3.5 In-Band Emission

3.5.1 Regulation

Part. 15.407(b)

For transmitters operating within the 5.925–7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

3.5.2 Test Procedure

1. Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:

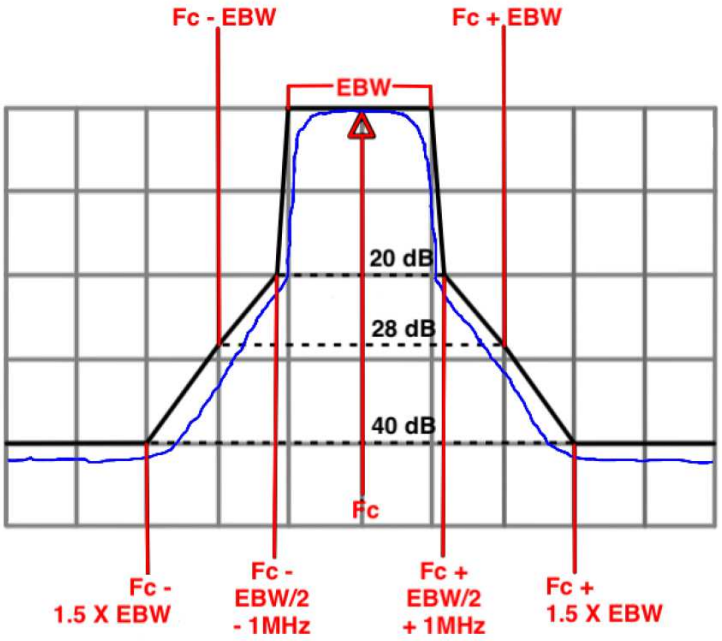
a. Set the span to encompass the entire 26 dB EBW of the signal.
b. Set RBW = same RBW used for 26 dB EBW measurement.
c. Set VBW ≥ 3 X RBW
d. Number of points in sweep ≥ [2 X span / RBW].
e. Sweep time = auto.
f. Detector = RMS (i.e., power averaging)
g. Trace average at least 100 traces in power averaging (rms) mode.
h. Use the peak search function on the instrument to find the peak of the spectrum.

2. For the purposes of developing the emission mask, the channel bandwidth is defined as the 26 dB EBW.

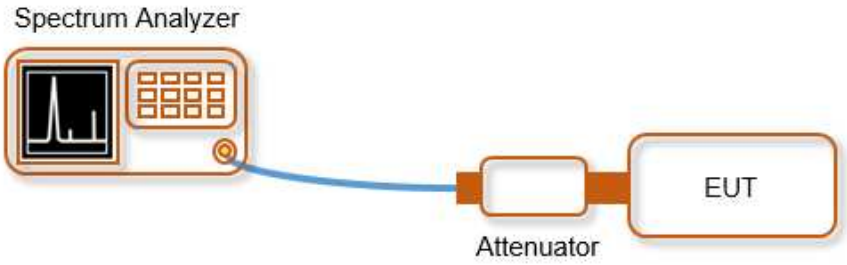
3. Clear trace.

4. Trace average at least 100 traces in power averaging (rms) mode.

5.. Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

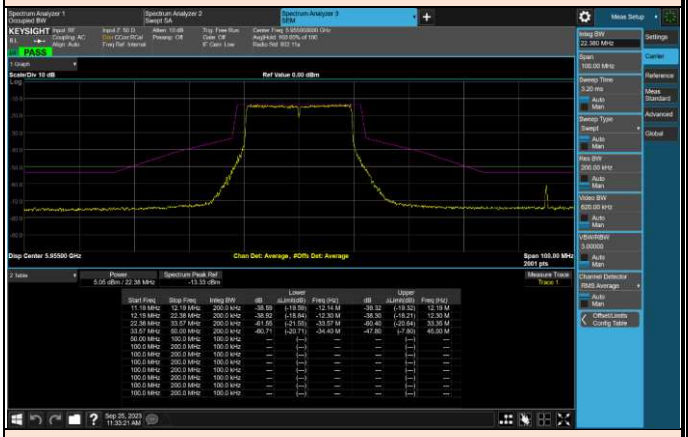
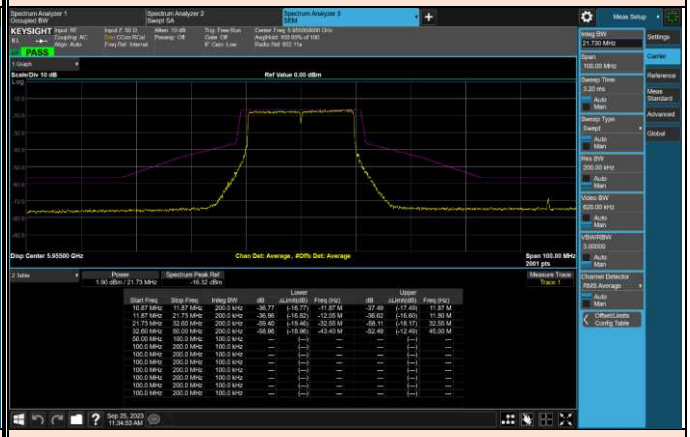
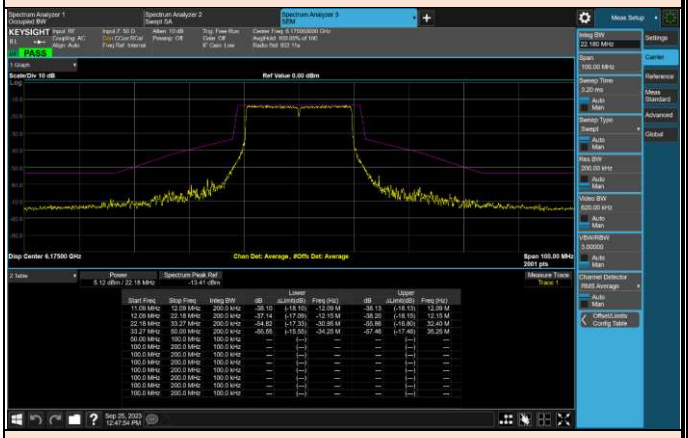
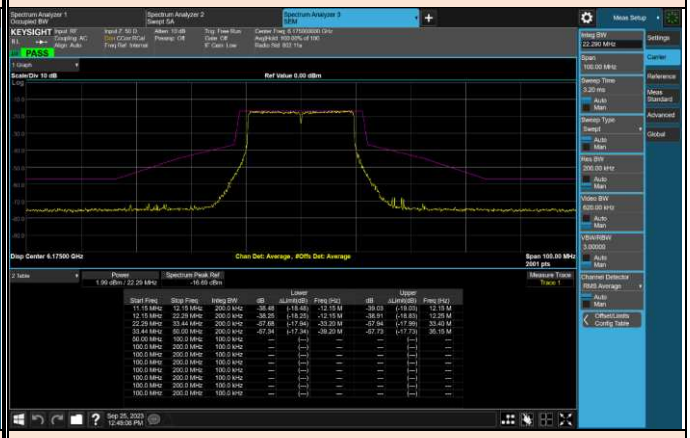
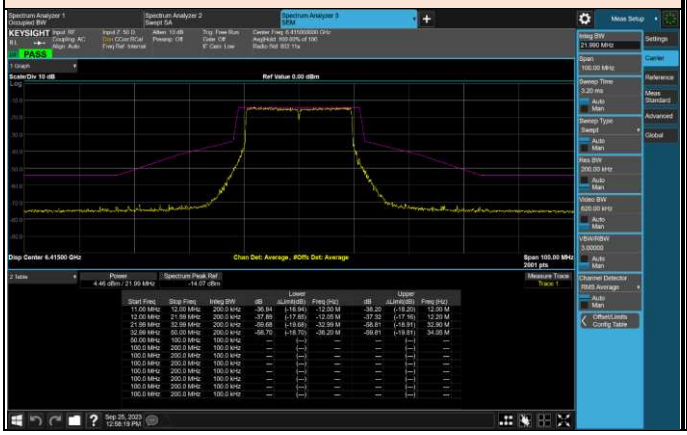
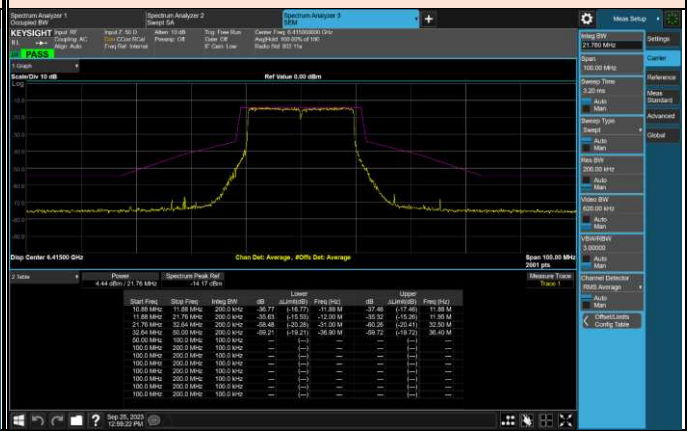


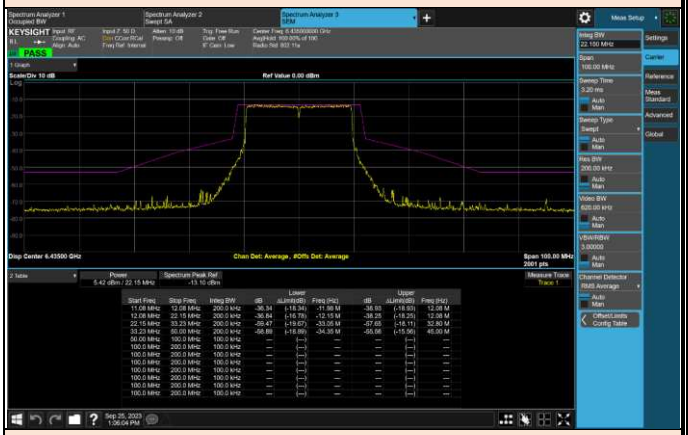
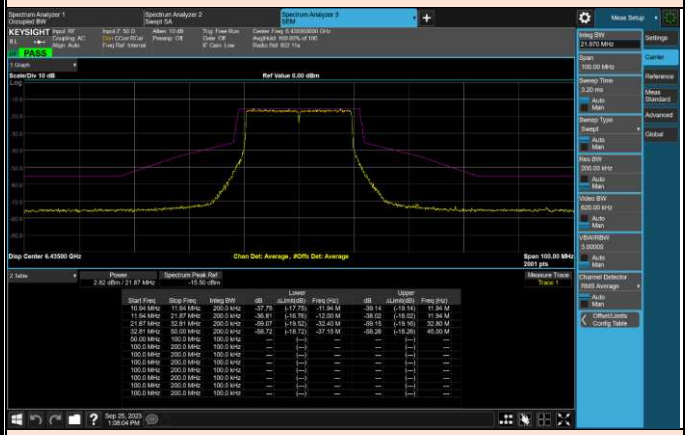
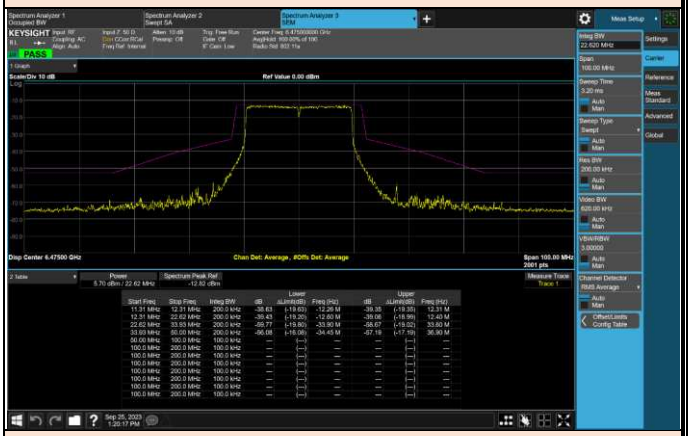
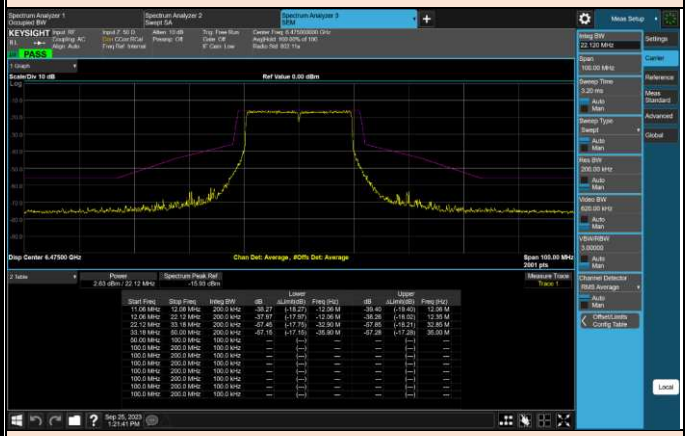
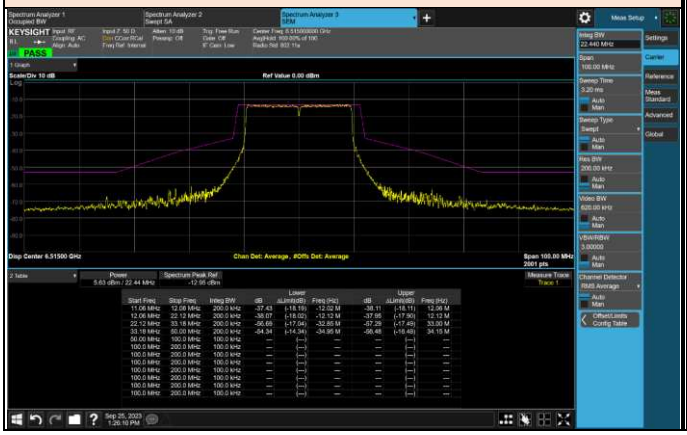
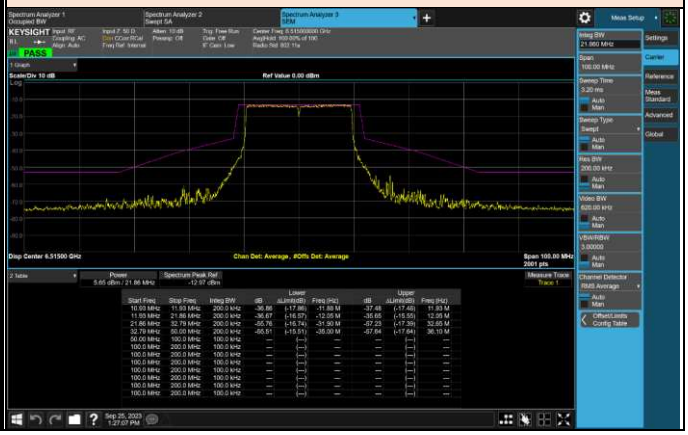
3.5.3 Test Setup

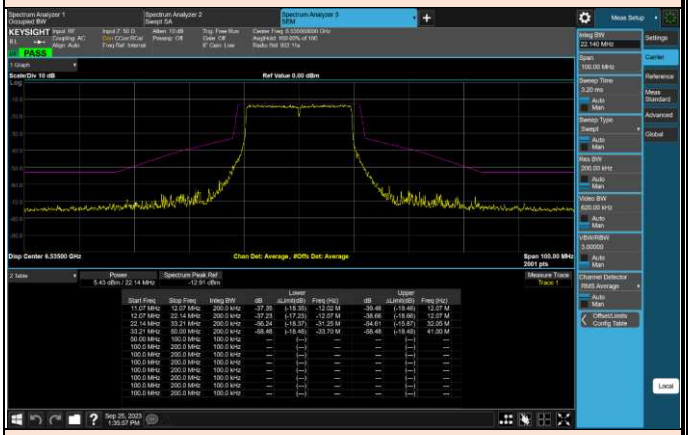
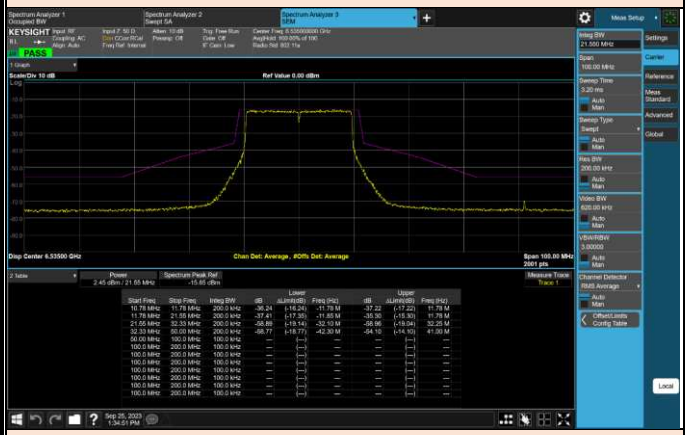
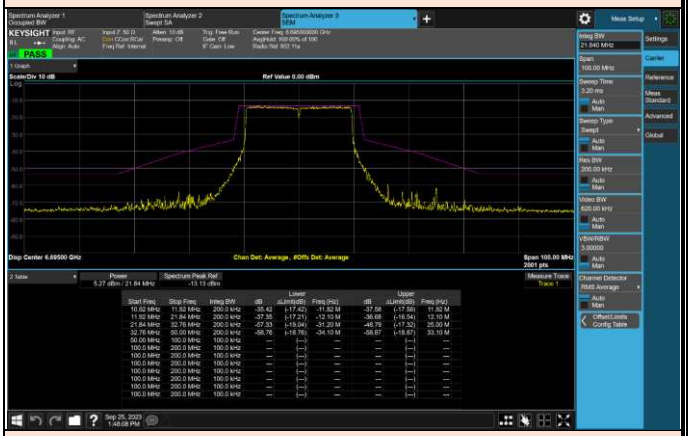
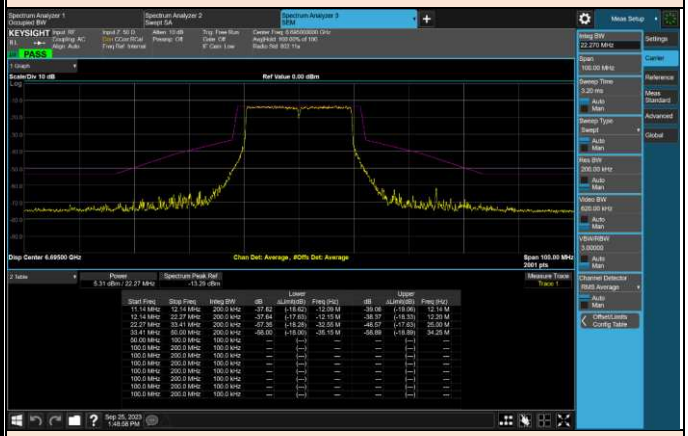
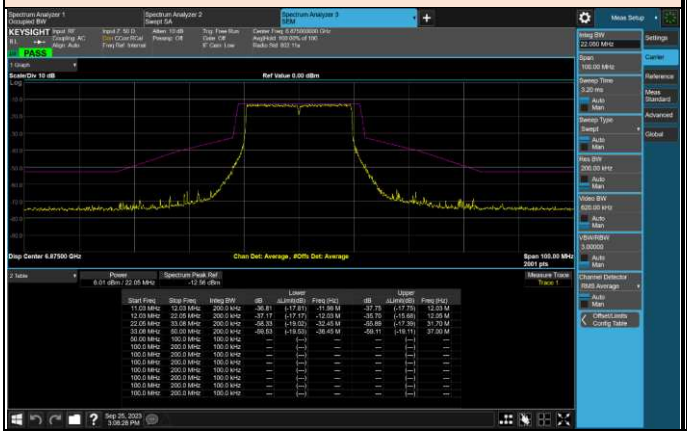
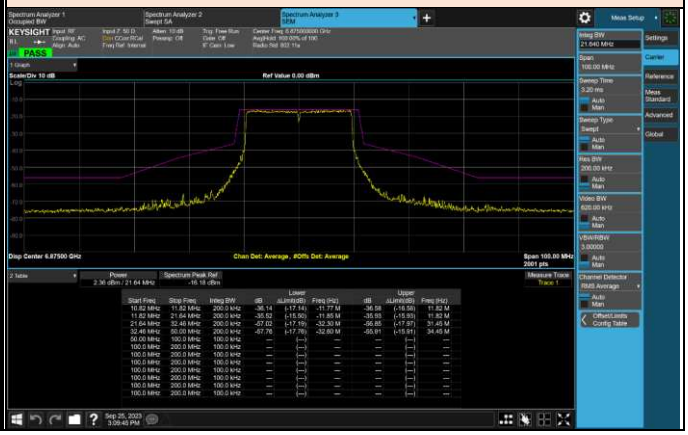


