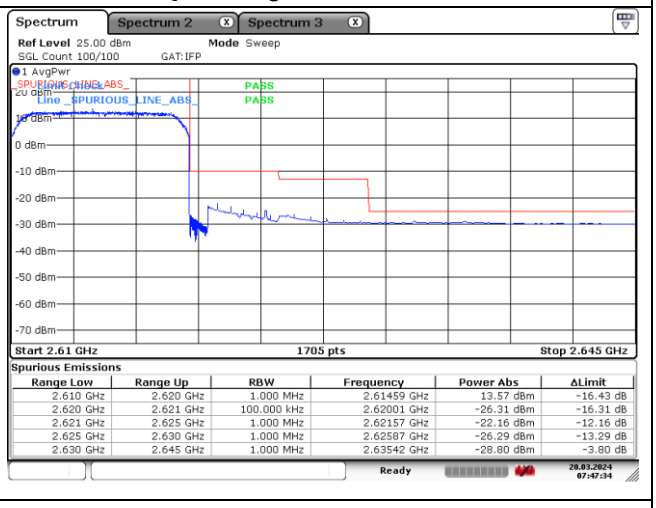
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

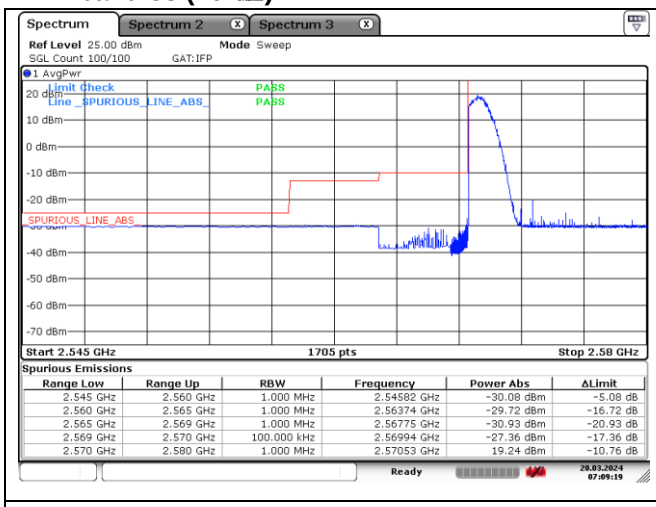


QPSK Low Channel - Full RB

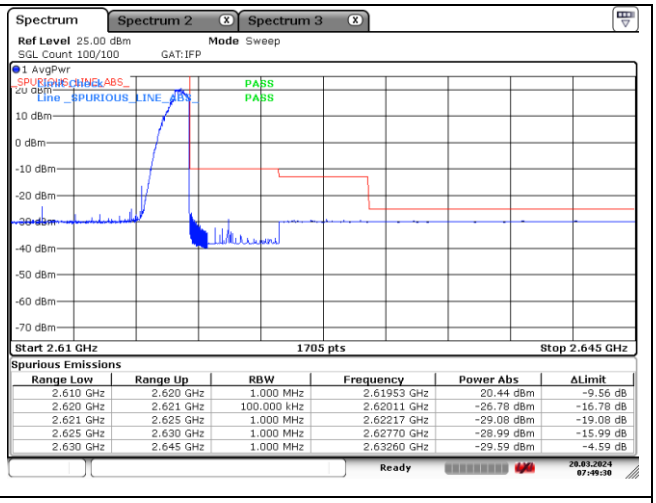


QPSK High Channel - Full RB

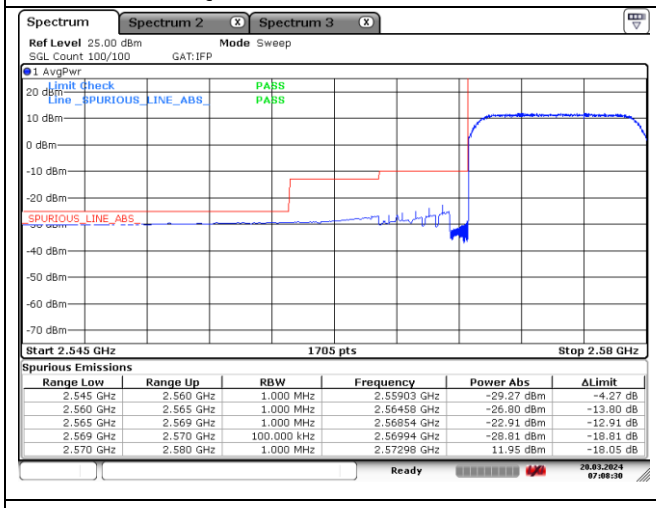
LTE band 38 (10 ㎒)



