3.4 Maximum Conducted Output Power

3.4.1 Regulation

Part. 15.407(a)

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) **For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.**

(2) **For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.**

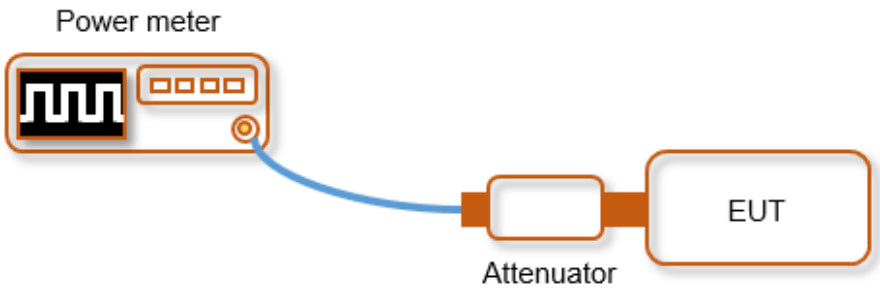
(3) **For the band 5.725 - 5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.** However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

3.4.2 Test Procedure

Method PM-G of KDB789033

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.4.3 Test Setup



3.4.4 Test Result

[Test Result of Maximum Conducted Output Power]

Limit:

5 GHz Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case) [dBi]	Conducted Limit [dBm]
NII 1	250	23.97	3.43	23.97
NII 3	1000	30.00	1.74	30.00

Test Mode	Band	Tested Frequency	Measured Power [dBm]			
			12 V		24 V	
			Average	Result	Average	Result
802.11a	NII 1	5 180	4.16	4.16	4.10	4.10
		5 200	4.60	4.60	4.54	4.54
		5 240	**5.06**	**5.06**	4.91	4.91
	NII 3	5 745	**3.00**	**3.00**	2.95	2.95
		5 785	1.92	1.92	1.81	1.81
		5 825	1.56	1.56	1.52	1.52
802.11n(HT20)	NII 1	5 180	3.86	3.86	3.89	3.89
		5 200	4.51	4.51	4.42	4.42
		5 240	3.89	3.89	3.71	3.71
	NII 3	5 745	2.46	2.46	2.35	2.35
		5 785	1.87	1.87	1.72	1.72
		5 825	1.63	1.63	1.41	1.41
802.11n(HT40)	NII 1	5 190	2.91	2.91	2.84	2.84
		5 230	2.75	2.75	2.70	2.70
	NII 3	5 755	1.30	1.30	1.71	1.71
		5 795	0.84	0.84	1.26	1.26
802.11ac(VHT20)	NII 1	5 180	4.04	4.04	3.87	3.87
		5 200	4.57	4.57	4.44	4.44
		5 240	3.78	3.78	3.71	3.71
	NII 3	5 745	2.49	2.49	2.31	2.31
		5 785	1.87	1.87	1.74	1.74
		5 825	1.51	1.51	1.41	1.41
802.11ac(VHT40)	NII 1	5 190	2.95	2.95	2.83	2.83
		5 230	2.82	2.82	2.67	2.67
	NII 3	5 755	1.28	1.28	1.74	1.74
		5 795	0.87	0.87	1.25	1.25
802.11ac(VHT80)	NII 1	5 210	2.43	2.43	2.27	2.27
	NII 3	5 775	1.14	1.14	1.17	1.17

Note 1: The intent is to test at 100 % duty cycle.
Note 2: Result = Average Power + Duty cycle factor

3.5 Maximum Power Spectral Density

3.5.1 Regulation

Part. 15.407(a)

(1) For the band 5.15 - 5.25 GHz.
(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. note1

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. note1

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) **For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1**

(2) **For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. note1**

(3) **For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.[note1,note2]**

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

3.5.2 Test Procedure

Maximum Power Spectral Density is measured using Measurement Procedure of KDB789033 D02v02r01

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA - 1, SA - 2, SA - 3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2) Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3) Make the following adjustments to the peak value of the spectrum, if applicable:
a) If Method SA - 2 or SA - 2 Alternative was used, add 10 log(1 / x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA - 3 Alternative was used and the linear mode was used in step II.E.2.g (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