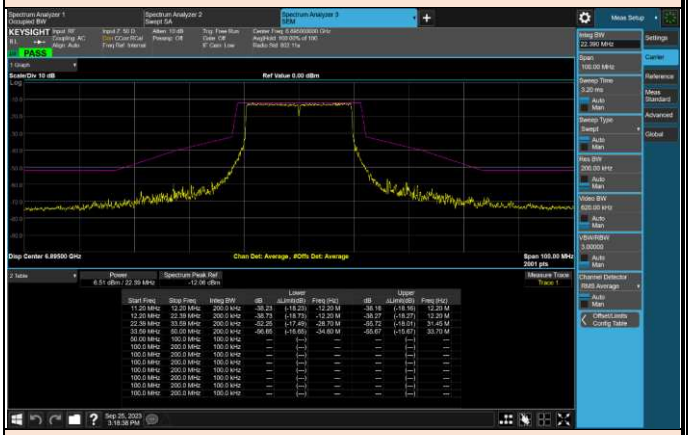
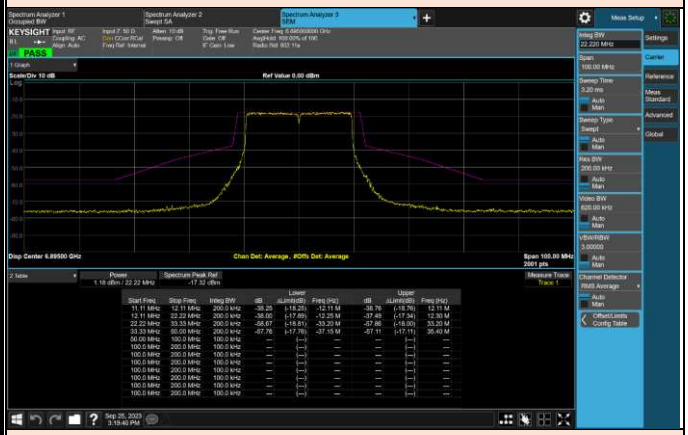
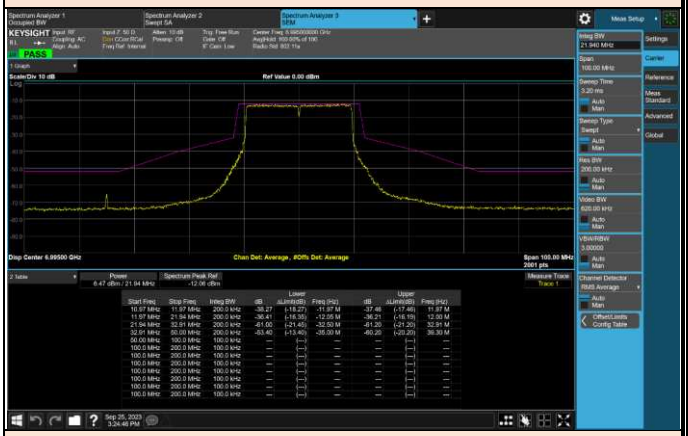
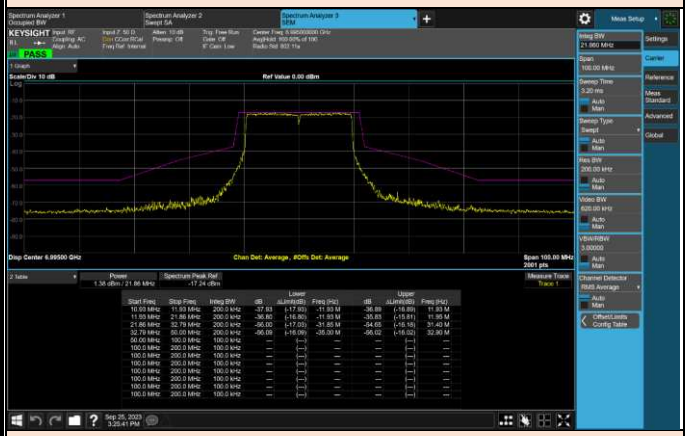
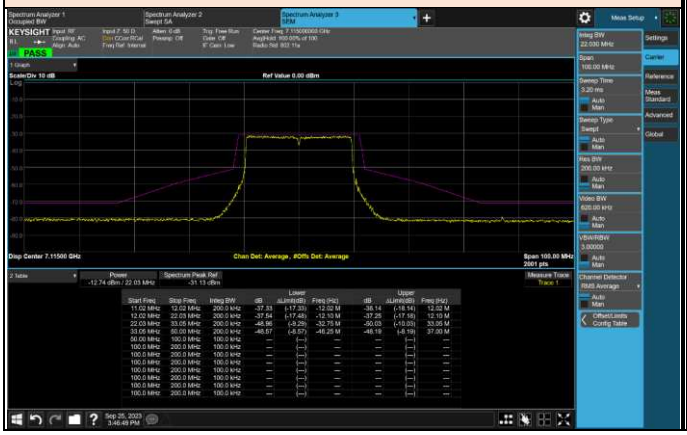
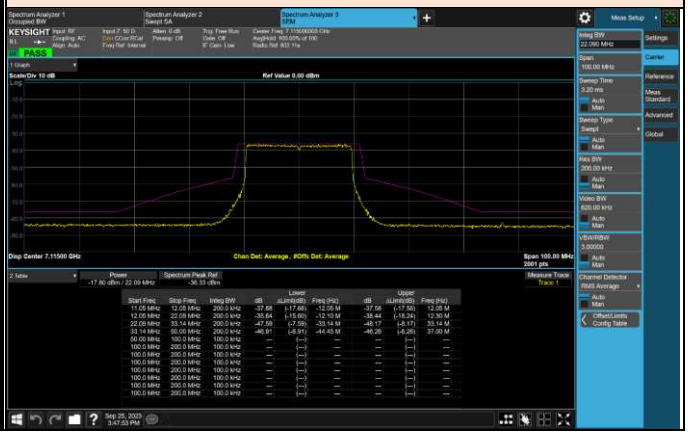
3.5.4 Test Result

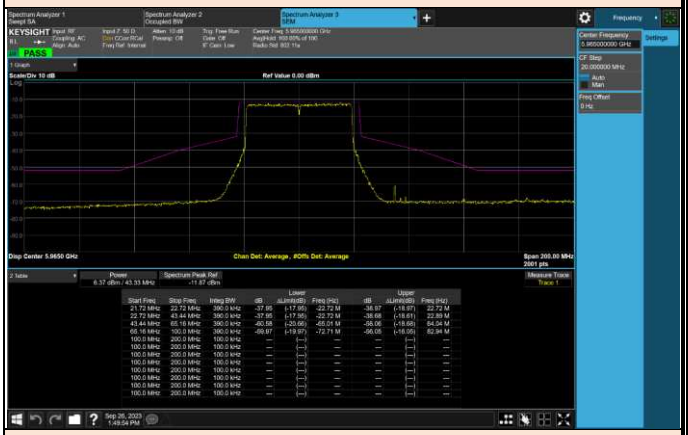
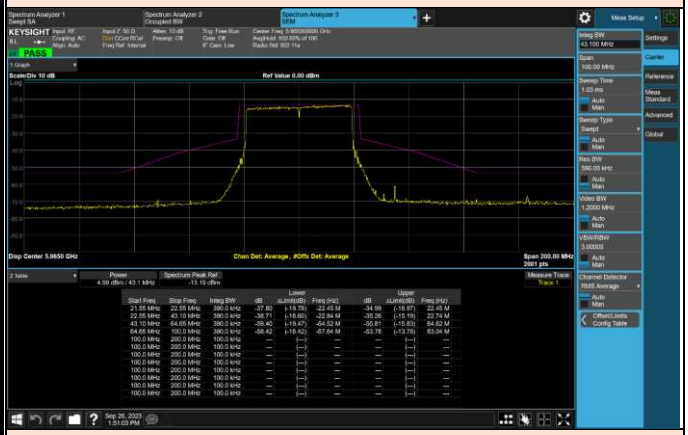
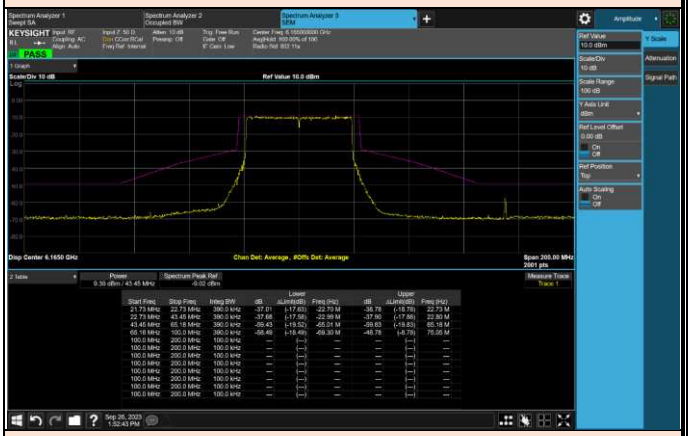
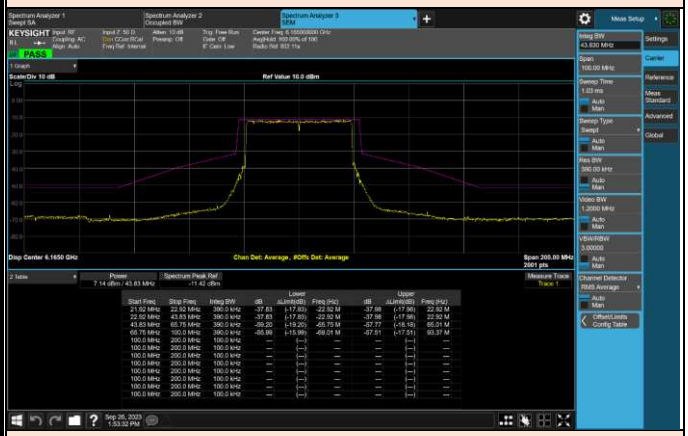
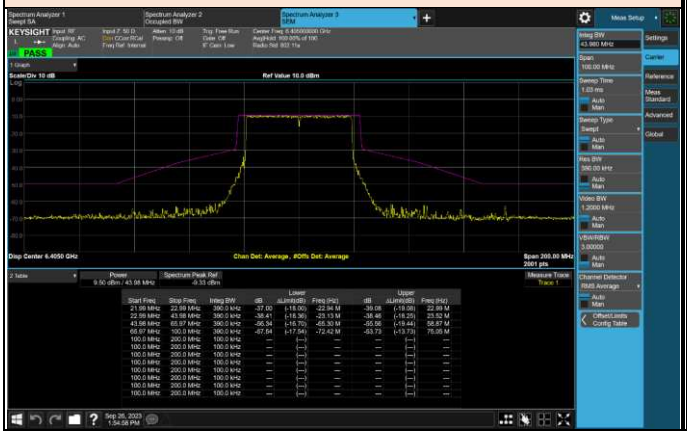
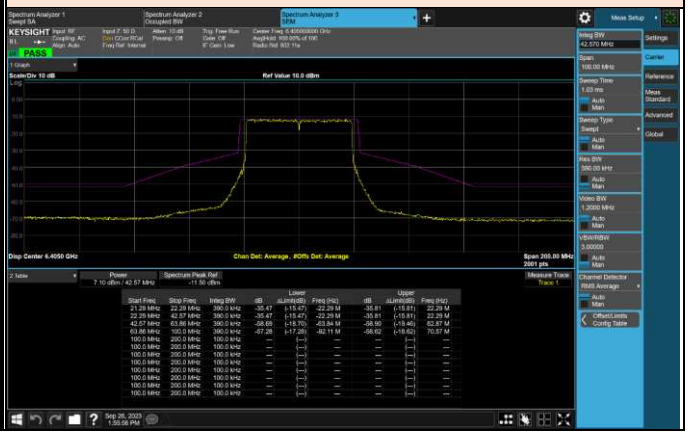
[Test Plot of In-band Emissions]

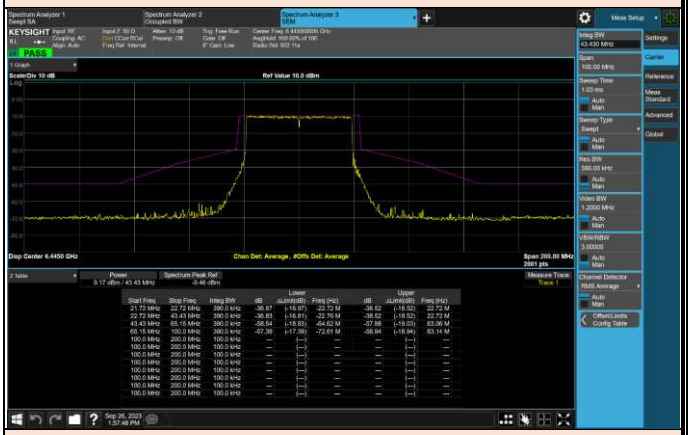
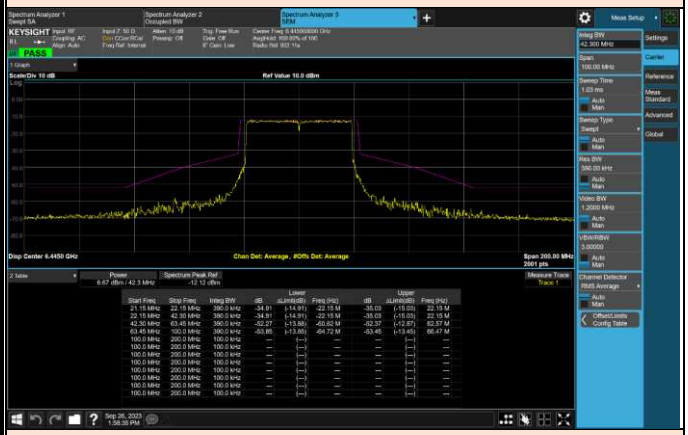
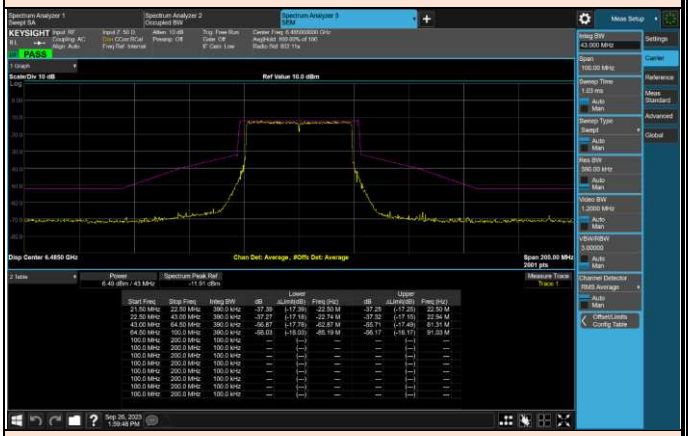
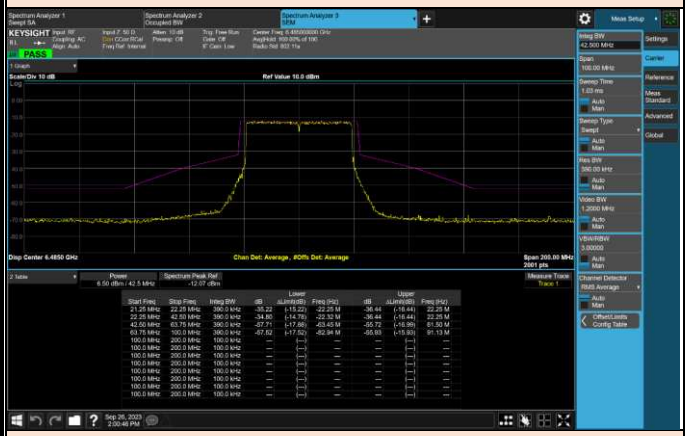
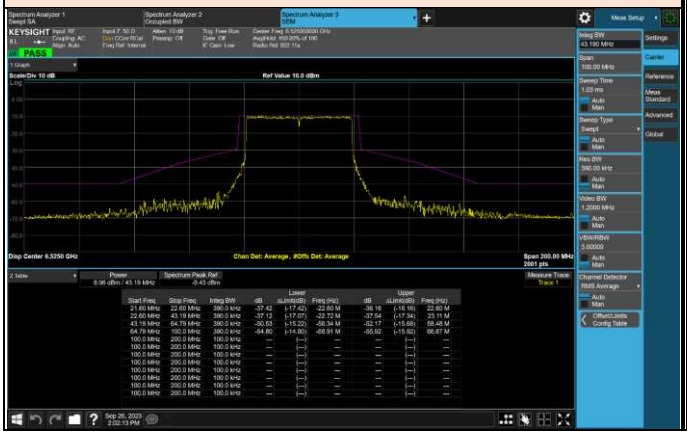
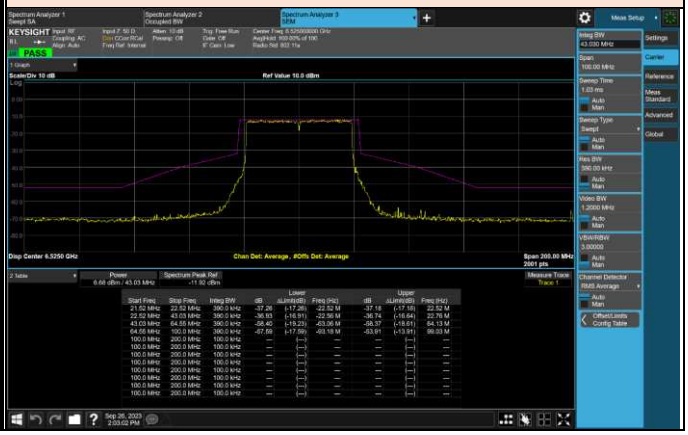
TM 1 _ NII 5	
ANT 1	**ANT 2**
5 955 MHz	**5 955 MHz**
	
6 175 MHz	**6 175 MHz**
	
6 415 MHz	**6 415 MHz**
	

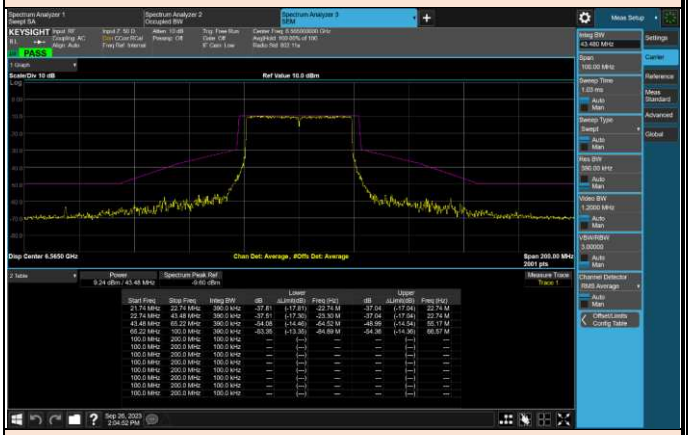
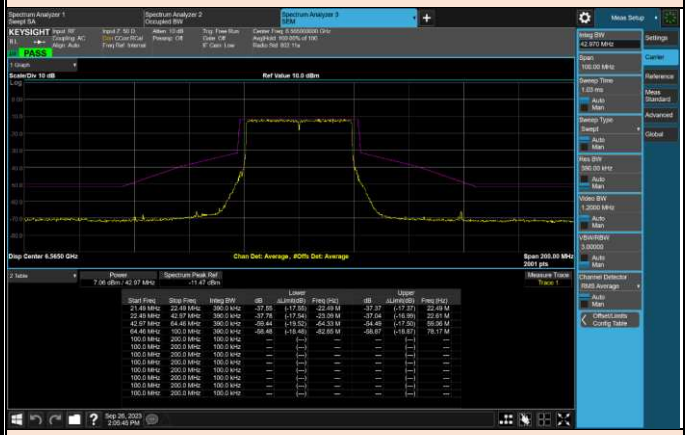
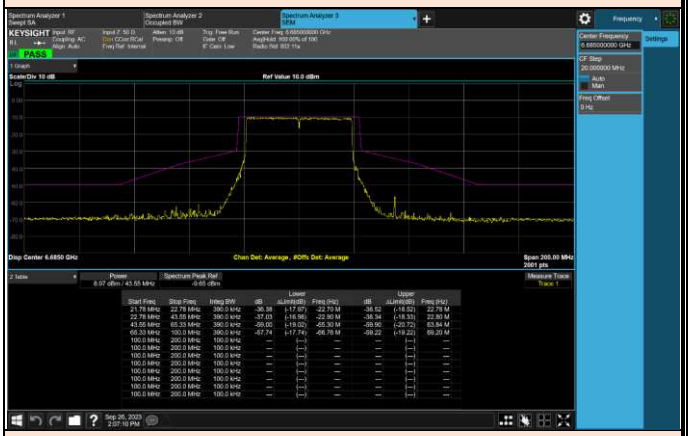
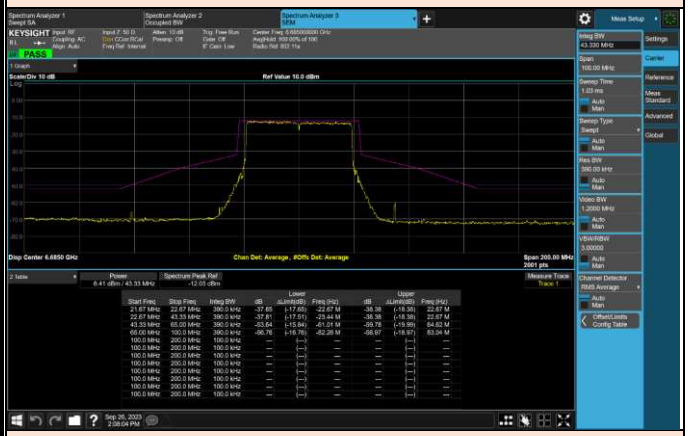
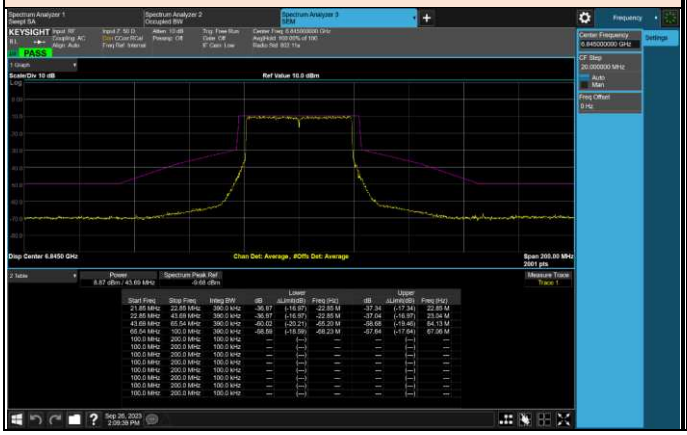
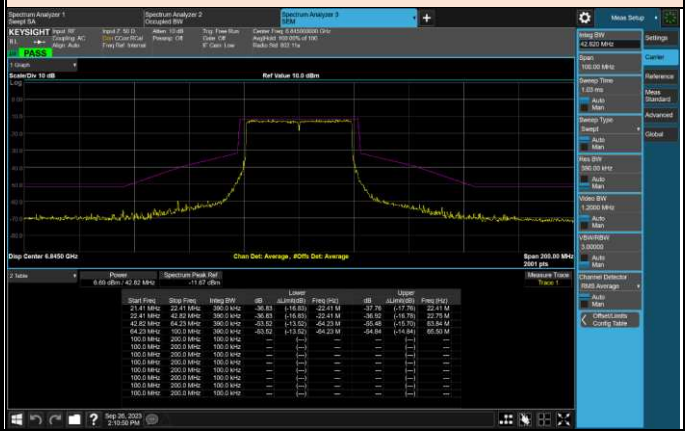
TM 1 _ NII 6	
ANT 1	**ANT 2**
6 435 MHz	**6 435 MHz**
	