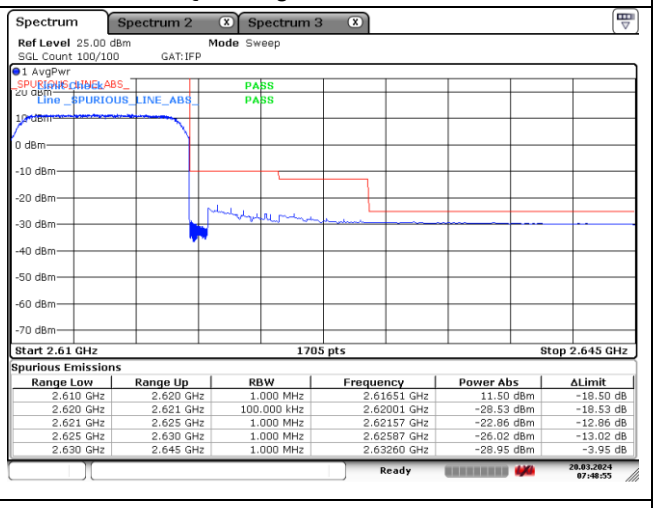
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

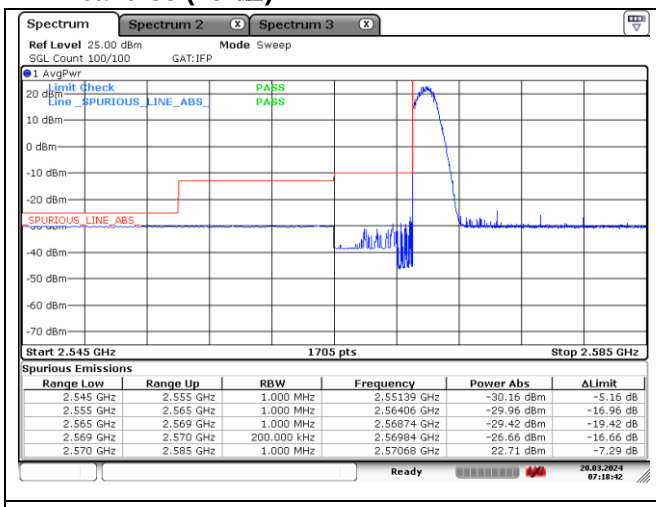


16QAM Low Channel - Full RB

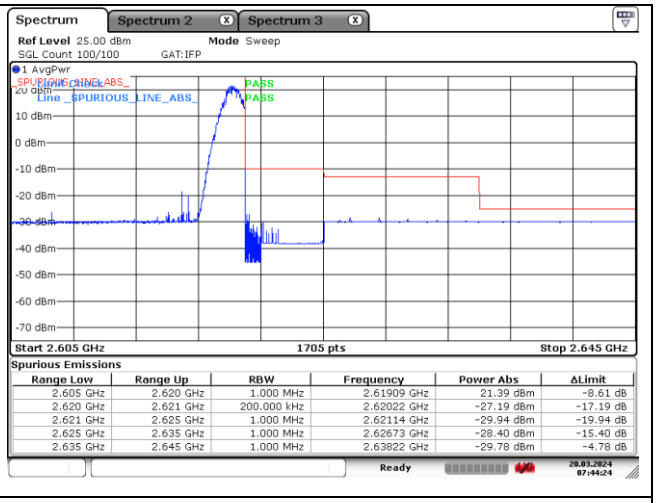