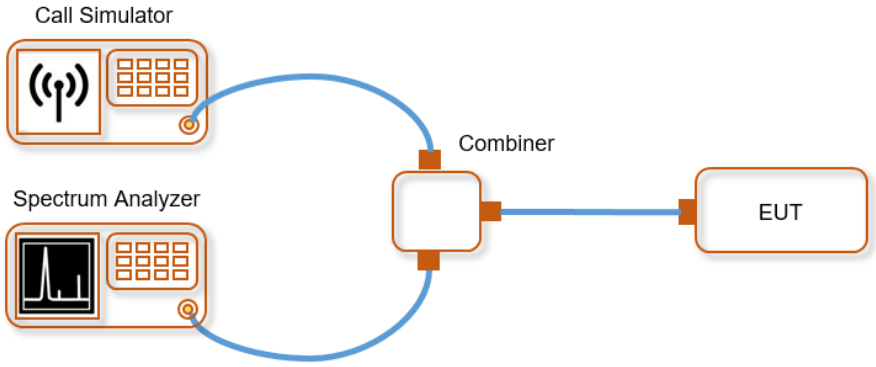
4) The result is the Maximum PSD over 1 MHz reference bandwidth.

5) For devices operating in the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, and 5.47 - 5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in §15.407(a)(5). For devices operating in the band 5.725 - 5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may

need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1 / T, where T is defined in section II.B.1.a). (Refer to Appendix II)
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log(500 kHz / RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log(1 MHz / RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW = 100 kHz is available on nearly all spectrum analyzers.

3.5.3 Test Setup



3.5.4 Test Result

[Test Result of Maximum Power Spectral Density]

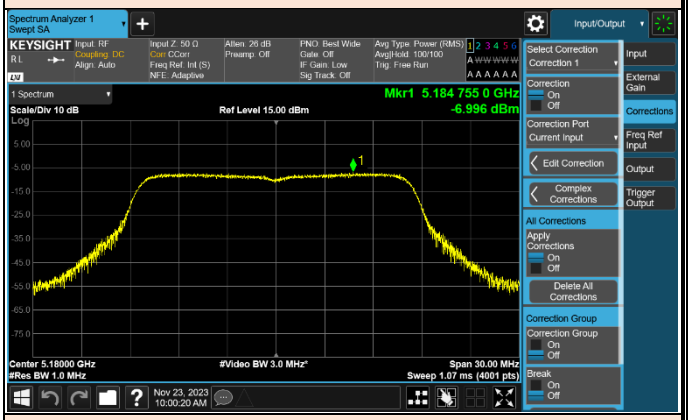
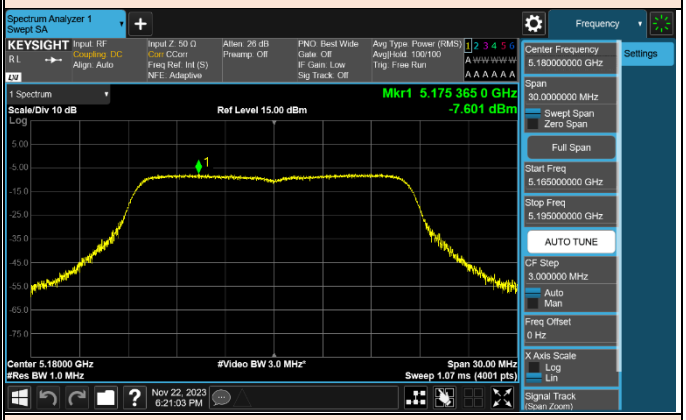
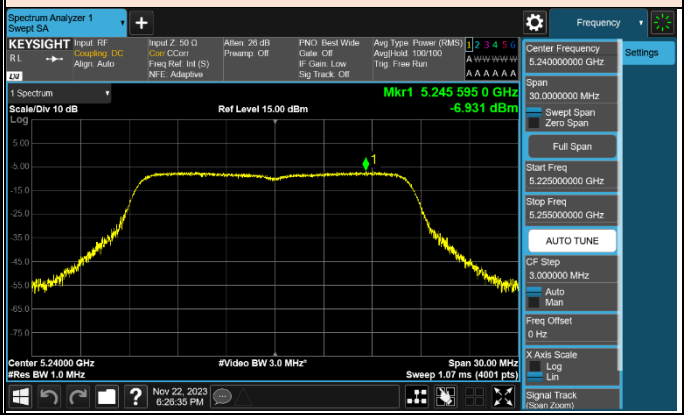
Limit