6 475 MHz	**6 475 MHz**
	
6 515 MHz	**6 515 MHz**
	

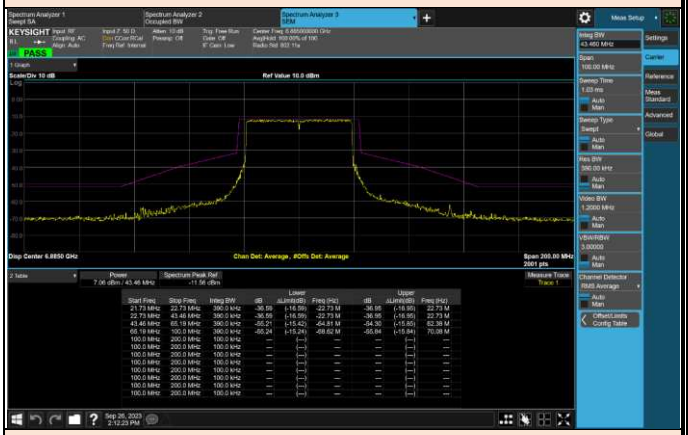
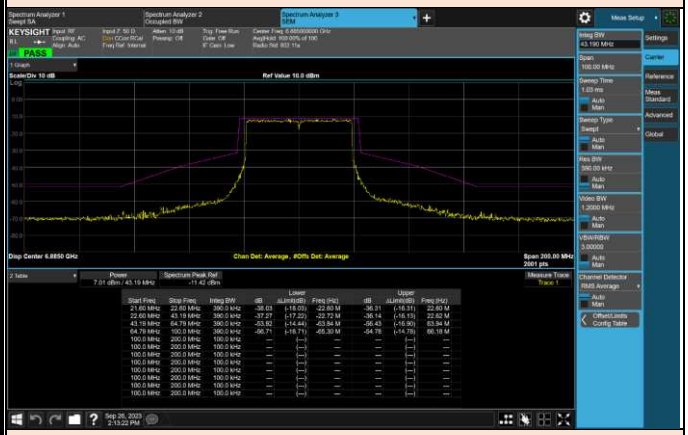
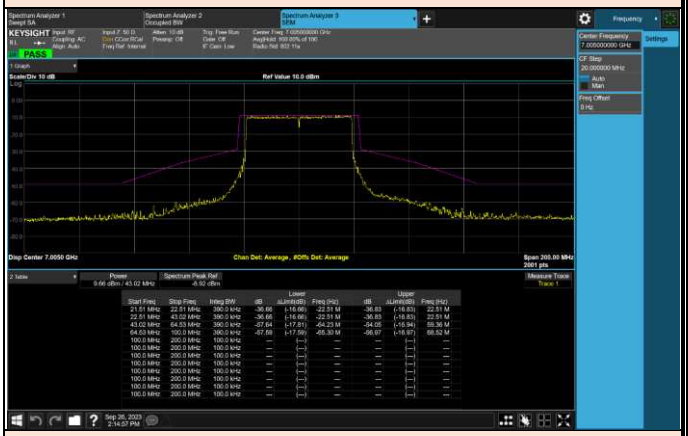
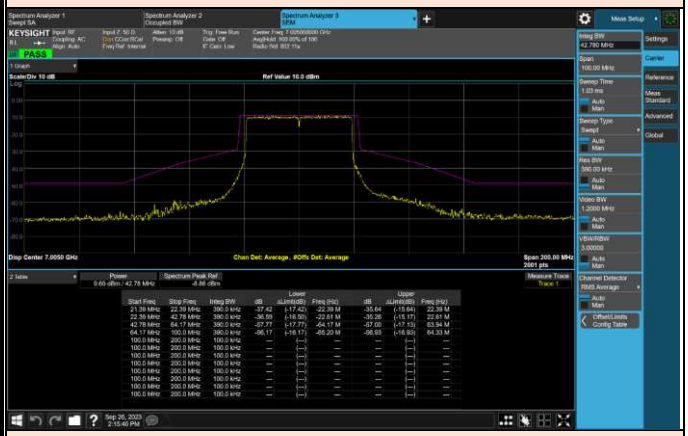
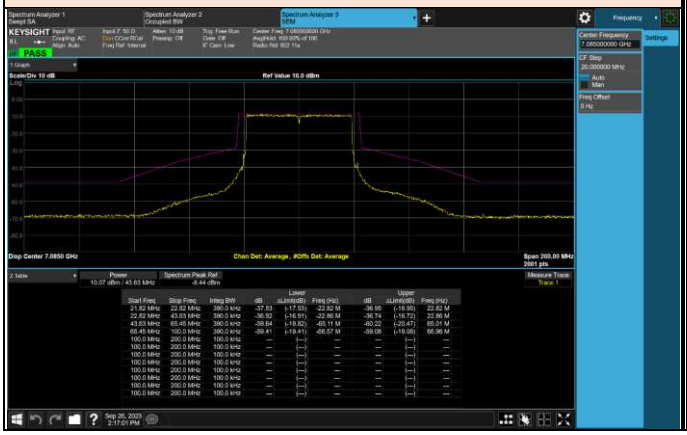
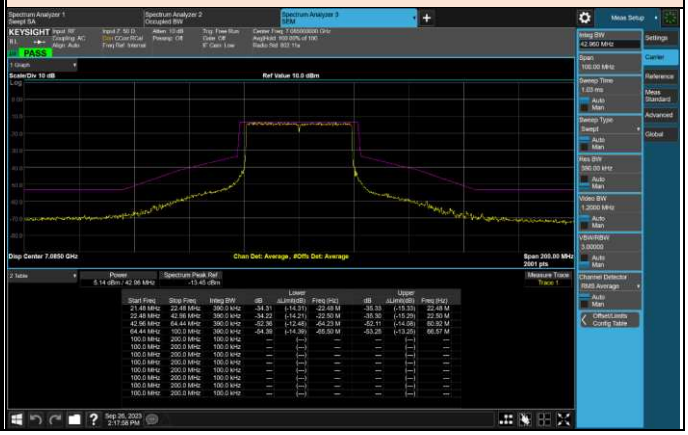
TM 1 _ NII 7	
ANT 1	**ANT 2**
6 535 MHz	**6 535 MHz**
	
6 695 MHz	**6 695 MHz**
	
6 875 MHz	**6 875 MHz**
	

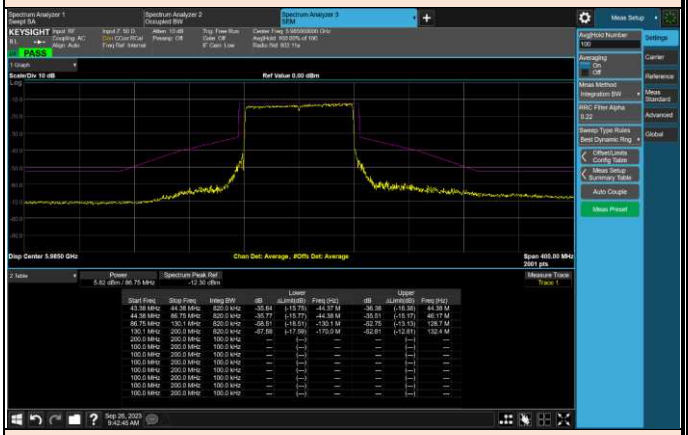
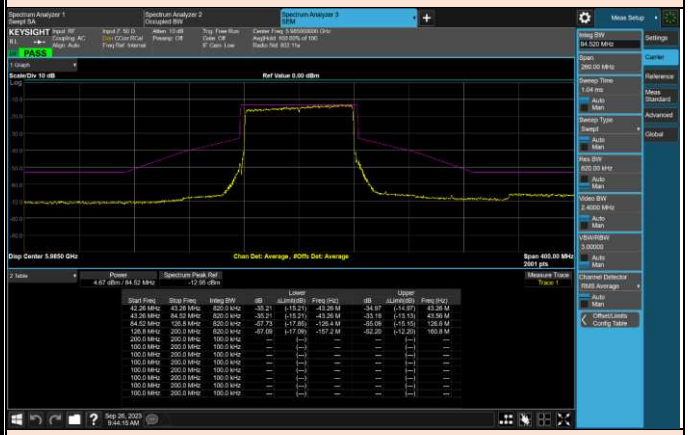
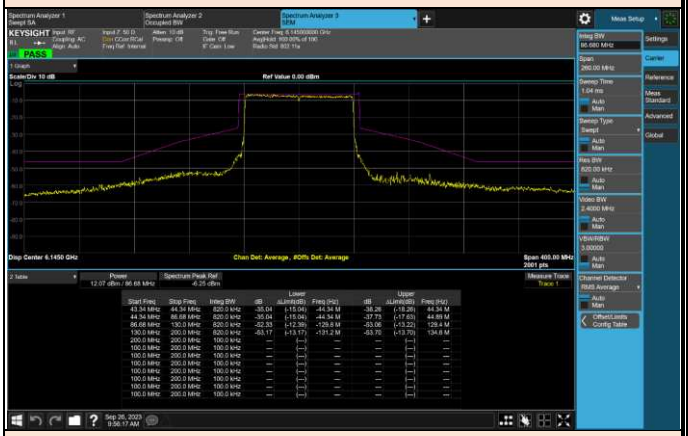
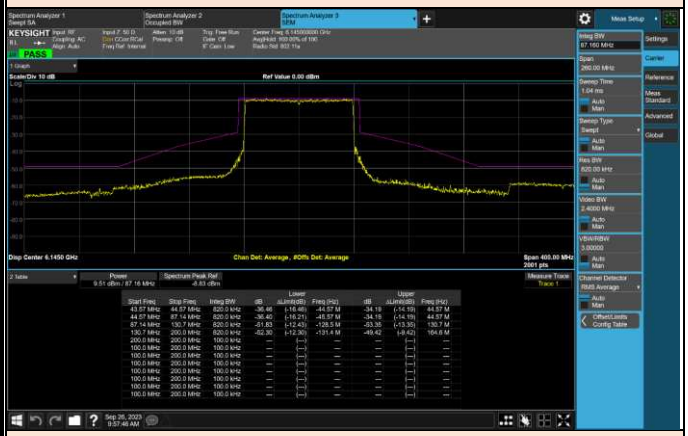
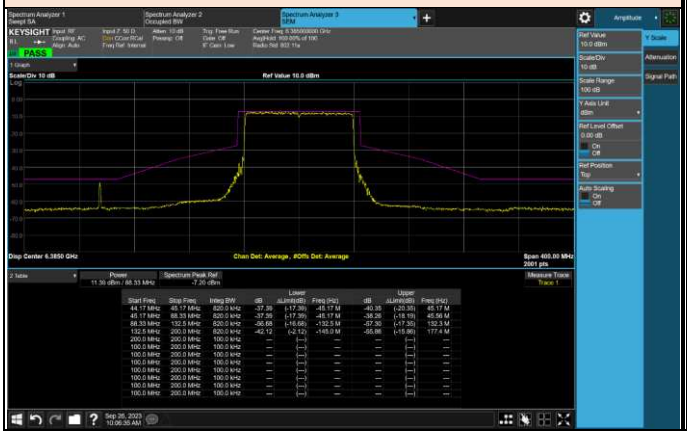
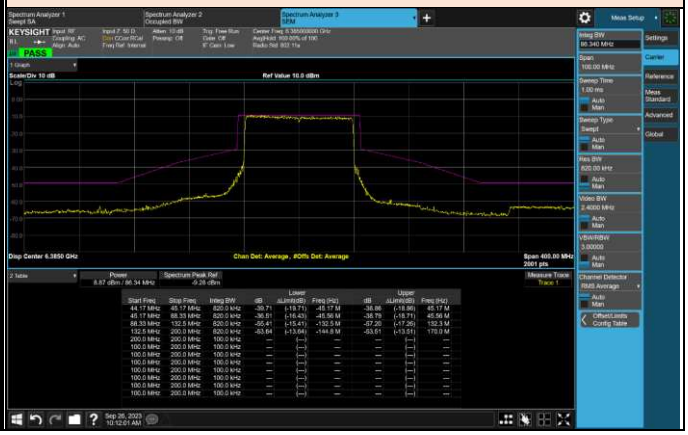
TM 1 _ NII 8	
ANT 1	**ANT 2**
6 895 MHz	**6 895 MHz**
	
6 995 MHz	**6 995 MHz**
	
7 115 MHz	**7 115 MHz**
	

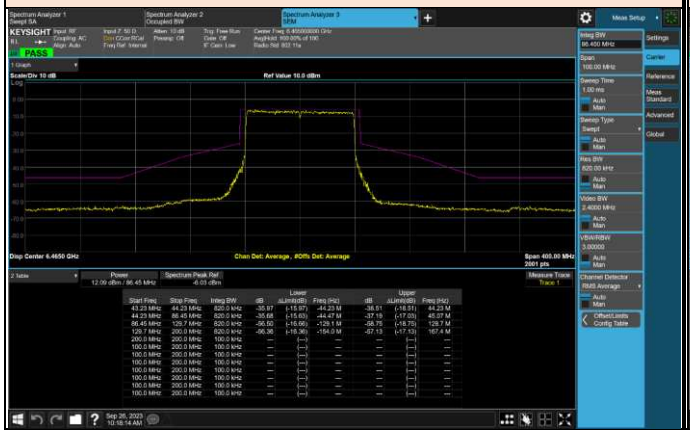
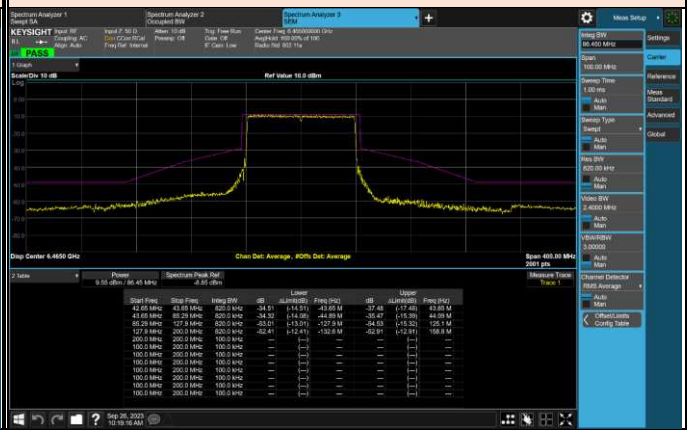
TM 2 _ NII 5	
ANT 1	**ANT 2**
5 965 MHz	**5 965 MHz**
	
6 165 MHz	**6 165 MHz**
	
6 405 MHz	**6 405 MHz**
	

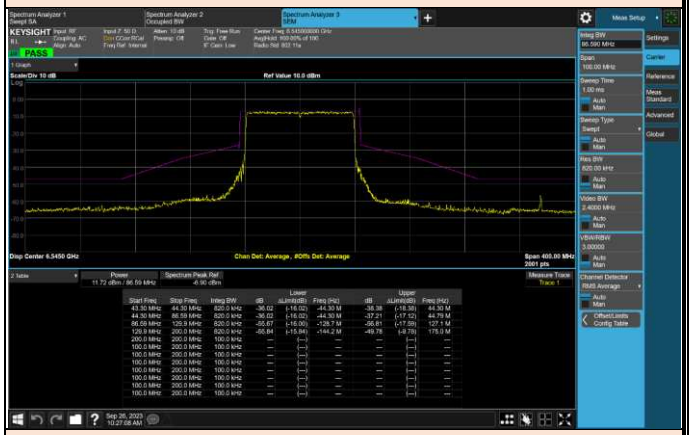
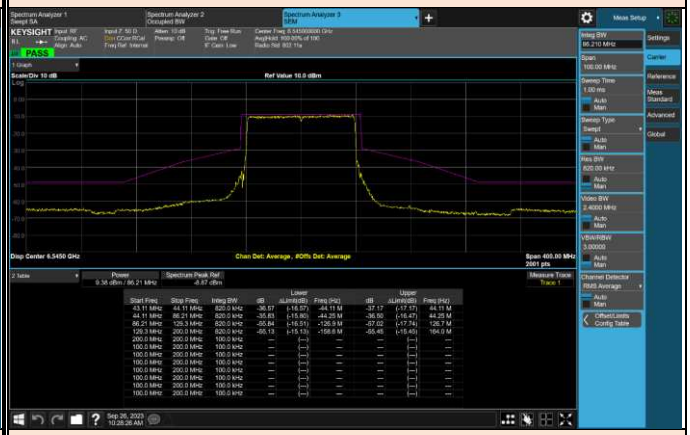
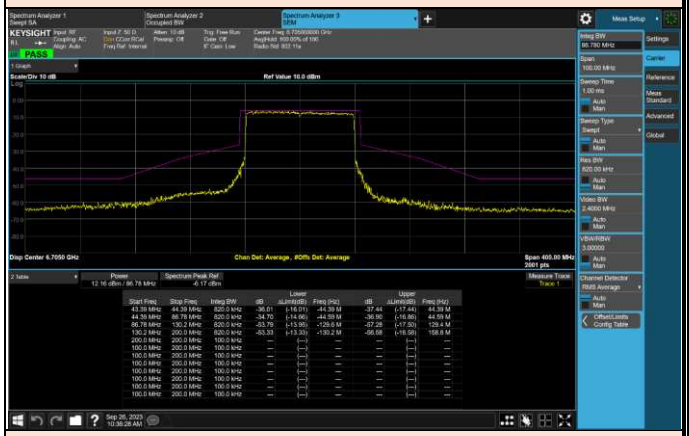
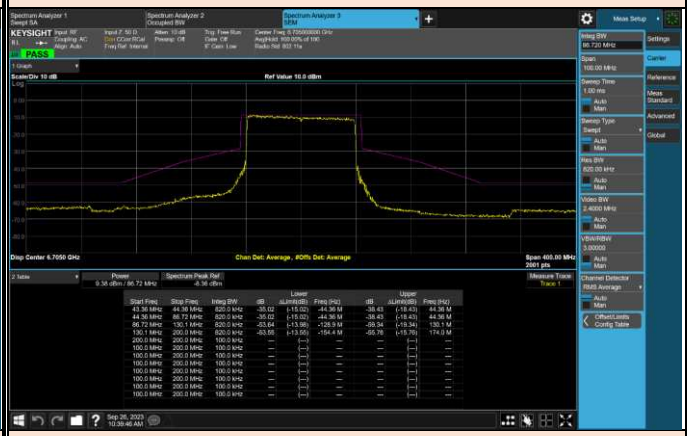
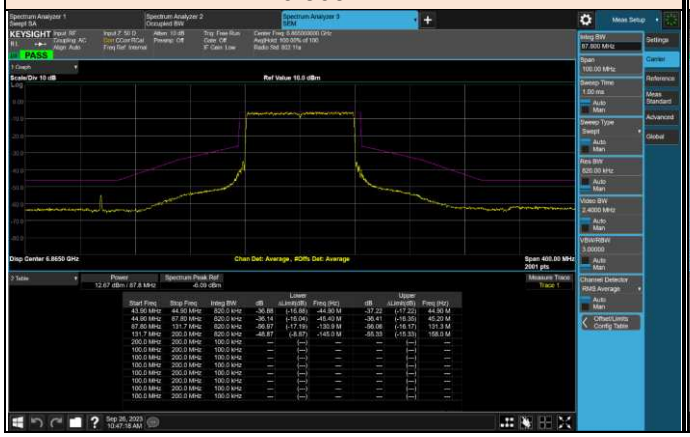
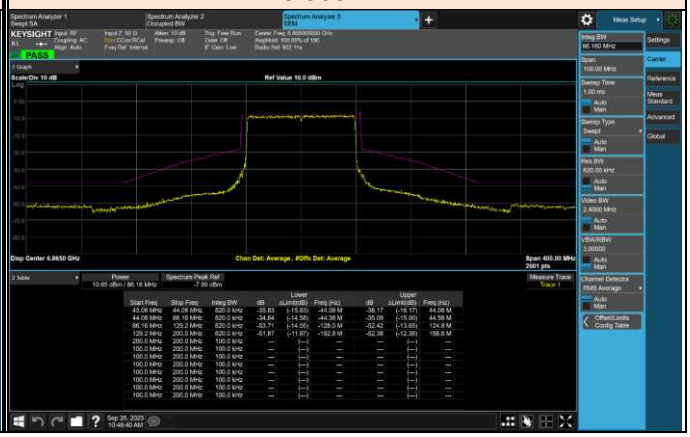
TM 2 _ NII 6	
ANT 1	**ANT 2**
6 445 MHz	**6 445 MHz**
	