16QAM High Channel - Full RB

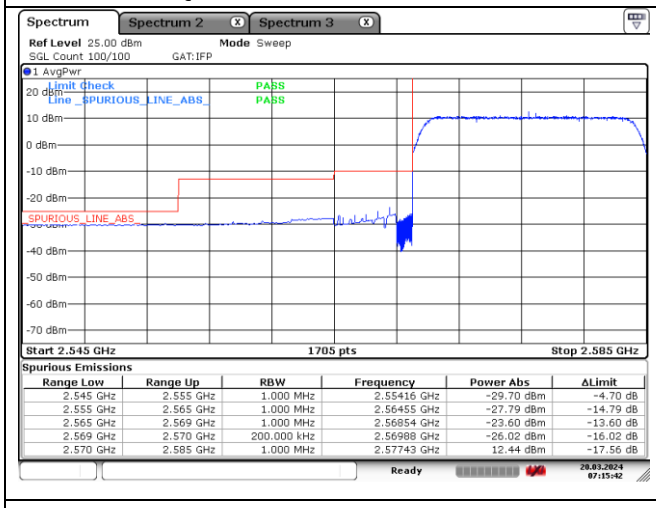
LTE band 38 (15 ㎒)



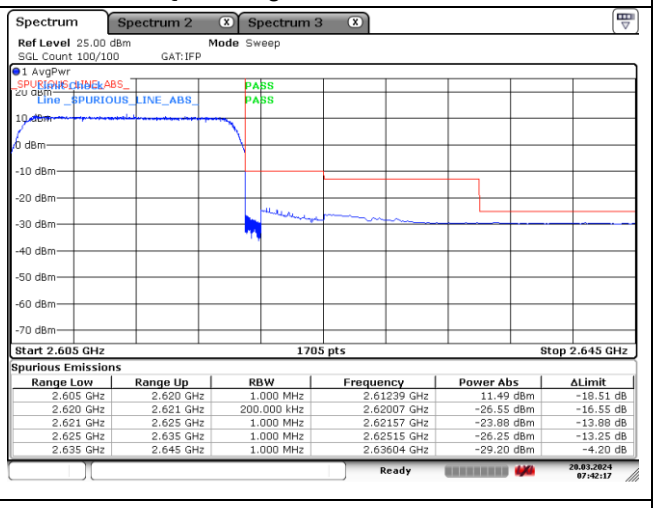
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