6 485 MHz	**6 485 MHz**
	
6 525 MHz	**6 525 MHz**
	

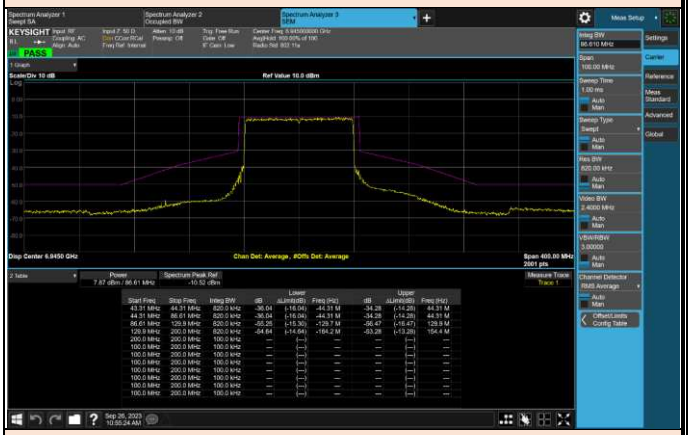
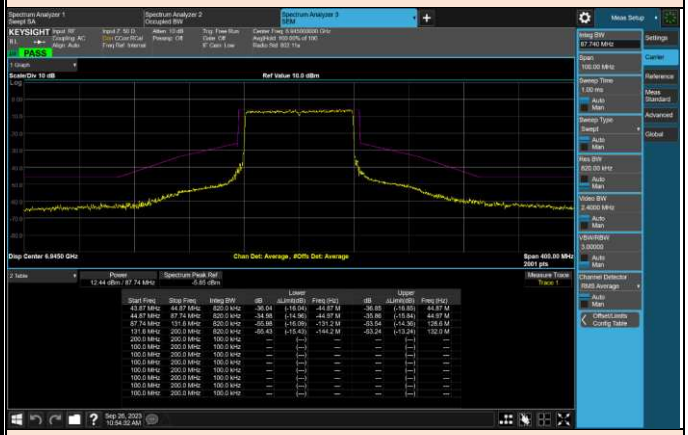
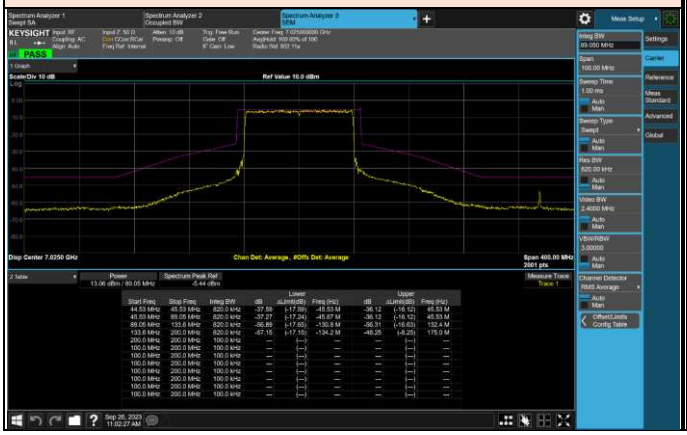
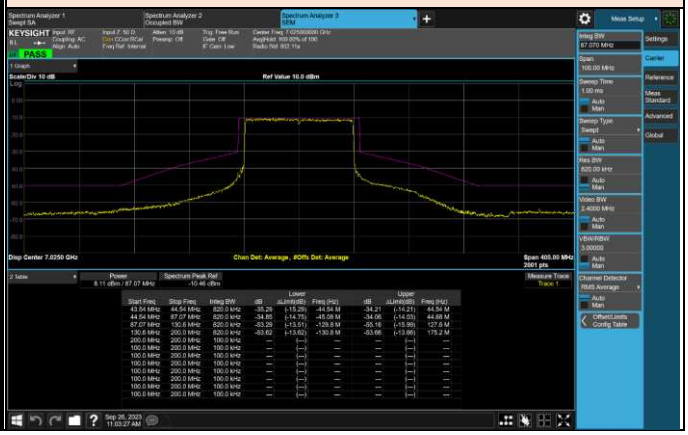
TM 2 _ NII 7	
ANT 1	**ANT 2**
6 565 MHz	**6 565 MHz**
	
6 685 MHz	**6 685 MHz**
	
6 845 MHz	**6 845 MHz**
	

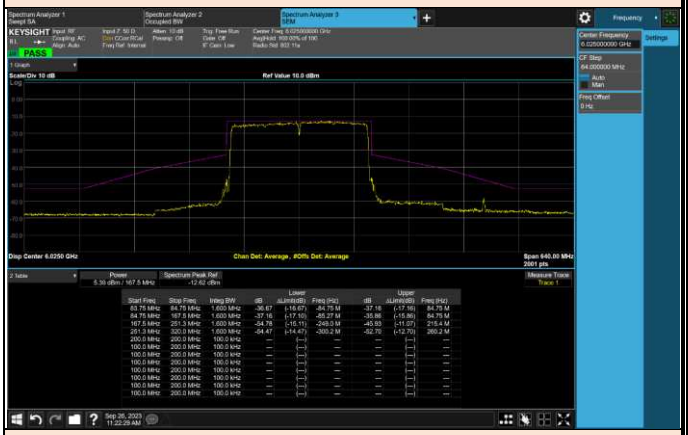
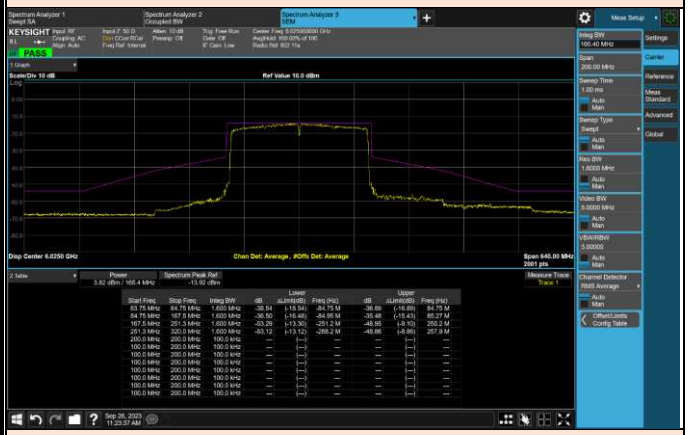
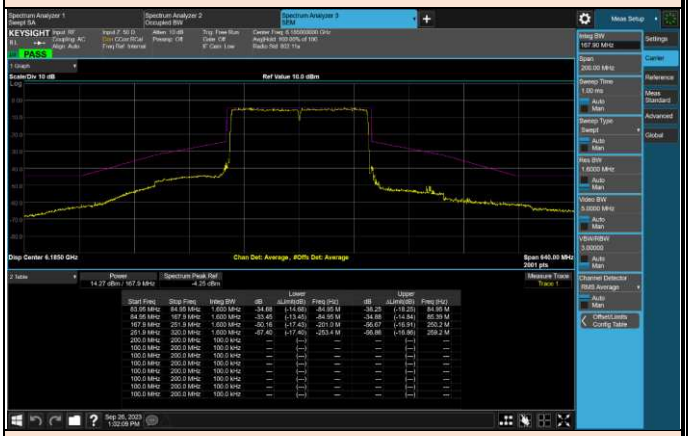
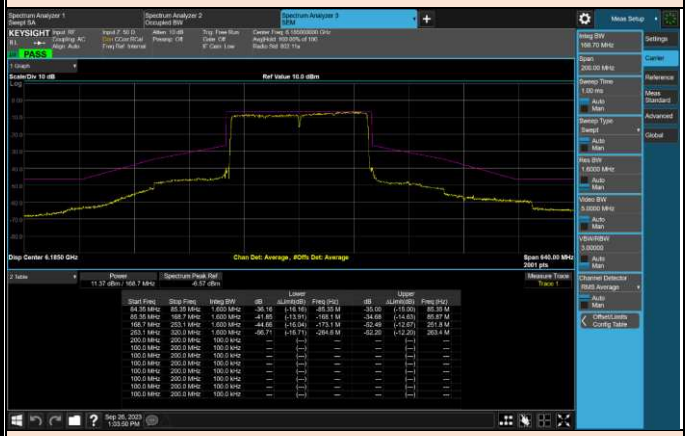
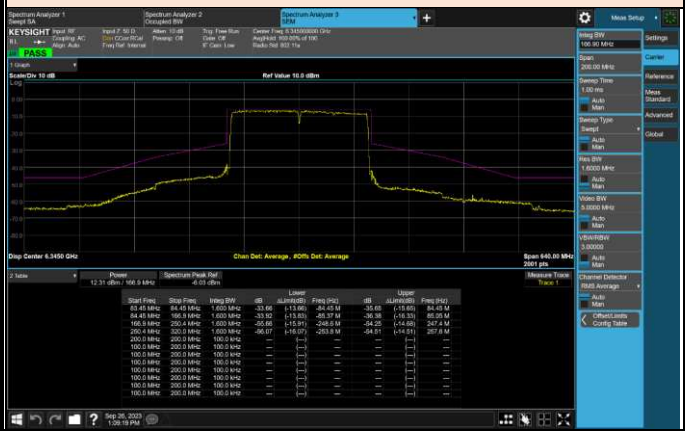
TM 2 _ NII 8	
ANT 1	**ANT 2**
6 885 MHz	**6 885 MHz**
	
7 005 MHz	**7 005 MHz**
	
7 085 MHz	**7 085 MHz**
	

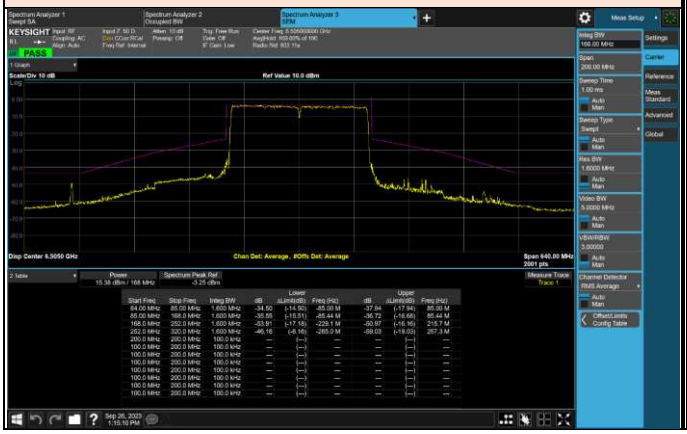
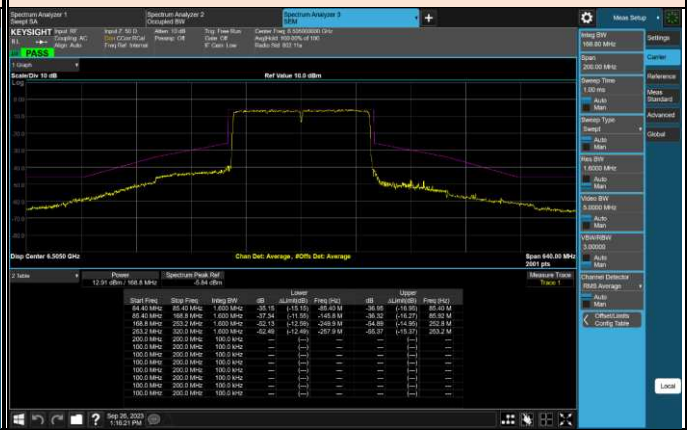
TM 3 _ NII 5	
ANT 1	**ANT 2**
5 985 MHz	**5 985 MHz**
	
6 145 MHz	**6 145 MHz**
	
6 385 MHz	**6 385 MHz**
	

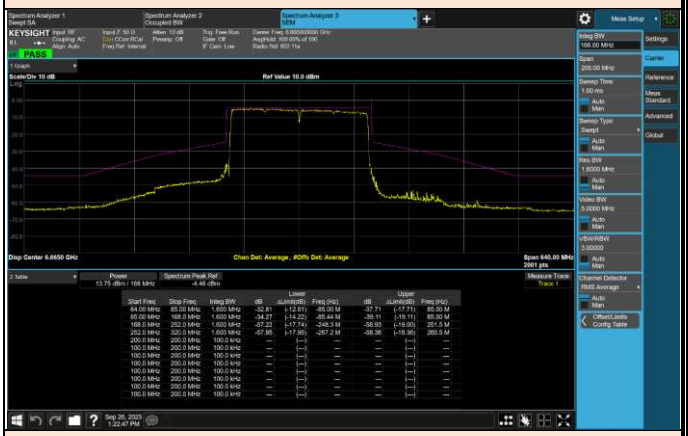
TM 3 _ NII 6	
ANT 1	**ANT 2**
6 465 MHz	**6 465 MHz**
	

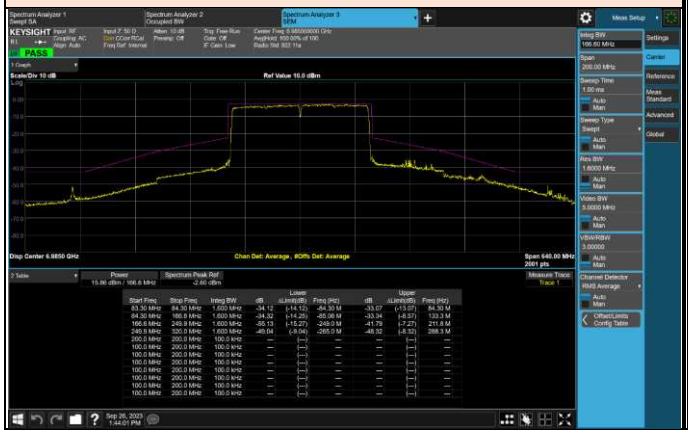
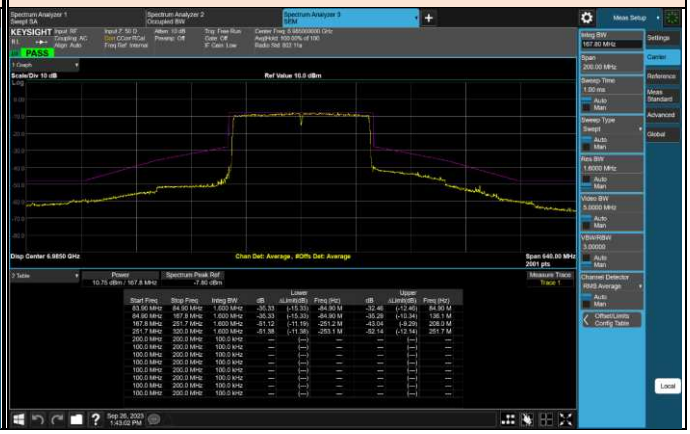
TM 3 _ NII 7	
ANT 1	**ANT 2**
6 545 MHz	**6 545 MHz**
	
6 705 MHz	**6 705 MHz**
	
6 865 MHz	**6 865 MHz**
	

TM 3 _ NII 8	
ANT 1	**ANT 2**
6 945 MHz	**6 945 MHz**
	
7 025 MHz	**7 025 MHz**
	

TM 4 _ NII 5	
ANT 1	**ANT 2**
6 025 MHz	**6 025 MHz**
	
6 185 MHz	**6 185 MHz**
	
6 345 MHz	**6 345 MHz**
	

TM 4 _ NII 6	
ANT 1	**ANT 2**
6 505 MHz	**6 505 MHz**
	

TM 4 _ NII 7	
ANT 1	**ANT 2**
6 665 MHz	**6 665 MHz**
	
6 825 MHz	**6 825 MHz**
	

TM 4 _ NII 8	
ANT 1	**ANT 2**
6 985 MHz	**6 985 MHz**
	

3.6 Duty Cycle

3.6.1 Test Procedure

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure of KDB789033 D02v02r01

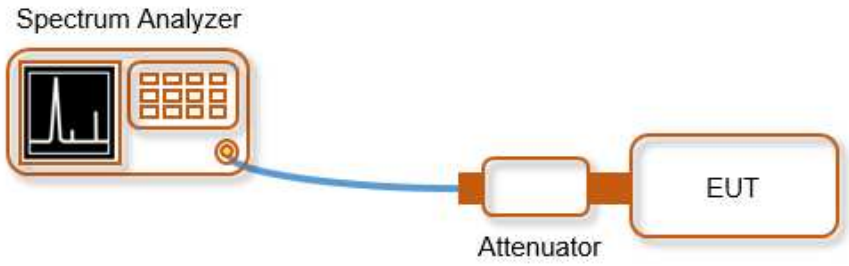
1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.

2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.

3. Set VBW ≥ RBW. Set detector = peak.

4. Note : The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T, where T is defined in section II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.) T : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
(T = On time of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

3.6.2 Test Setup



3.6.3 Test Result

Test Mode	On Time [ms]	Period [ms]	Duty Cycle [X]	Duty Cycle [D]	DCCF [dB]
TM 1	509.3	509.4	1.000	99.98	0.00
TM 2	513.6	513.7	1.000	99.98	0.00
TM 3	513.6	513.8	1.000	99.96	0.00
TM 4	512.1	512.2	1.000	99.98	0.00

3.7 Contention Based Protocol

3.7.1 Regulation

Part. 15.407(d)

(6) Indoor access points, subordinate devices and client devices operating in the 5.925–7.125 GHz band must employ a contention-based protocol.

3.7.2 Test Procedure

Maximum Power Spectral Density is measured using Measurement Procedure of KDB987594 D02v02r01

1. Configure the EUT to transmit with a constant duty cycle.

2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.

3. Set the signal analyzer center frequency to the nominal EEUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT.

4. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.

5. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.

6. Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in Figure 2.

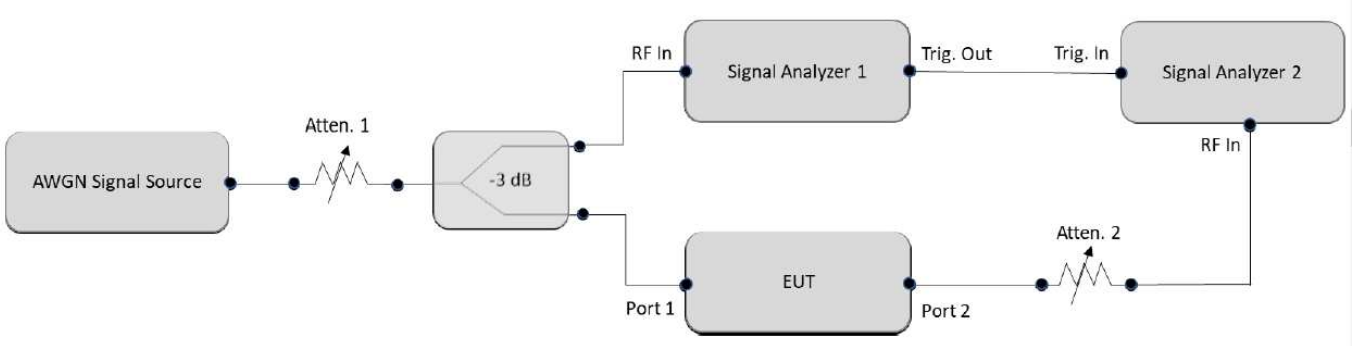
7. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.

8. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.

9. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.

10. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

3.7.3 Test Setup



3.7.4 Test Result

Limit

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Additionally, low-power indoor devices must detect co-channel energy with 90% or greater certainty.

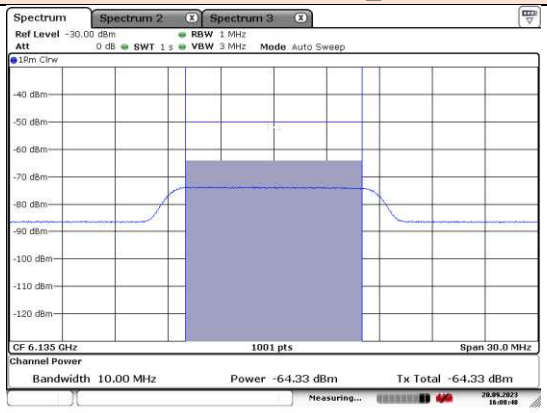
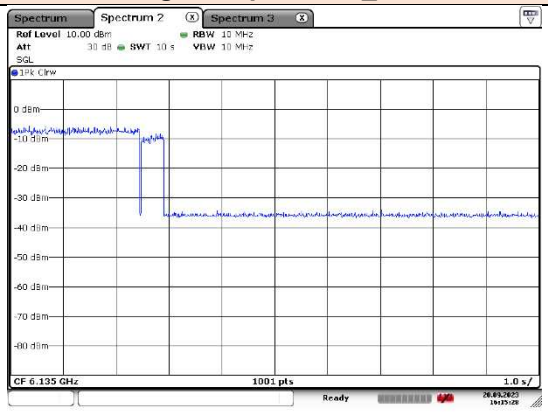
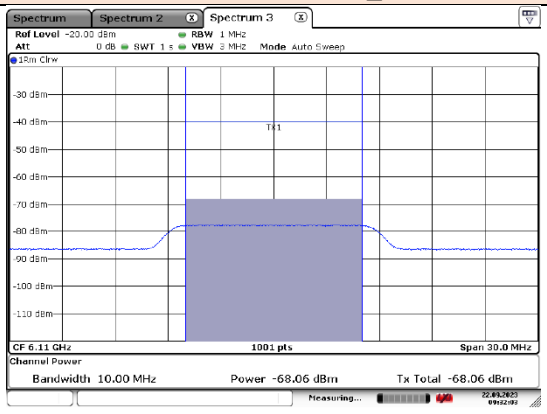
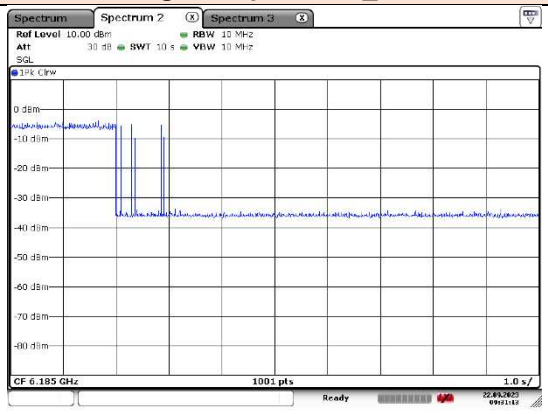
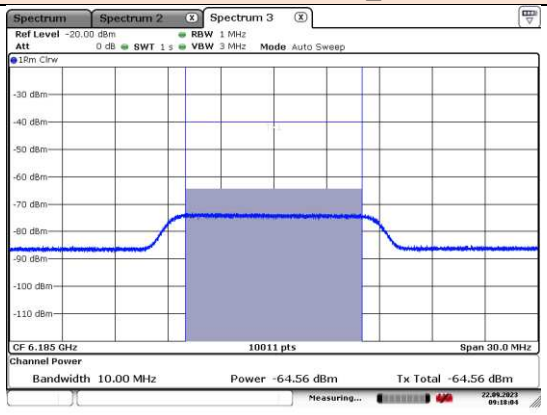
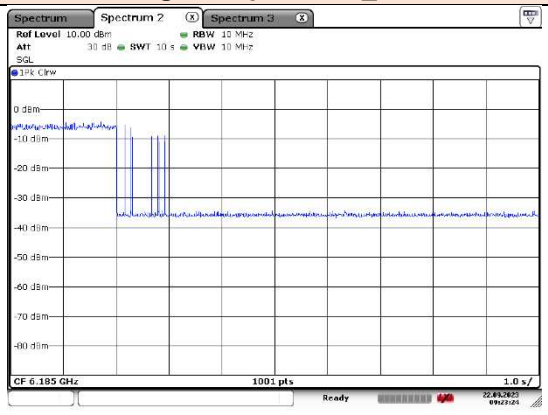
Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Measured Detection level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Margin (dB)
NII Band 5	6 135	20	6 135	-64.33	100	-56.97	7.36
	6 185	160	6 110	-68.06	100	-56.97	11.09
			6 185	-64.56	100	-56.97	7.59
			6 260	-68.00	100	-56.97	11.03
NII Band 6	6 455	20	6 455	-67.62	100	-56.91	10.71
	6 505	160	6 430	-67.99	100	-56.91	11.08
			6 505	-63.75	100	-56.91	6.84
			6 580	-68.30	100	-56.91	11.39
NII Band 7	6 695	20	6 695	-68.26	100	-56.27	11.99
	6 665	160	6 590	-67.63	100	-56.27	11.36
			6 665	-63.24	100	-56.27	6.97
			6 740	-67.89	100	-56.27	11.62
NII Band 8	7 015	20	7 015	-65.50	100	-56.99	8.51
	6 985	160	6 910	-67.37	100	-56.99	10.38
			6 985	-61.65	100	-56.99	4.66
			7 060	-65.33	100	-56.99	8.34

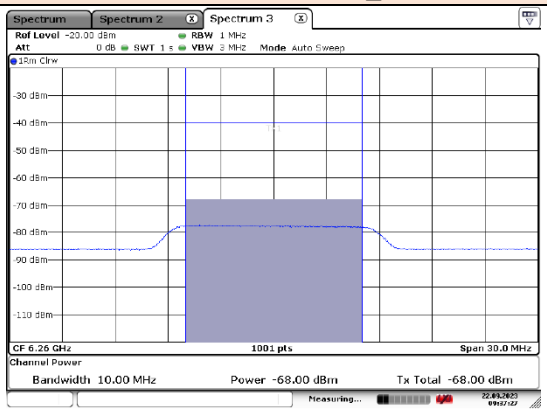
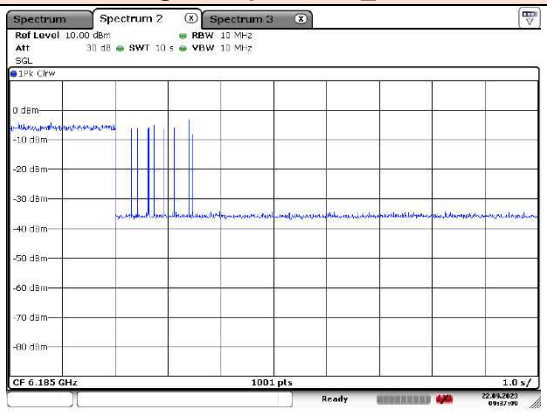
NOTE 1: Threshold Level (TL) = -62dBm + minimum antenna gain

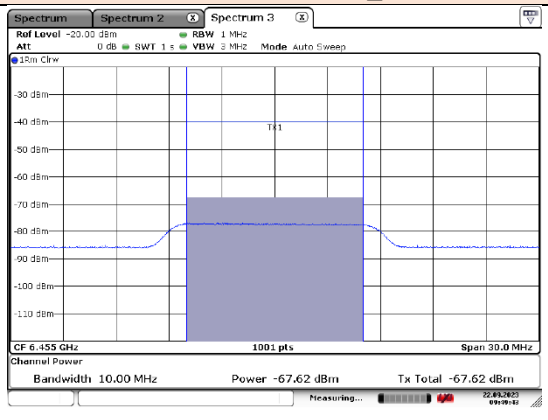
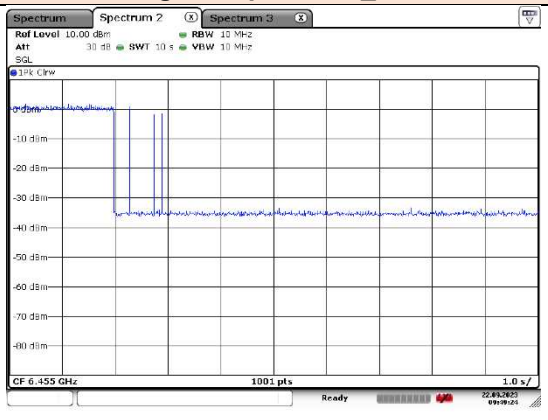
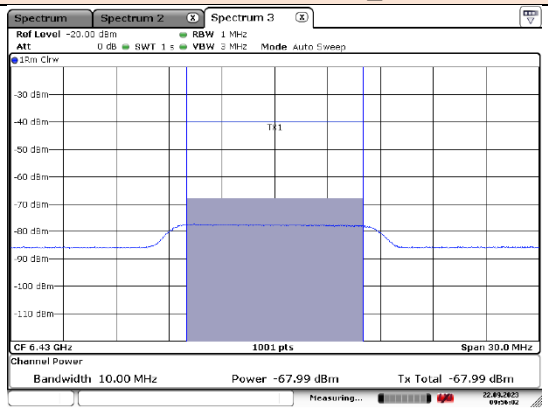
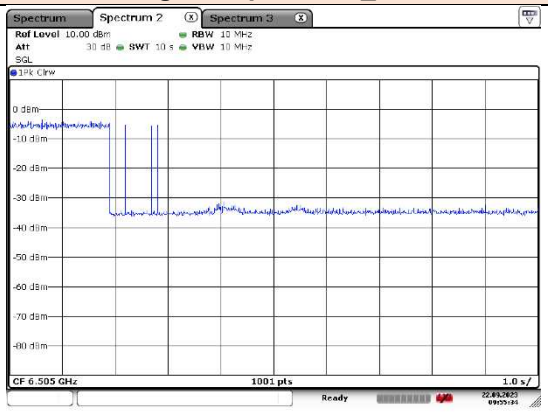
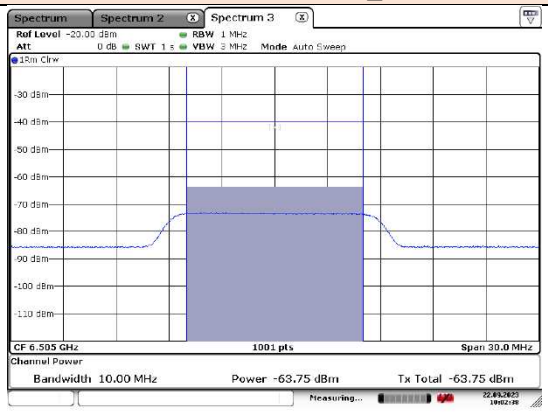
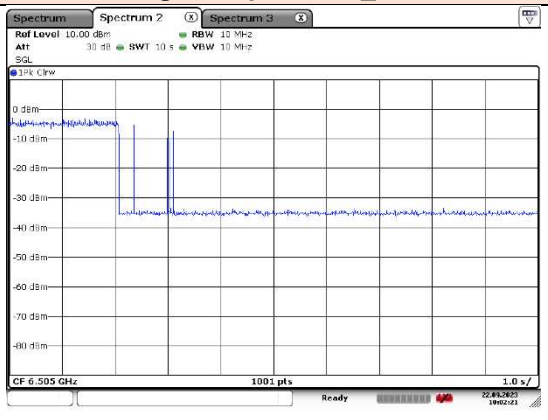
CBP Detection (1=Detection, Blank = No Detection)														
Band	**Channel Freq. (MHz)**	**Channel BW (MHz)**	**Incumbent freq. (MHz)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
NII Band 5	6 135	20	6 135	1	1	1	1	1	1	1	1	1	1	100
	6 185	160	6 110	1	1	1	1	1	1	1	1	1	1	100
			6 185	1	1	1	1	1	1	1	1	1	1	100
			6 260	1	1	1	1	1	1	1	1	1	1	100
NII Band 6	6 455	20	6 455	1	1	1	1	1	1	1	1	1	1	100
	6 505	160	6 430	1	1	1	1	1	1	1	1	1	1	100
			6 505	1	1	1	1	1	1	1	1	1	1	100
			6 580	1	1	1	1	1	1	1	1	1	1	100
NII Band 7	6 695	20	6 695	1	1	1	1	1	1	1	1	1	1	100
	6 665	160	6 590	1	1	1	1	1	1	1	1	1	1	100
			6 665	1	1	1	1	1	1	1	1	1	1	100
			6 740	1	1	1	1	1	1	1	1	1	1	100
NII Band 8	7 015	20	7 015	1	1	1	1	1	1	1	1	1	1	100
	6 985	160	6 910	1	1	1	1	1	1	1	1	1	1	100
			6 985	1	1	1	1	1	1	1	1	1	1	100
			7 060	1	1	1	1	1	1	1	1	1	1	100

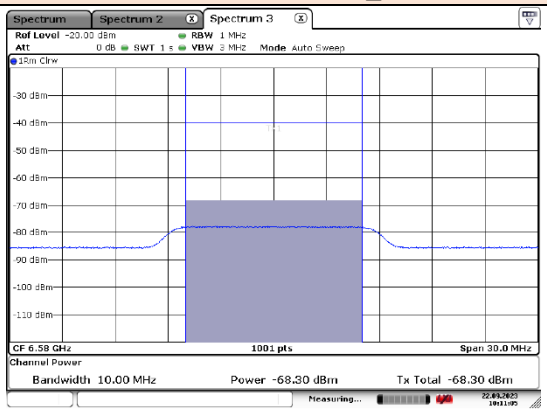
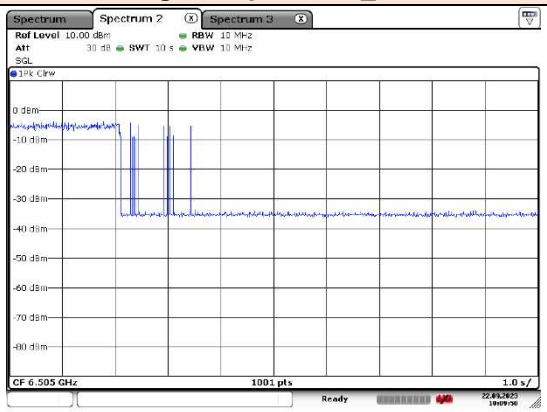
NOTE 1: This test started at the lowest level: -80 dBm and increased it until the value was detected.

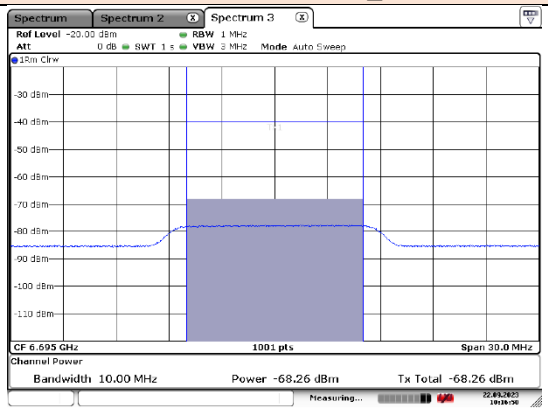
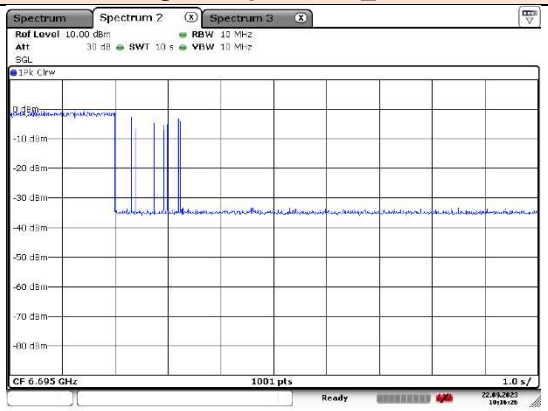
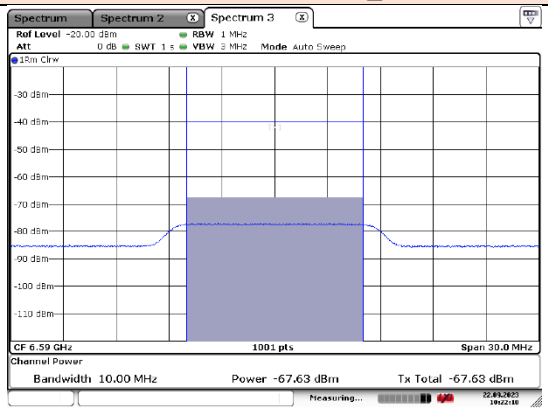
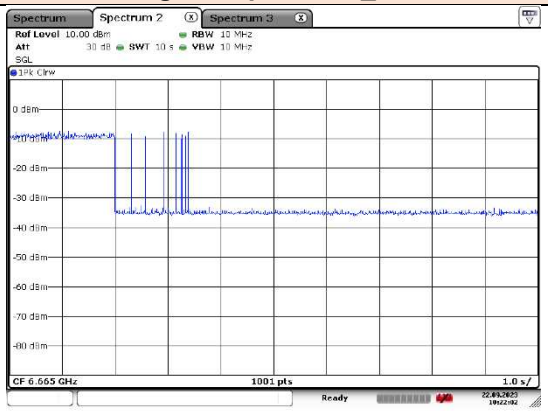
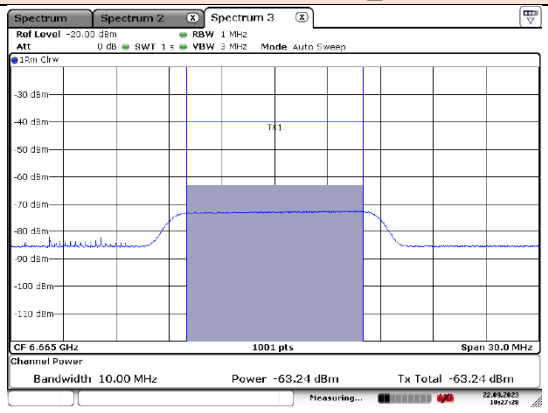
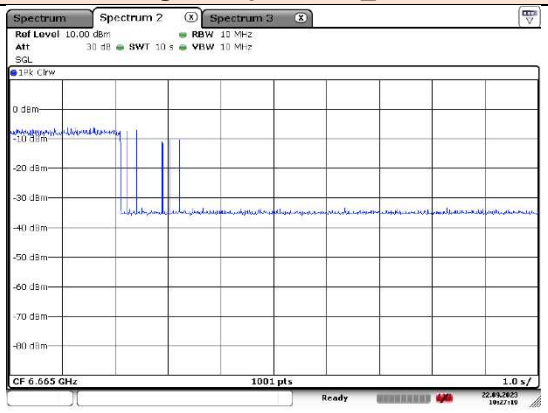
[Test Contention Based Protocol]

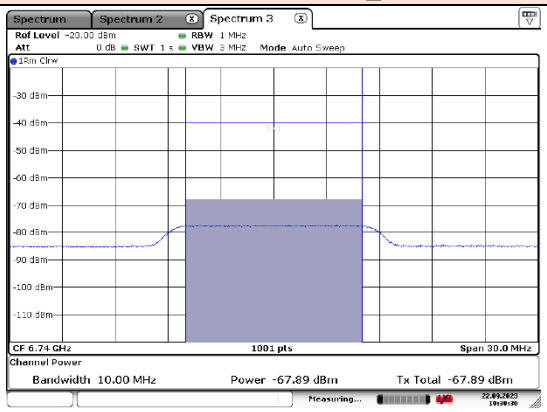
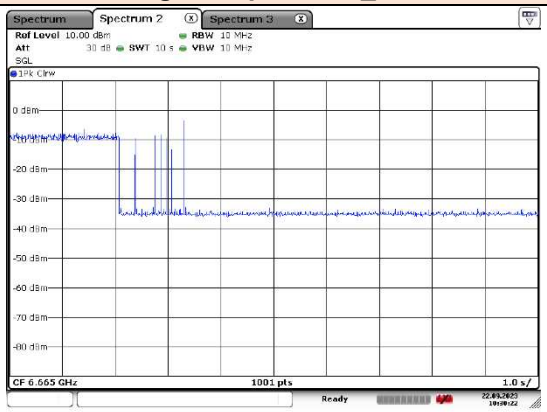
TM 1_ NII 5	TM 1 _ NII 5
Measured Detection level _6 135 MHz	**Monitoring live spectrum _ 6 135 MHz**
	
TM 4 _ NII 5	**TM 4_ NII 5**
Measured Detection level _6 110 MHz	**Monitoring live spectrum _ 6 110 MHz**
	
Measured Detection level _6 185 MHz	**Monitoring live spectrum _ 6 185 MHz**
	

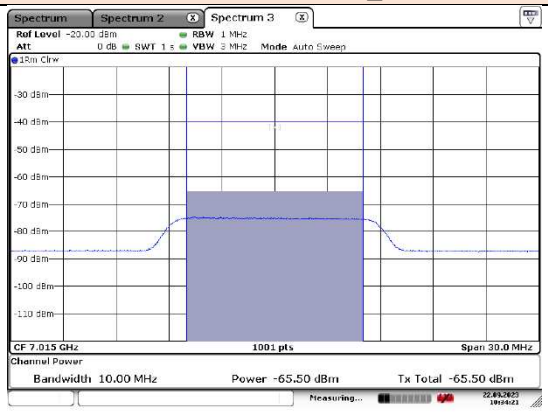
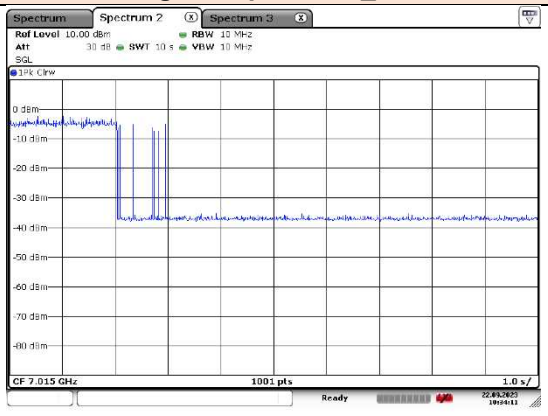
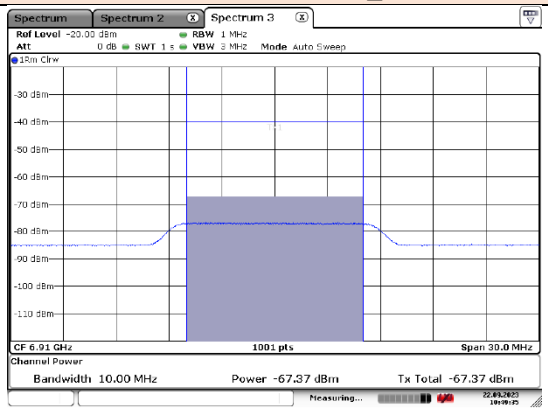
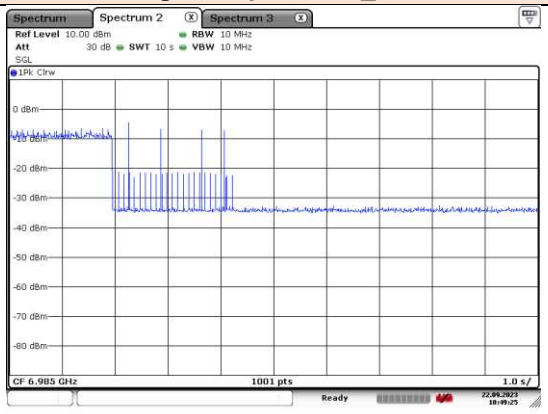
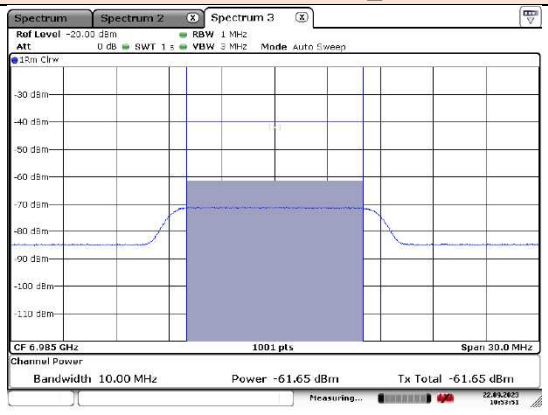
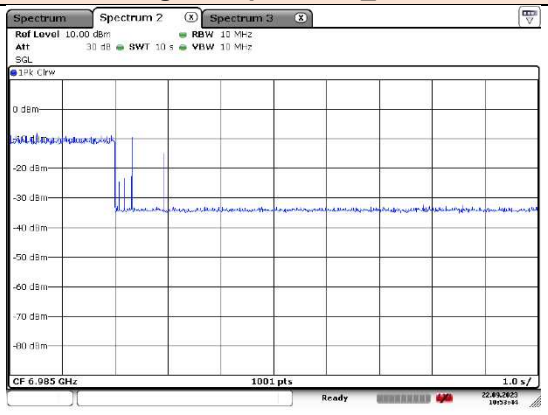
TM 4_ NII 5	TM 4_ NII 5
Measured Detection level _6 260 MHz	**Monitoring live spectrum _ 6 260 MHz**
	