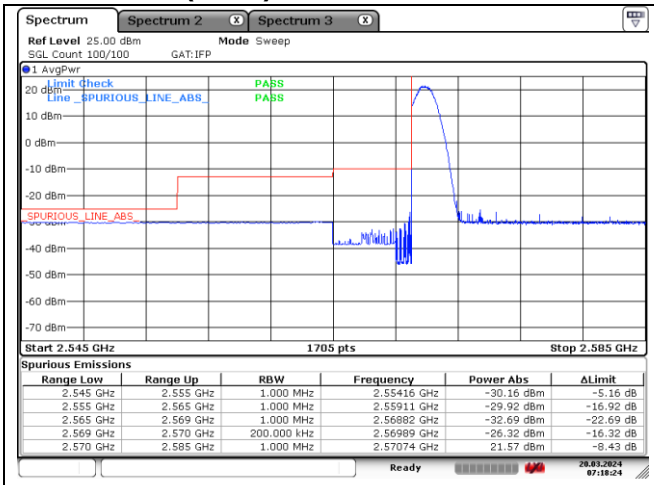


QPSK Low Channel - Full RB

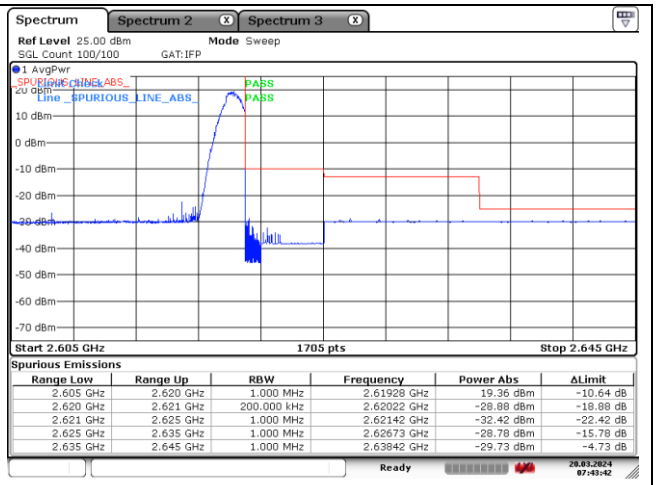


QPSK High Channel - Full RB

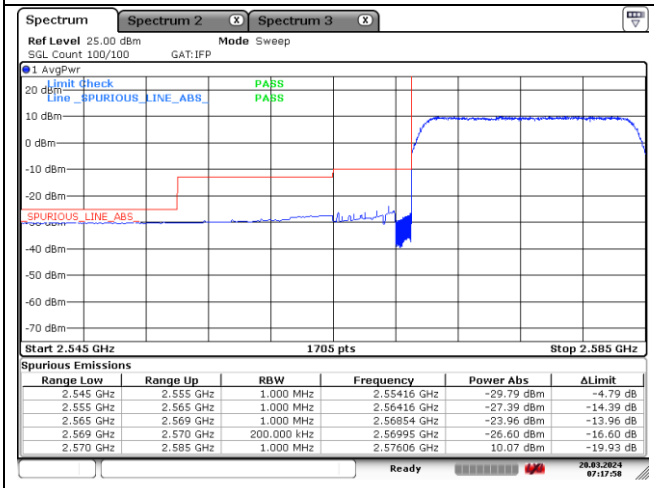
LTE band 38 (15 ㎒)



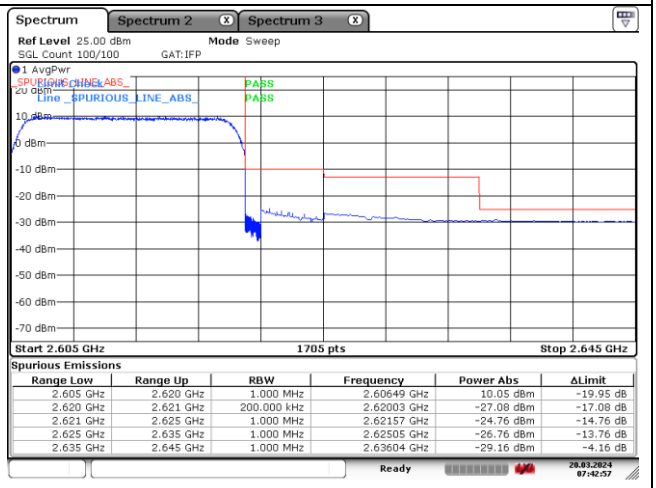
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