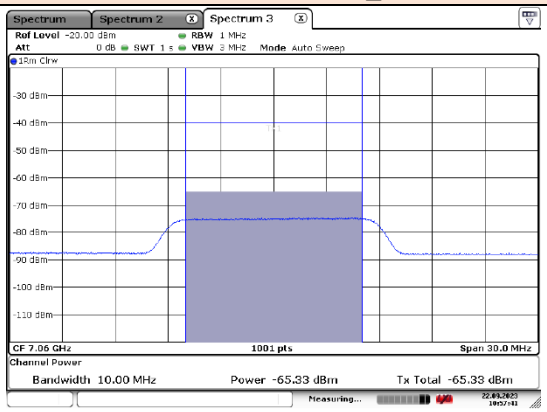
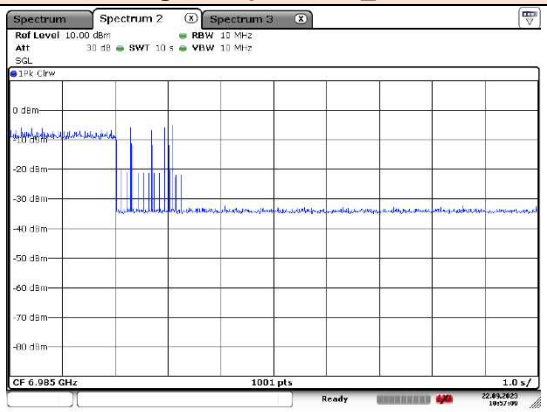
TM 1_ NII 6	TM 1 _ NII 6
Measured Detection level _6 455 MHz	**Monitoring live spectrum _ 6 455 MHz**
	
TM 4 _ NII 6	**TM 4_ NII 6**
Measured Detection level _6 430 MHz	**Monitoring live spectrum _ 6 430 MHz**
	
Measured Detection level _6 505 MHz	**Monitoring live spectrum _ 6 505 MHz**
	

TM 4_ NII 6	TM 4_ NII 6
Measured Detection level _6 580 MHz	**Monitoring live spectrum _ 6 580 MHz**
	

TM 1_ NII 7	TM 1 _ NII 7
Measured Detection level _6 695 MHz	**Monitoring live spectrum _ 6 695 MHz**
	
TM 4 _ NII 7	**TM 4_ NII 7**
Measured Detection level _6 590 MHz	**Monitoring live spectrum _ 6 590 MHz**
	
Measured Detection level _6 665 MHz	**Monitoring live spectrum _ 6 665 MHz**
	

TM 4_ NII 7	TM 4_ NII 7
Measured Detection level _6 740 MHz	**Monitoring live spectrum _ 6 740 MHz**
	

TM 1_ NII 8	TM 1 _ NII 8
Measured Detection level _7 015 MHz	**Monitoring live spectrum _ 7 015 MHz**
	
TM 4 _ NII 8	**TM 4_ NII 8**
Measured Detection level _6 910 MHz	**Monitoring live spectrum _ 6 910 MHz**
	
Measured Detection level _6 985 MHz	**Monitoring live spectrum _ 6 985 MHz**
	

TM 4_ NII 8	TM 4_ NII 8
Measured Detection level _7 060 MHz	**Monitoring live spectrum _ 7 060 MHz**
	

3.8 Spurious Emission, Band edge and Restricted Bands

3.8.1 Regulation

§15.209(a) : Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.

§15.205(a) : Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2]Above 38.6

§15.205 (b) : Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated

based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

FCC Part 15.407 (b): Undesirable emission limits. Except as shown in paragraph (b)(6) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating within the 5.925–7.125 GHz band: Any emissions outside of the 5.925–7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

3.8.2 Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 1m or 3 m away from the receiving antenna, which is varied from 1m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiated spurious emission measured using following Measurement Procedure of KDB789033 D02v02r01

► General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

▪ EUT Duty Cycle

(1) The EUT shall be configured or modified to transmit continuously except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

• The EUT shall be configured to operate at the maximum achievable duty cycle.

• Measure the duty cycle, x, of the transmitter output signal.

• Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.

• The test report shall include the following additional information:

◦ The reason for the duty cycle limitation.

◦ The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.

◦ The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

► Measurements below 1000 MHz

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

► Measurements Above 1000 MHz (Peak)

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Peak emission levels are measured by setting the analyzer as follows:

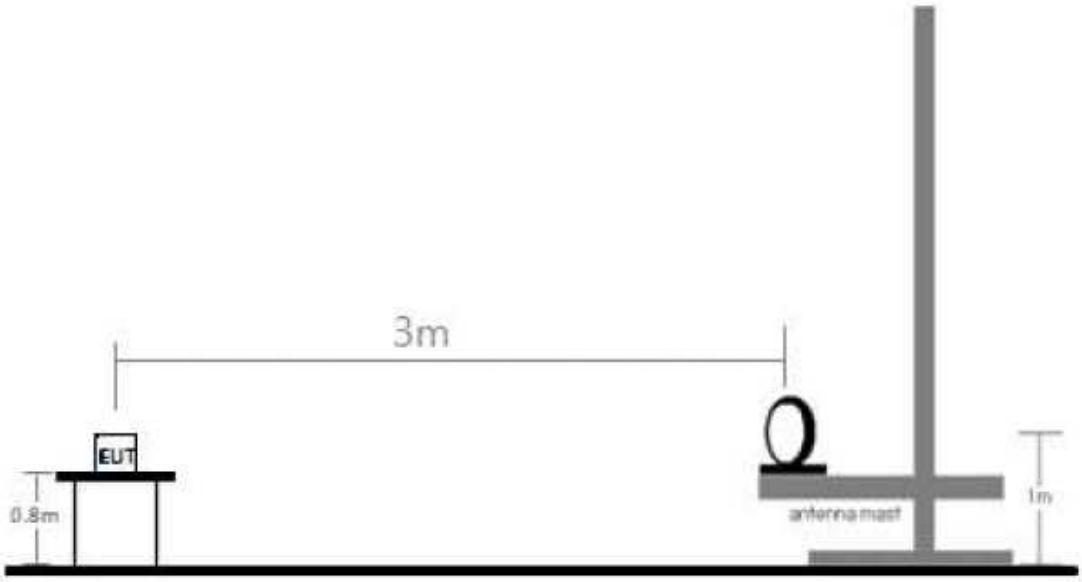
(i) RBW = 1 MHz.
(ii) VBW ≥ 3 MHz.
(iii) Detector = Peak.
(iv) Sweep time = Auto.
(v) Trace mode = Max hold.
(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► Measurements Above 1000 MHz (Method AD)

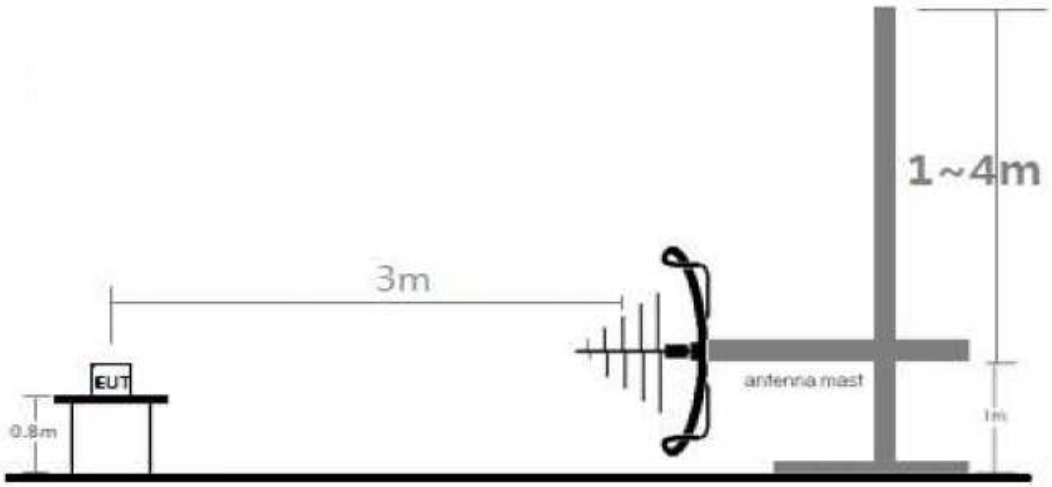
(i) RBW = 1 MHz.
(ii) VBW ≥ 3 MHz.
(iii) Detector = RMS, if span / (# of points in sweep) ≤ RBW / 2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(v) Sweep time = Auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
• If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

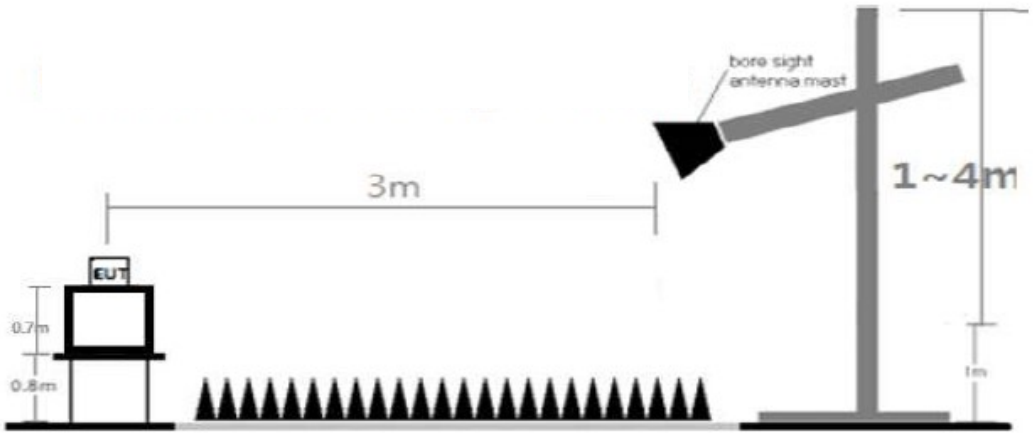
3.8.3 Test Setup

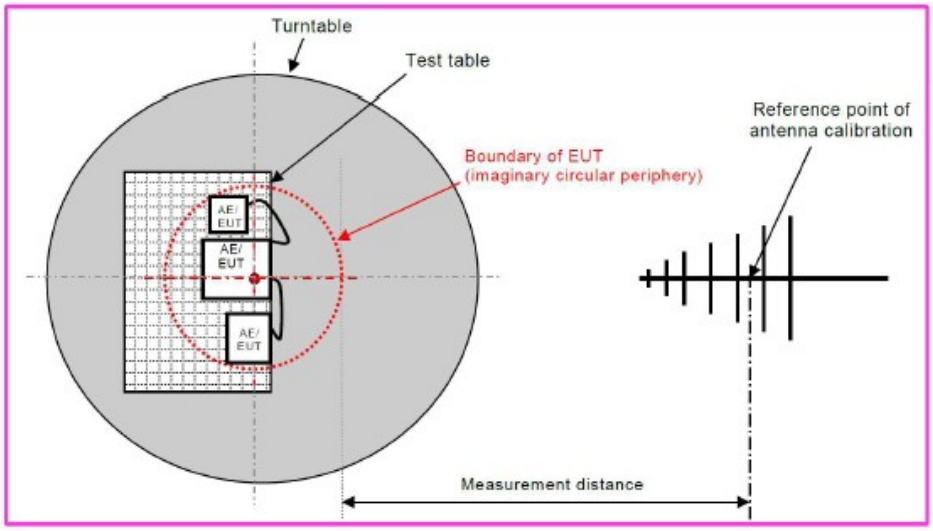


[Radiated Emission Test Setup Below 30 MHz]



[Radiated Emission Test Setup Below 1 GHz]





[Radiated Emission Test Setup Above 1 GHz]

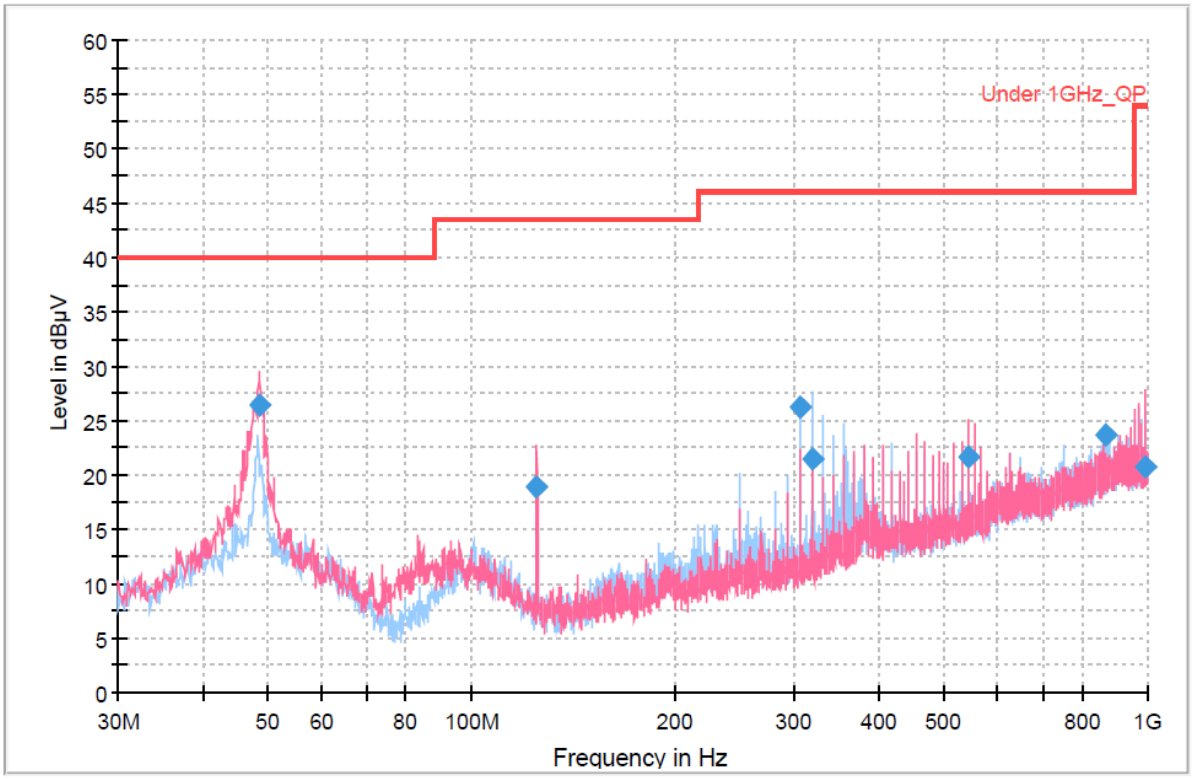
3.8.4 Test Result of Radiated Spurious Emission

Remarks

1. Result(dBμV/m) = Reading Value(dBμV) + Total Factor(dB) + DCCF(dB)
2. Total Factor(dB) = T.F (dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = Result (dBμV/m) – Limit (dBμV/m)
4. Measurement Distance = 3 m.
6. DCCF = Duty Cycle Correction Factor.
7. No other spurious and harmonic emissions were found greater than listed emissions on above table
8. If the measured peak value satisfies the AVG LIMIT, the AVG value was not written.

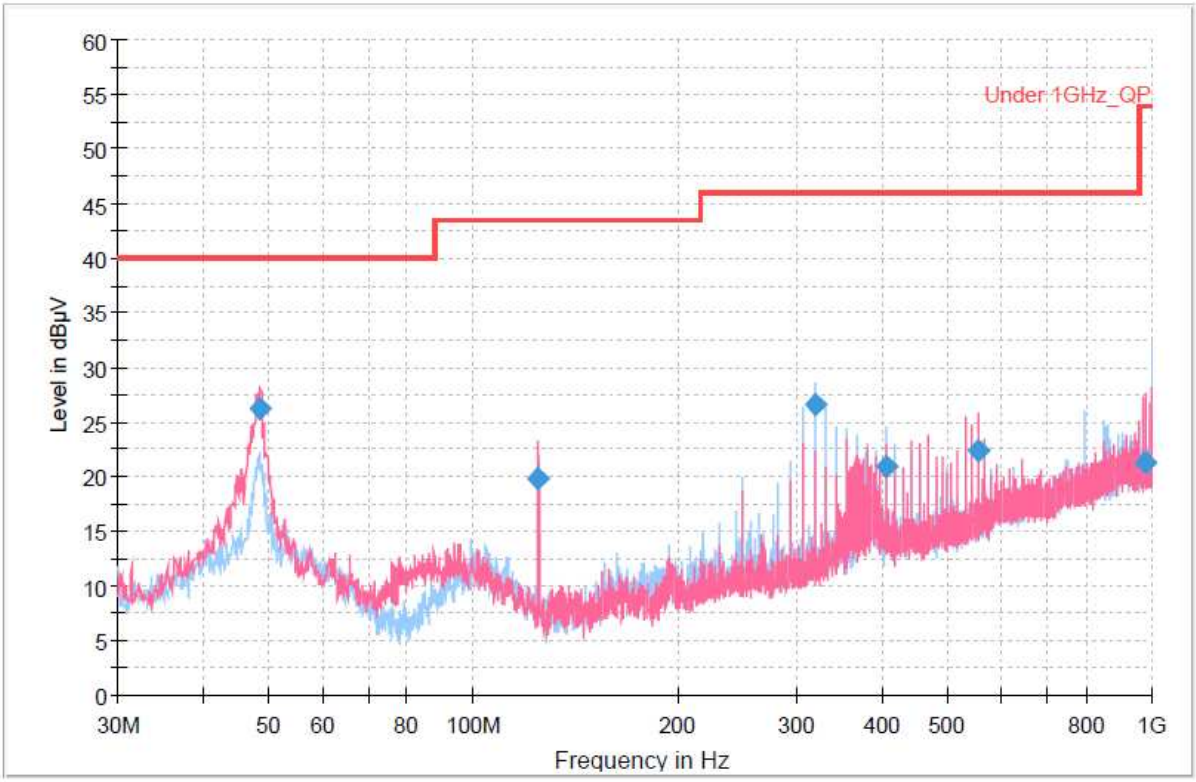
3.8.4.1 Radiated Emissions (Below 1 GHz)

Worst case – RSE (Below 1 GHz)_TM 4 (NII 5)



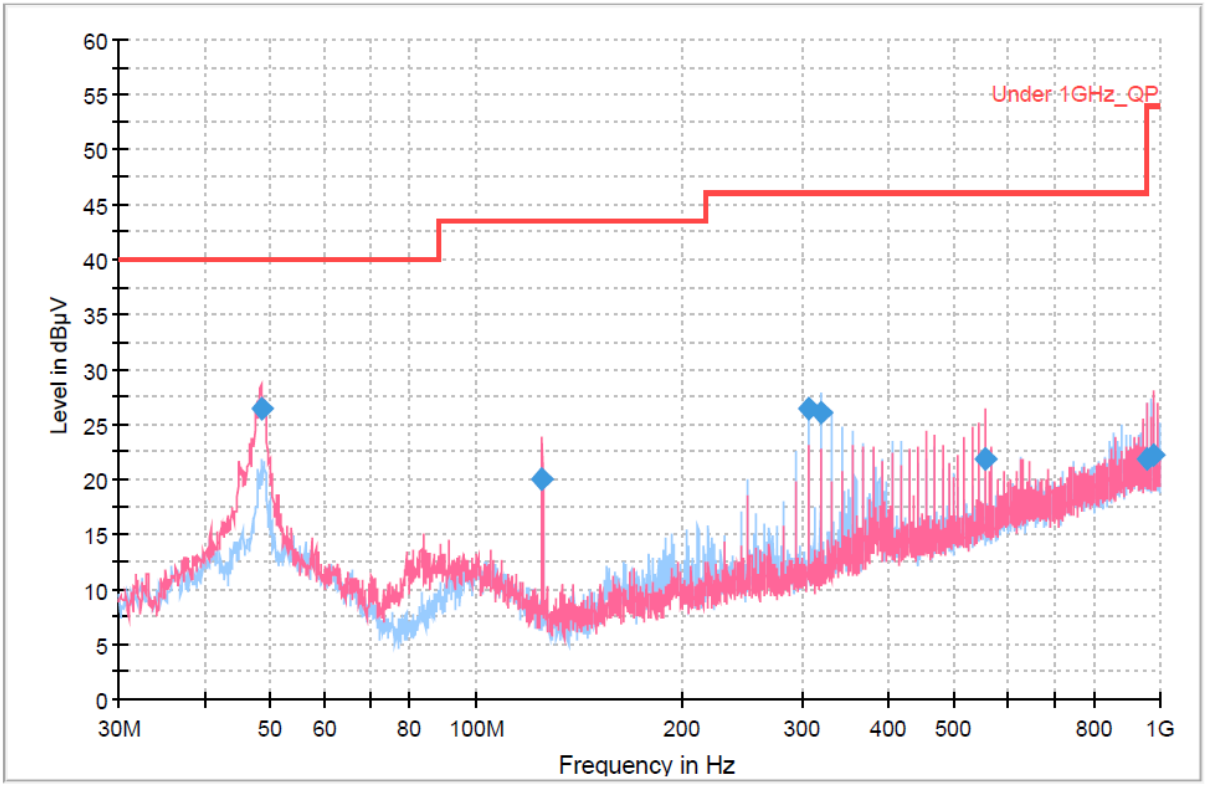
Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 185	48.62	46.90	V	X	Quasi Peak	0.00	-20.40	26.50	40.00	13.50
	124.96	45.20	V	X	Quasi Peak	0.00	-26.30	18.90	43.52	24.62
	306.26	48.67	H	X	Quasi Peak	0.00	-22.50	26.17	46.02	19.85
	318.67	43.49	H	X	Quasi Peak	0.00	-22.10	21.39	46.02	24.63
	543.71	39.73	V	X	Quasi Peak	0.00	-18.10	21.63	46.02	24.39
	868.76	38.37	H	X	Quasi Peak	0.00	-14.70	23.67	46.02	22.35
	993.79	35.40	V	X	Quasi Peak	0.00	-14.60	20.80	53.97	33.17