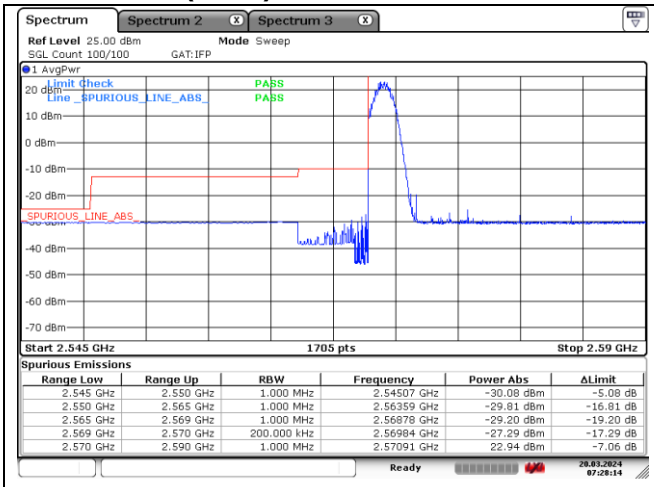


16QAM Low Channel - Full RB

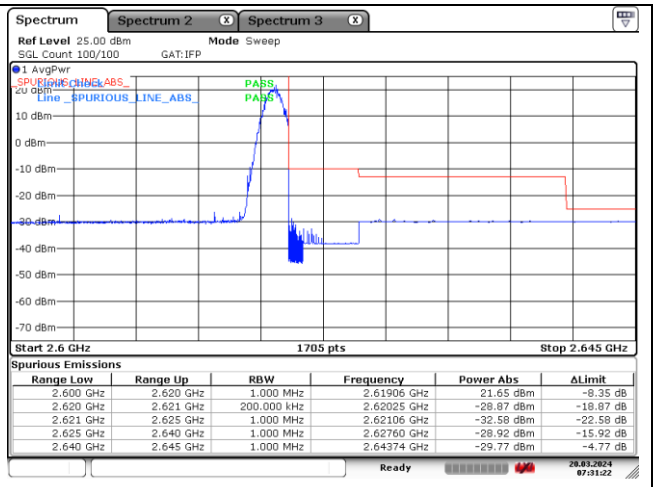


16QAM High Channel - Full RB

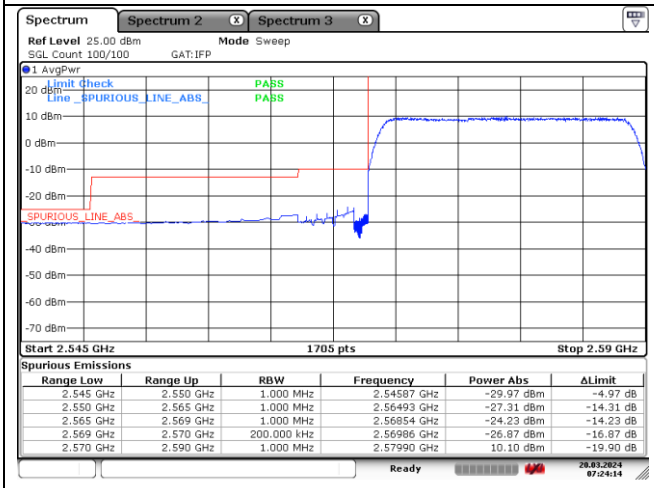
LTE band 38 (20 ㎒)



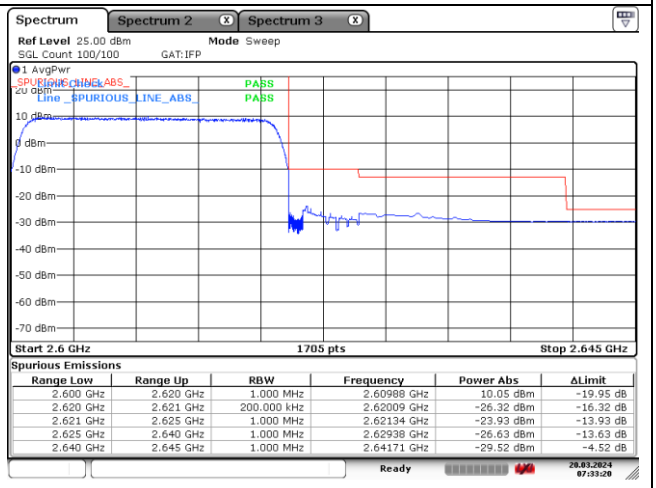
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

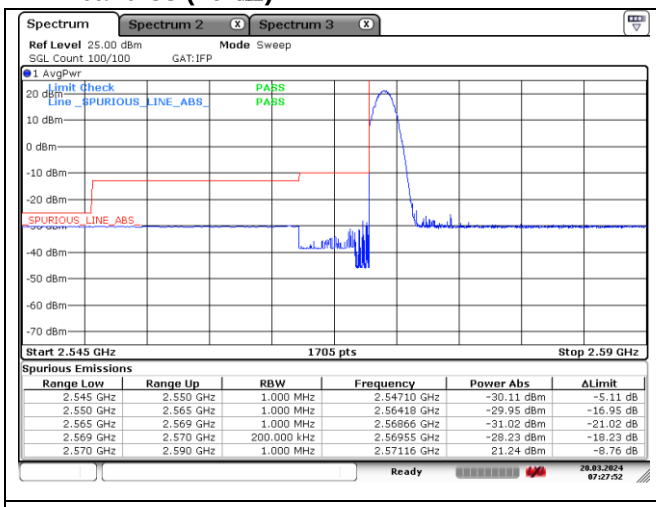


QPSK Low Channel - Full RB

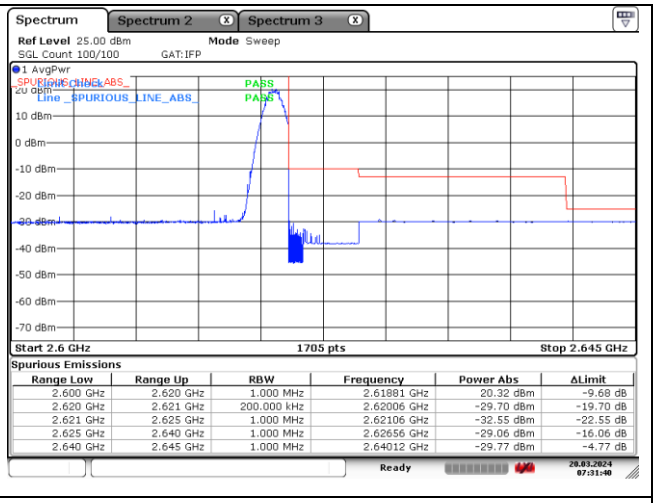


QPSK High Channel - Full RB

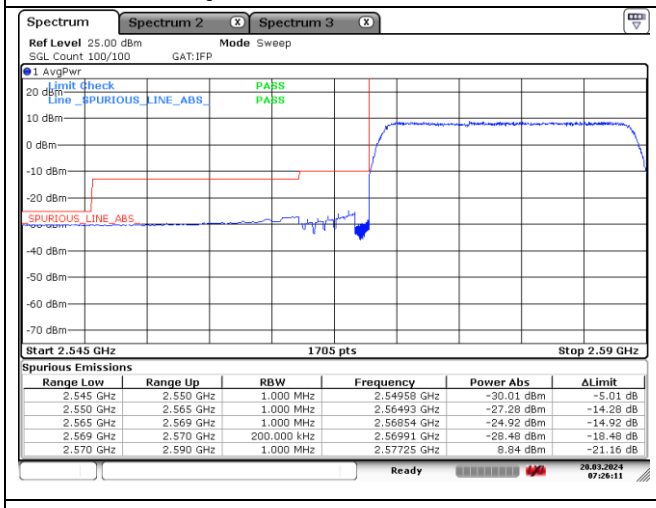
LTE band 38 (20 ㎒)



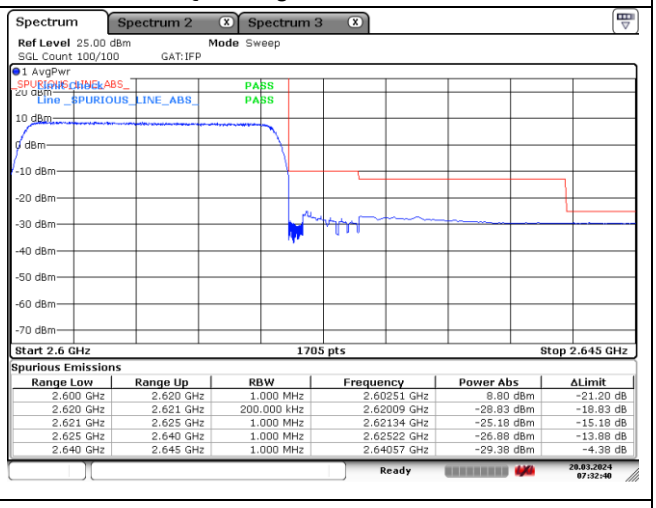
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