Worst case – RSE (Below 1 GHz)_TM 4 (NII 6)



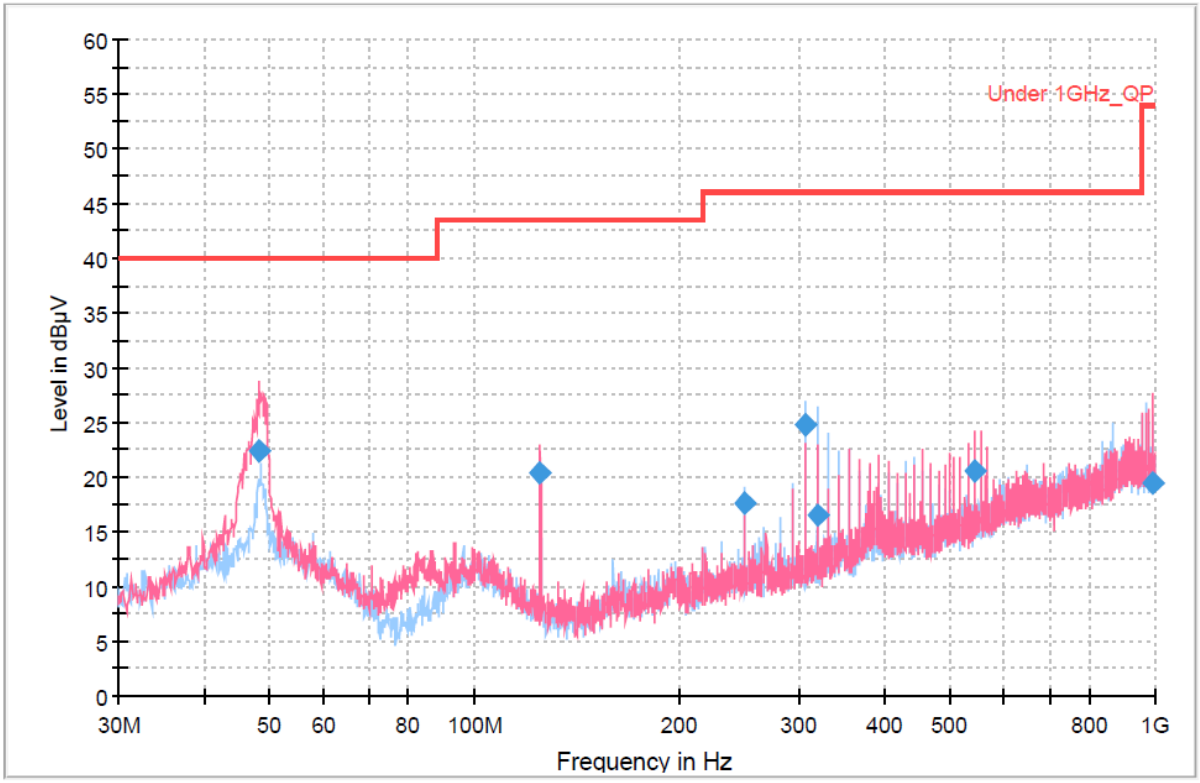
Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 505	48.721	46.59	V	X	Quasi Peak	0.00	-20.40	26.19	40.00	13.81
	124.963	46.10	V	X	Quasi Peak	0.00	-26.30	19.80	43.52	23.72
	318.769	48.75	H	X	Quasi Peak	0.00	-22.10	26.65	46.02	19.37
	406.263	40.84	H	X	Quasi Peak	0.00	-19.90	20.94	46.02	25.08
	556.225	40.21	V	X	Quasi Peak	0.00	-17.90	22.31	46.02	23.71
	981.279	35.85	V	X	Quasi Peak	0.00	-14.60	21.25	53.97	32.72

Worst case – RSE (Below 1 GHz)_TM 4 (NII 7)



Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 665	48.43	46.91	V	X	Quasi Peak	0.00	-20.40	26.51	40.00	13.49
	124.963	46.36	V	X	Quasi Peak	0.00	-26.30	20.06	43.52	23.46
	306.256	48.90	H	X	Quasi Peak	0.00	-22.50	26.40	46.02	19.62
	318.769	48.11	H	X	Quasi Peak	0.00	-22.10	26.01	46.02	20.01
	556.225	39.72	V	X	Quasi Peak	0.00	-17.90	21.82	46.02	24.20
	956.253	36.38	V	X	Quasi Peak	0.00	-14.60	21.78	46.02	24.24
	981.279	36.74	V	X	Quasi Peak	0.00	-14.60	22.14	53.97	31.83

Worst case – RSE (Below 1 GHz)_TM 4 (NII 8)



Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 985	48.236	42.84	V	X	Quasi Peak	0.00	-20.40	22.44	40.00	17.56
	124.963	46.65	V	X	Quasi Peak	0.00	-26.30	20.35	43.52	23.17
	249.996	40.65	H	X	Quasi Peak	0.00	-23.10	17.55	46.02	28.47
	306.256	47.35	H	X	Quasi Peak	0.00	-22.50	24.85	46.02	21.17
	318.672	38.70	H	X	Quasi Peak	0.00	-22.10	16.60	46.02	29.42
	543.712	38.67	V	X	Quasi Peak	0.00	-18.10	20.57	46.02	25.45
	993.792	33.99	V	X	Quasi Peak	0.00	-14.60	19.39	53.97	34.58

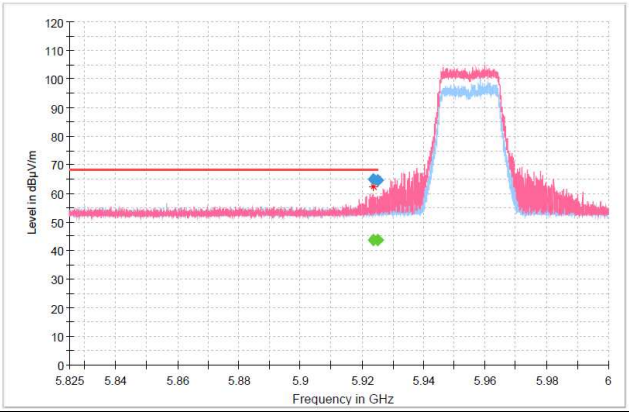
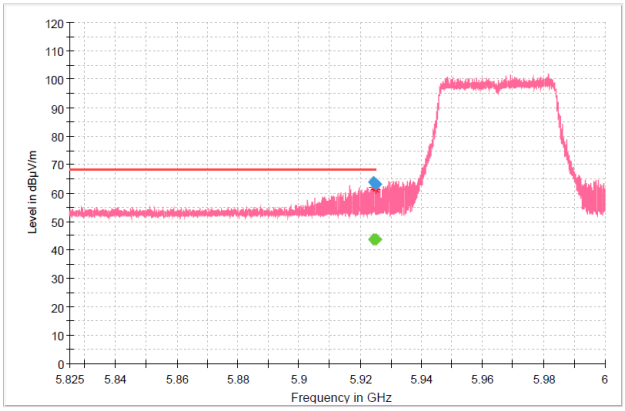
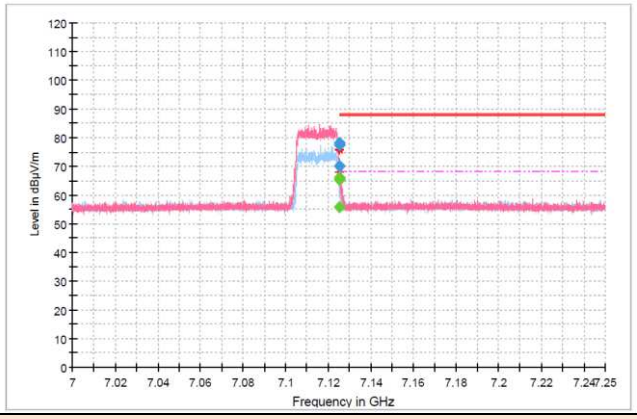
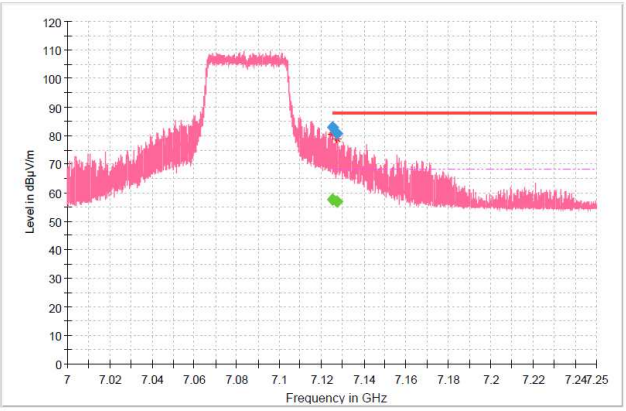
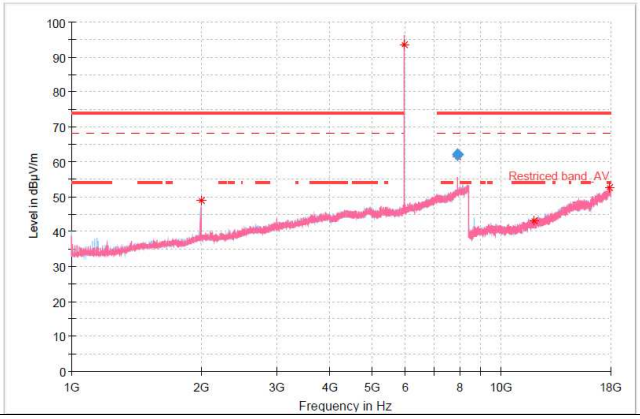
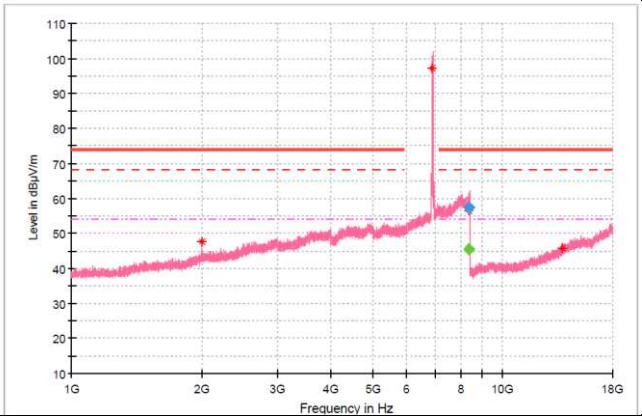
3.8.4.2 Radiated Emissions (Above 1 GHz)

TM 1

6 GHz Band	Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
NII 5	5 955	5 923.82	51.04	V	X	Peak	0.00	14.00	65.04	68.20	**3.16**
		7 940.04	44.26	V	X	Peak	0.00	17.80	62.06	68.20	6.14
		11 910.00	28.36	V	X	Peak	0.00	14.70	43.06	74.00	30.94
	6 175	1 999.93	44.70	V	X	Peak	0.00	2.70	47.40	68.20	20.80
		12 350.40	28.79	V	X	Peak	0.00	15.30	44.09	74.00	29.91
	6 415	1 999.69	44.72	V	X	Peak	0.00	2.70	47.42	68.20	20.78
		12 830.10	27.77	V	X	Peak	0.00	15.70	43.47	68.20	24.73
NII 6	6 435	1 999.69	45.41	V	X	Peak	0.00	2.70	48.11	68.20	**20.09**
		12 869.70	28.30	V	X	Peak	0.00	15.70	44.00	68.20	24.20
	6 475	1 999.93	43.54	V	X	Peak	0.00	2.70	46.24	68.20	21.96
		12 950.40	28.56	V	X	Peak	0.00	15.80	44.36	68.20	23.84
	6 515	1 999.93	44.72	V	X	Peak	0.00	2.70	47.42	68.20	20.78
		13 029.60	27.63	V	X	Peak	0.00	16.10	43.73	68.20	24.47
NII 7	6 535	1 999.93	47.07	V	X	Peak	0.00	2.70	49.77	68.20	18.43
		8 370.86	35.23	V	X	Peak	0.00	18.40	53.63	74.00	20.37
		13 069.80	29.98	V	X	Peak	0.00	16.20	46.18	68.20	22.02
	6 695	1 999.69	44.40	V	X	Peak	0.00	2.70	47.10	68.20	21.10
		7 977.04	35.29	V	X	Peak	0.00	17.80	53.09	68.20	**15.11**
		13 383.30	27.92	V	X	Peak	0.00	17.00	44.92	74.00	29.08
	6 875	1 999.93	44.36	V	X	Peak	0.00	2.70	47.06	68.20	21.14
		8 369.24	34.64	V	X	Peak	0.00	18.40	53.04	74.00	20.96
		13 748.70	27.69	V	X	Peak	0.00	18.00	45.69	68.20	22.51
NII 8	6 895	1 999.69	44.31	V	X	Peak	0.00	2.70	47.01	68.20	21.19
		8 381.96	38.45	V	X	Peak	0.00	18.40	56.85	74.00	17.15
		8 381.96	26.78	V	X	Average	0.00	18.40	45.18	54.00	8.82
		13 790.70	27.91	V	X	Peak	0.00	18.10	46.01	68.20	22.19
	6 995	1 999.93	44.55	V	X	Peak	0.00	2.70	47.25	68.20	20.95
		8 252.69	35.14	V	X	Peak	0.00	18.20	53.34	74.00	20.66
		13 989.00	27.76	V	X	Peak	0.00	18.50	46.26	68.20	21.94
	7 115	1 999.93	44.73	V	X	Peak	0.00	2.70	47.43	68.20	20.77
		7 125.00	61.53	V	X	Peak	0.00	16.70	78.23	88.20	9.97
		7 125.00	49.22	V	X	Peak	0.00	16.70	65.92	68.20	**2.28**
		14 231.40	28.01	V	X	Peak	0.00	19.00	47.01	68.20	21.19

TM 2

6 GHz Band	Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
NII 5	5 965	5 924.26	50.01	V	X	Peak	0.00	14.00	64.01	68.20	**4.19**
		7 953.69	38.51	V	X	Peak	0.00	17.80	56.31	68.20	11.89
		17 895.00	27.53	V	X	Peak	0.00	24.40	51.93	74.00	22.07
	6 165	1 999.93	44.37	V	X	Peak	0.00	2.70	47.07	68.20	21.13
		12 298.80	31.57	V	X	Peak	0.00	15.10	46.67	74.00	27.33
	6 405	2 000.16	43.92	V	X	Peak	0.00	2.70	46.62	68.20	21.58
		12 819.30	27.86	V	X	Peak	0.00	15.70	43.56	68.20	24.64
NII 6	6 445	1 999.93	45.26	V	X	Peak	0.00	2.70	47.96	68.20	20.24
		12 890.10	27.71	V	X	Peak	0.00	15.80	43.51	68.20	24.69
	6 485	1 999.69	45.25	V	X	Peak	0.00	2.70	47.95	68.20	20.25
		13 029.90	28.42	V	X	Peak	0.00	16.10	44.52	68.20	23.68
	6 525	1 999.93	45.48	V	X	Peak	0.00	2.70	48.18	68.20	**20.02**
		13 129.80	27.86	V	X	Peak	0.00	16.30	44.16	68.20	24.04
NII 7	6 565	1 999.93	45.48	V	X	Peak	0.00	2.70	48.18	68.20	20.02
		13 129.80	27.86	V	X	Peak	0.00	16.30	44.16	68.20	24.04
	6 685	2 000.16	44.84	V	X	Peak	0.00	2.70	47.54	68.20	20.66
		13 370.70	27.34	V	X	Peak	0.00	16.90	44.24	74.00	29.76
	6 845	1 999.93	44.89	V	X	Peak	0.00	2.70	47.59	68.20	20.61
		13 690.80	27.98	V	X	Peak	0.00	17.70	45.68	68.20	22.52
NII 8	6 885	1 999.93	44.96	V	X	Peak	0.00	2.70	47.66	68.20	20.54
		8 352.59	38.08	V	X	Peak	0.00	18.40	56.48	74.00	17.52
		8 352.59	27.34	V	X	Average	0.00	18.40	45.74	54.00	8.26
		13 770.60	27.64	V	X	Peak	0.00	18.10	45.74	68.20	22.46
	7 005	1 999.93	44.18	V	X	Peak	0.00	2.70	46.88	68.20	21.32
		14 103.00	27.10	V	X	Peak	0.00	18.80	45.90	68.20	22.30
	7 085	1 999.93	44.69	V	X	Peak	0.00	2.70	47.39	68.20	20.81
		7 125.00	66.07	V	X	Peak	0.00	16.70	82.77	88.20	**5.43**
		7 125.00	40.97	V	X	Average	0.00	16.70	57.67	68.20	10.53
		14 168.70	27.06	V	X	Peak	0.00	18.90	45.96	68.20	22.24

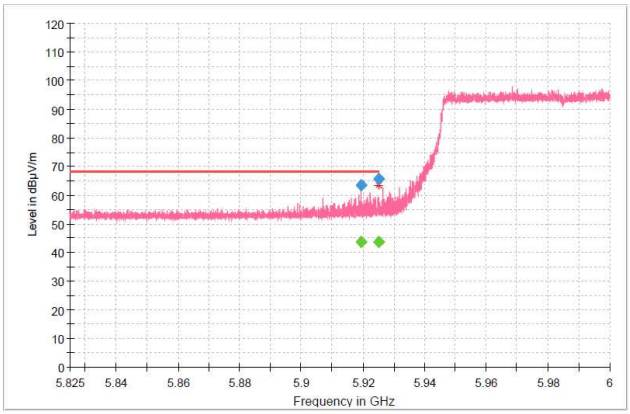
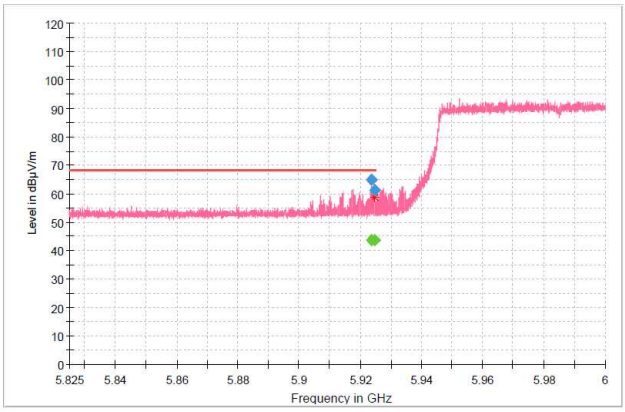
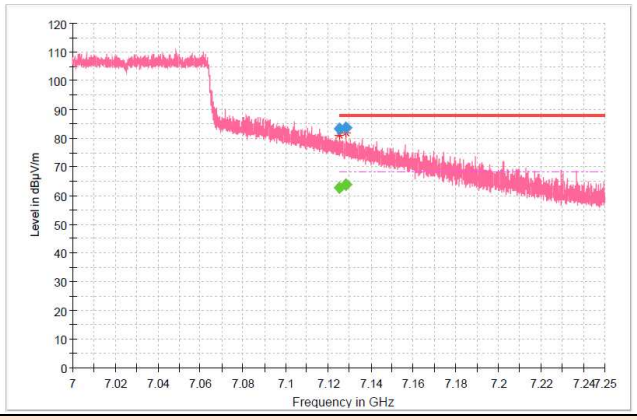
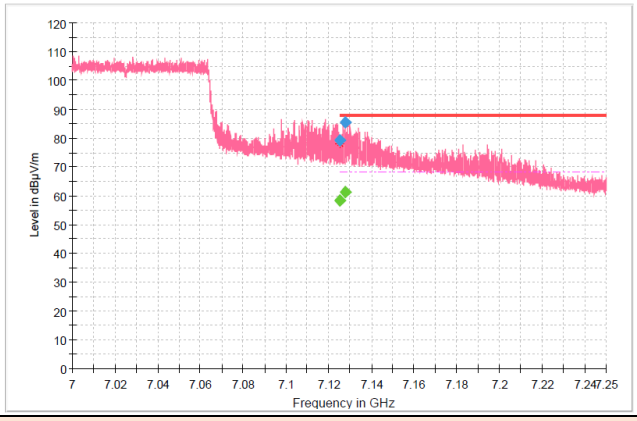
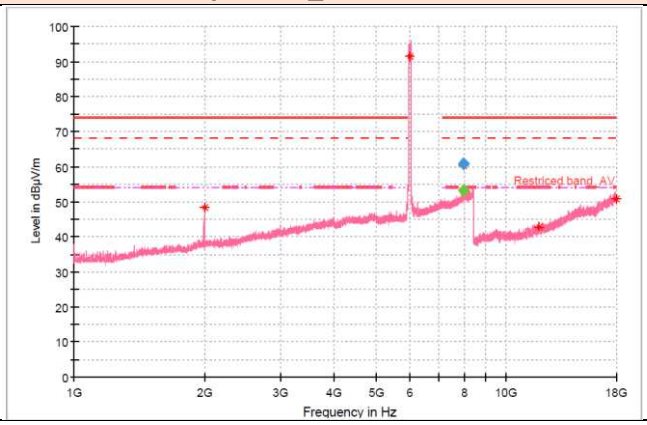
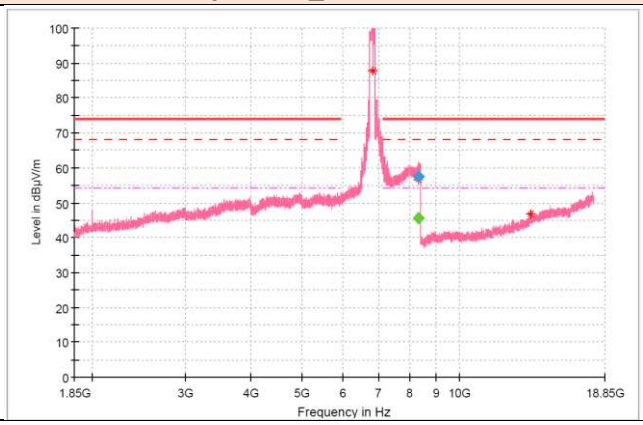
TM 1	TM 2
MIMO	MIMO
Bandedge_5 955 MHz	Bandedge_5 965 MHz
	