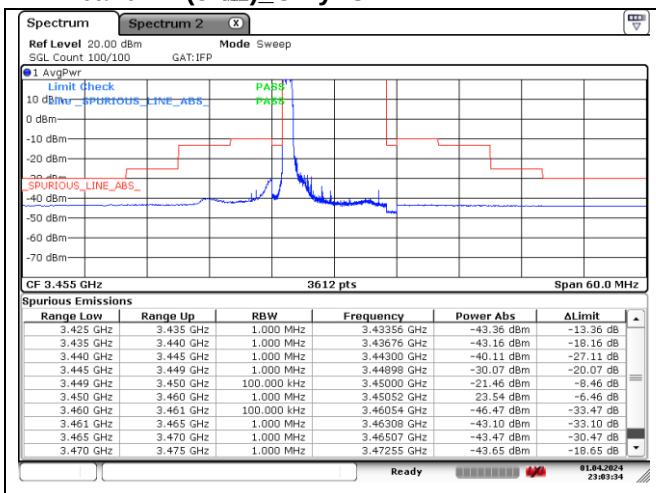


16QAM Low Channel - Full RB

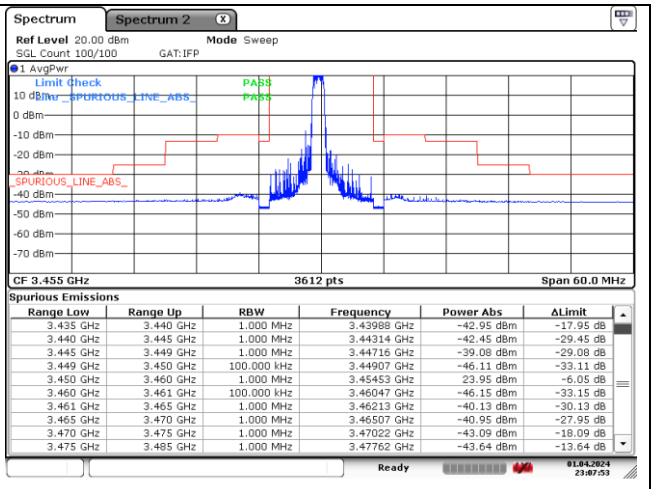


16QAM High Channel - Full RB

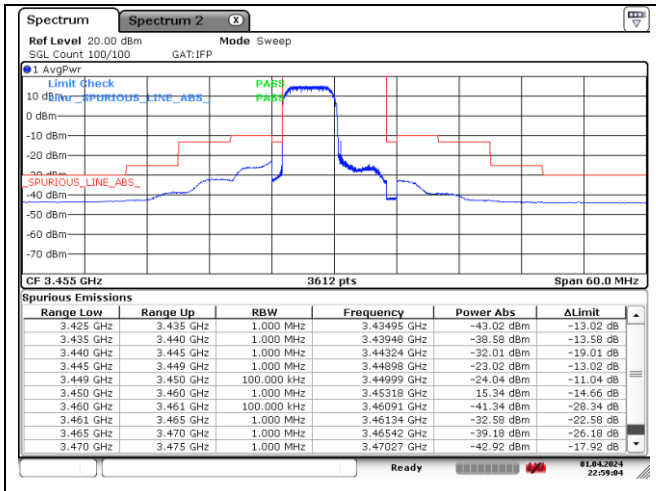
LTE band 42 (5 ㎒)_Only IC



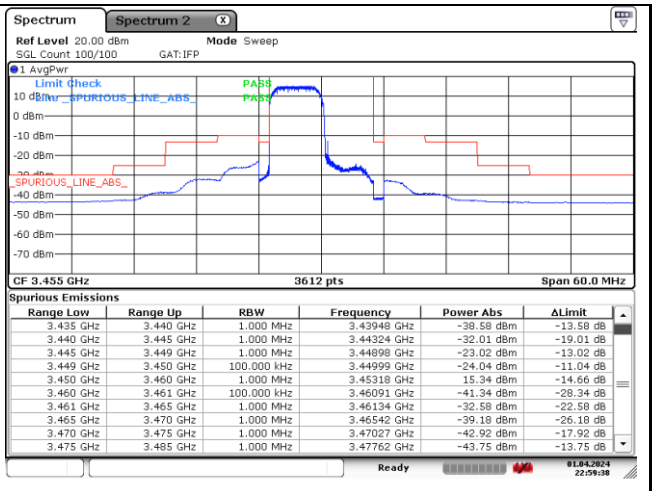
QPSK Low Channel - 1 RB



QPSK Low Channel - 1 RB



QPSK - Low Channel - Full RB



QPSK - Low Channel - Full RB