Bandedge_7 115 MHz	Bandedge_7 085 MHz
	
Spurious_6 955 MHz	Spurious_6 885 MHz
	

TM 3

6 GHz Band	Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
NII 5	5 985	1 999.93	45.68	V	X	Peak	0.00	2.70	48.38	68.20	19.82
		5 919.54	49.38	V	X	Peak	0.00	14.00	63.38	68.20	**4.82**
		7 980.28	43.09	V	X	Peak	0.00	17.80	60.89	68.20	7.31
		11 970.30	28.02	V	X	Peak	0.00	14.70	42.72	74.00	31.28
	6 145	1 999.93	44.11	V	X	Peak	0.00	2.70	46.81	68.20	21.39
		12 292.80	30.51	V	X	Peak	0.00	15.10	45.61	74.00	28.39
	6 385	1 999.93	45.26	V	X	Peak	0.00	2.70	47.96	68.20	20.24
		12 773.70	29.19	V	X	Peak	0.00	15.70	44.89	68.20	23.31
NII 6	6 465	2 000.16	44.17	V	X	Peak	0.00	2.70	46.87	68.20	**21.33**
NII 7	6 545	2 000.16	45.25	V	X	Peak	0.00	2.70	47.95	68.20	20.25
		13 088.10	29.28	V	X	Peak	0.00	16.20	45.48	68.20	22.72
	6 865	8 338.03	39.06	V	X	Peak	0.00	18.40	57.46	74.00	**16.54**
		8 338.03	27.00	V	X	Peak	0.00	18.40	45.40	74.00	28.60
		13 722.30	29.07	V	X	Peak	0.00	17.90	46.97	68.20	21.23
NII 8	7 025	1 999.93	44.56	V	X	Peak	0.00	2.70	47.26	68.20	20.94
		7 128.45	67.10	V	X	Peak	0.00	16.70	83.80	88.20	4.40
		7 128.45	47.31	V	X	Average	0.00	16.70	64.01	68.20	**4.19**
		14 050.80	27.37	V	X	Peak	0.00	18.60	45.97	68.20	22.23

TM 4

6 GHz Band	Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Pol [H/V]	EUT Axis	Detector Mode	DCCF [dB]	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
NII 5	6 025	1 999.93	45.01	V	X	Peak	0.00	2.70	47.71	68.20	20.49
		5 923.77	50.88	V	X	Peak	0.00	14.00	64.88	68.20	**3.32**
		8 033.24	35.84	V	X	Peak	0.00	17.90	53.74	74.00	20.26
		12 051.30	29.35	V	X	Peak	0.00	14.90	44.25	74.00	29.75
	6 185	1 999.93	45.02	V	X	Peak	0.00	2.70	47.72	68.20	20.48
		12 336.90	34.93	V	X	Peak	0.00	15.20	50.13	74.00	23.87
	6 345	1 999.93	44.47	V	X	Peak	0.00	2.70	47.17	68.20	21.03
		12 645.90	31.23	V	X	Peak	0.00	15.50	46.73	74.00	27.27
NII 6	6 505	1 999.93	43.94	V	X	Peak	0.00	2.70	46.64	68.20	**21.56**
		13 009.80	27.82	V	X	Peak	0.00	16.10	43.92	68.20	24.28
NII 7	6 665	1 999.69	45.03	V	X	Peak	0.00	2.70	47.73	68.20	20.47
		13 410.60	29.18	V	X	Peak	0.00	17.10	46.28	68.20	21.92
	6 825	8 341.96	39.04	V	X	Peak	0.00	18.40	57.44	74.00	16.56
		8 341.96	27.07	V	X	Average	0.00	18.40	45.47	54.00	**8.53**
		13 646.40	29.11	V	X	Peak	0.00	17.60	46.71	68.20	21.49
NII 8	6 985	2 000.16	45.03	V	X	Peak	0.00	2.70	47.73	68.20	**20.47**
		13 971.30	27.61	V	X	Peak	0.00	18.50	46.11	68.20	22.09

TM 3	TM 4
MIMO	MIMO
Bandedge_5 985 MHz	Bandedge_6 025 MHz
	
Bandedge_7 025 MHz	Bandedge_6 985 MHz
	
Spurious_5 985 MHz	Spurious_6 825 MHz
	

3.9 AC Conducted Emissions (150 kHz to 30 MHz)

3.9.1 Regulation

§15.207(a) : Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBμV)	
Frequency of emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

3.9.2 Test Procedure

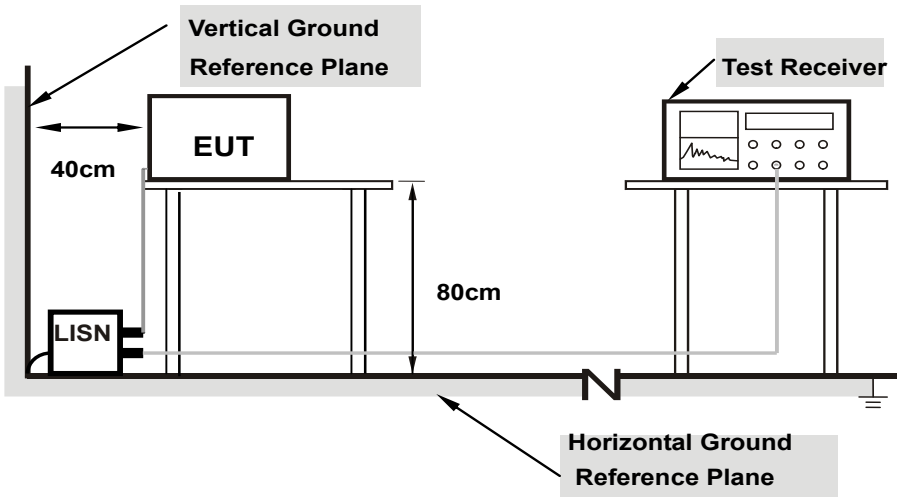
a) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50 μH of coupling impedance for the measuring instrument.

b) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c) The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

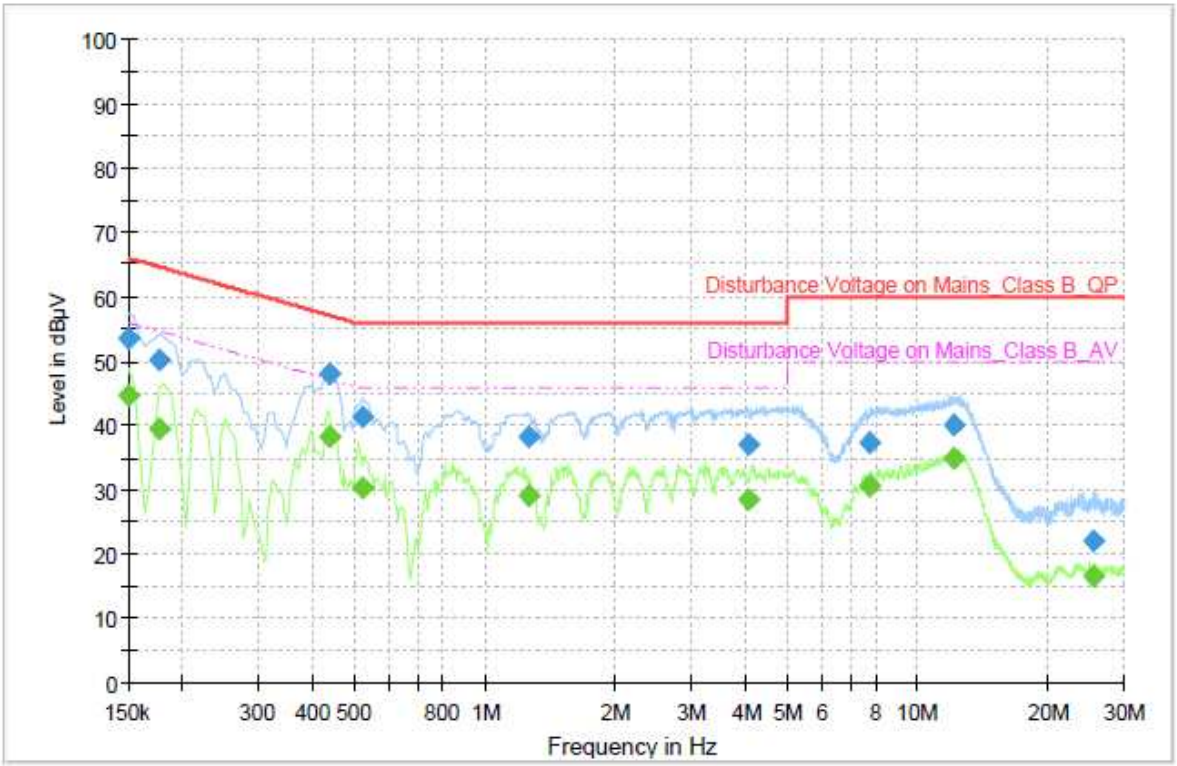
Remark : The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

3.9.3 Test Setup



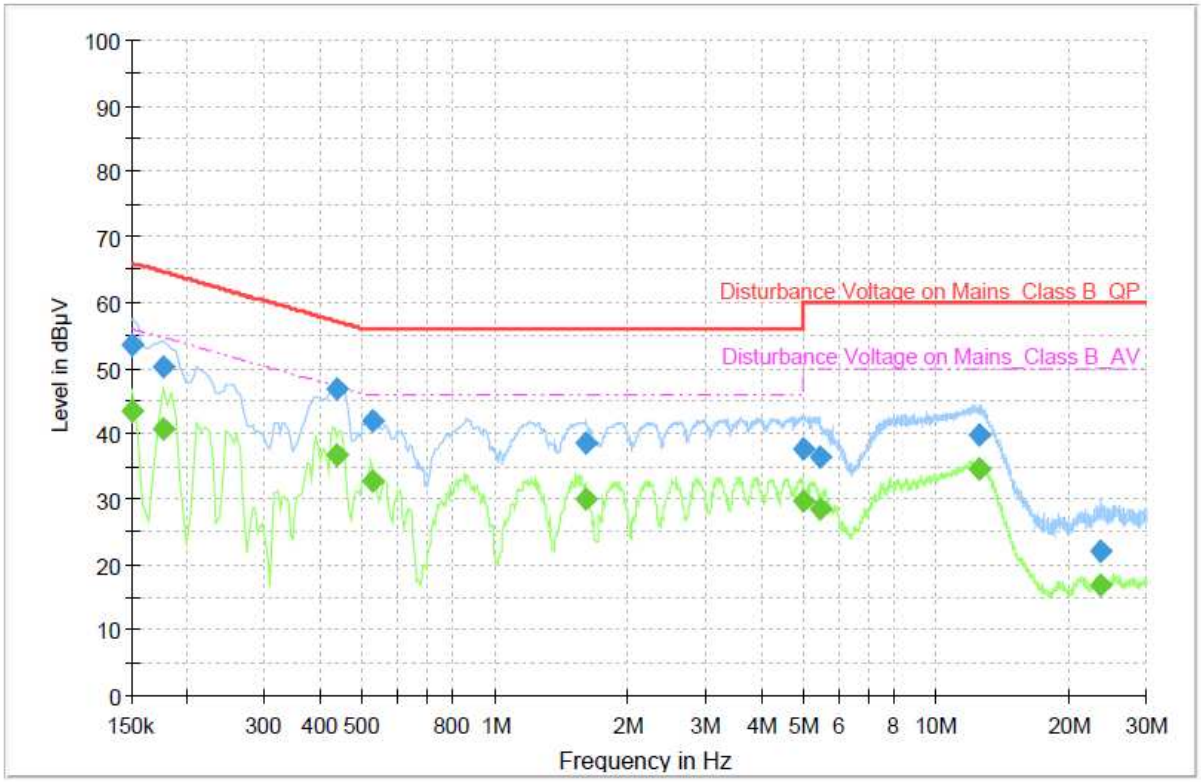
3.9.4 Test Result

Worst case – AC Line (150 kHz ~ 30 MHz)_TM 4 (NII 5)



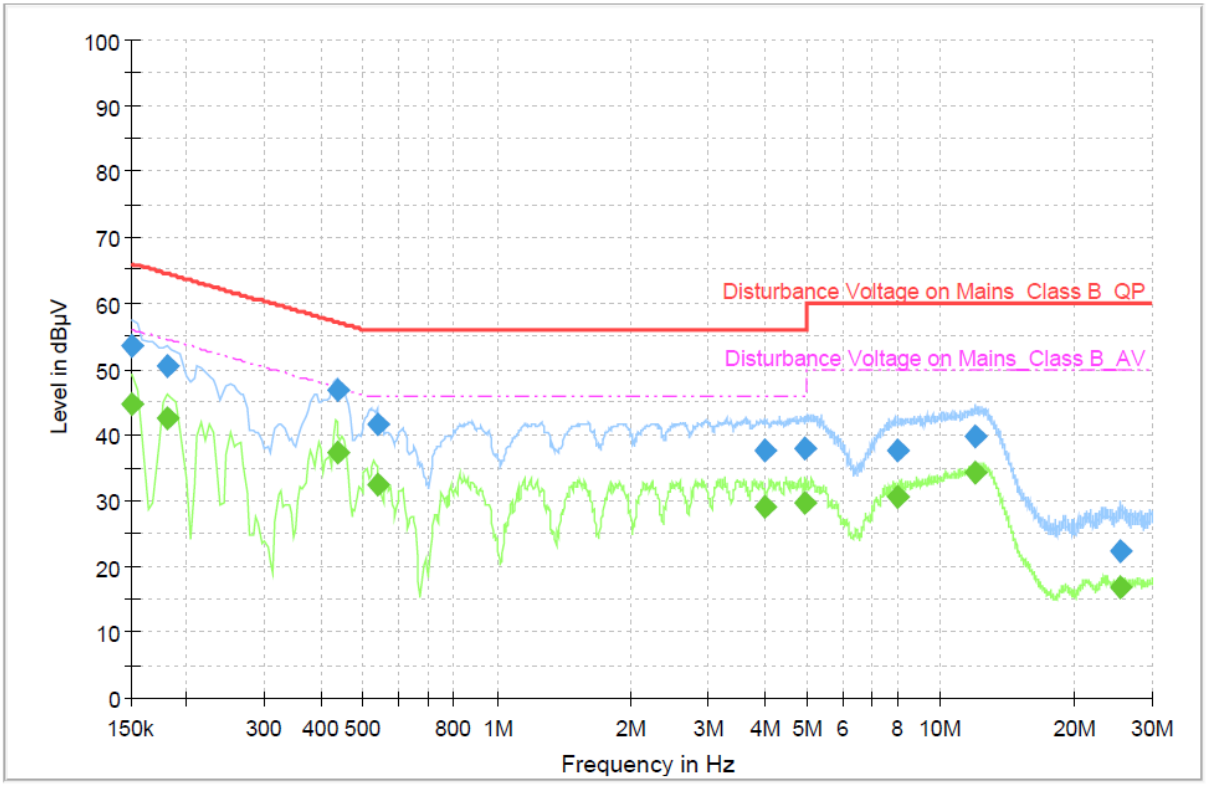
Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Line	Detector Mode	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 025	0.435 331	37.86	N	QP	10.10	47.96	57.15	9.19
	0.435 331	28.01	N	AV	10.10	38.11	47.15	**9.04**
	4.052 449	26.95	N	QP	10.00	36.95	56.00	19.05
	4.052 449	18.59	N	AV	10.00	28.59	46.00	17.41
	12.120 728	29.79	N	QP	10.30	40.09	60.00	19.91
	12.120 728	24.47	N	AV	10.30	34.77	50.00	15.23

Worst case – AC Line (150 kHz ~ 30 MHz)_TM 4 (NII 6)



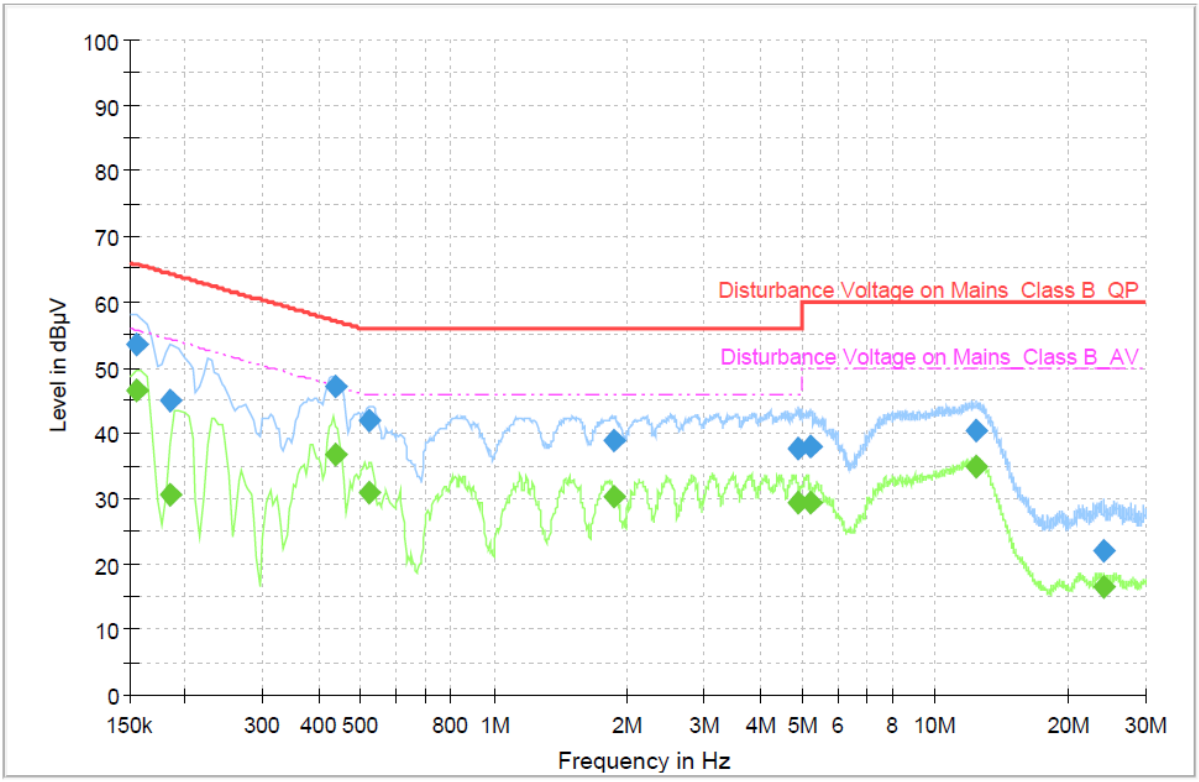
Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Line	Detector Mode	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 505	0.150 000	43.47	L1	QP	9.90	53.37	66.00	12.63
	0.150 000	33.50	L1	AV	9.90	43.40	56.00	**12.60**
	0.527 515	31.65	N	QP	10.10	41.75	56.00	14.25
	0.527 515	22.48	N	AV	10.10	32.58	46.00	13.42
	12.476 294	29.56	N	QP	10.30	39.86	60.00	20.14
	12.476 294	24.24	N	AV	10.30	34.54	50.00	15.46

Worst case – AC Line (150 kHz ~ 30 MHz)_TM 4 (NII 7)



Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Line	Detector Mode	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 665	0.150 000	43.56	L	QP	9.90	53.46	66.00	12.54
	0.150 000	34.61	L	AV	9.90	44.51	56.00	11.49
	0.435 331	36.79	N	QP	10.10	46.89	57.15	10.26
	0.435 331	27.18	N	AV	10.00	37.18	47.15	**9.97**
	11.993 427	29.45	N	QP	10.30	39.75	60.00	20.25
	11.993 427	24.08	N	AV	10.30	34.38	50.00	15.62

Worst case – AC Line (150 kHz ~ 30 MHz)_TM 4 (NII 8)



Tested Frequency [MHz]	Frequency [MHz]	Reading Value [dBuV]	Line	Detector Mode	T.F [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
6 985	0.154 390	43.60	L	QP	10.00	53.60	65.76	12.16
	0.154 390	36.46	L	AV	10.00	46.46	55.76	**9.30**
	0.523 125	31.78	N	QP	10.10	41.88	56.00	14.12
	0.523 125	20.90	N	AV	10.10	31.00	46.00	15.00
	12.432 397	29.99	N	QP	10.30	40.29	60.00	19.71
	12.432 397	24.61	N	AV	10.30	34.91	50.00	15.09

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services Korea. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

Test Firm Name : BV CPS ADT Korea Ltd.

Address : Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 KOREA

FCC

Designation Number : KR0158
Test Firm Registration Number : 666061

ISED

Designation Number : KR0158
Test Firm Registration Number : 25944

If you have any comments, please feel free to contact us at the following:

Email: Meyer.Shin@bureauveritas.com
Web Site: www.bureauveritas.co.kr/cps/eaw

The address and road map of all our labs can be found in our web site also.

- End of report -