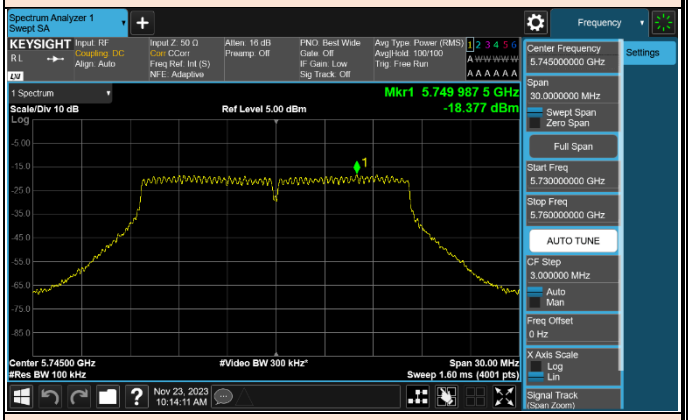
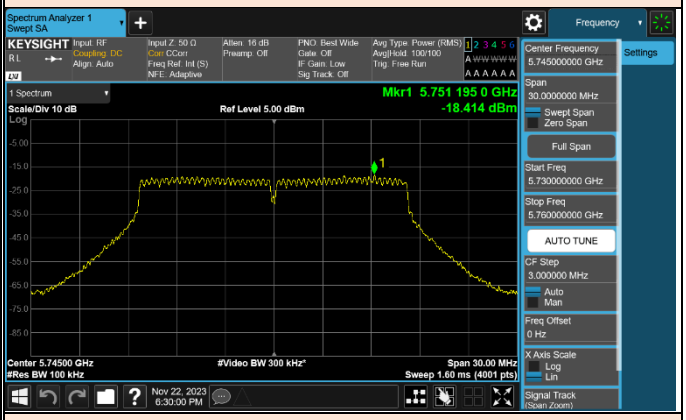
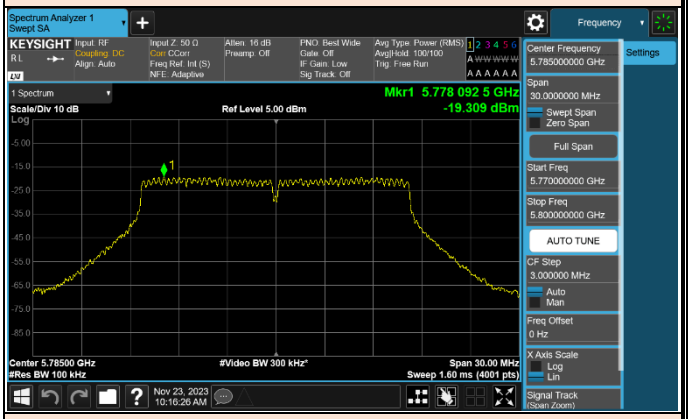
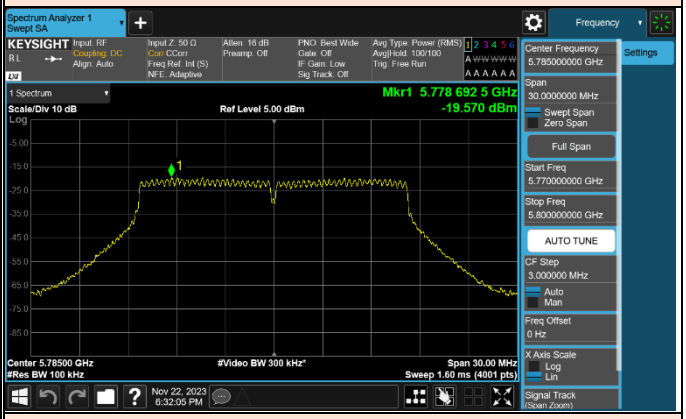
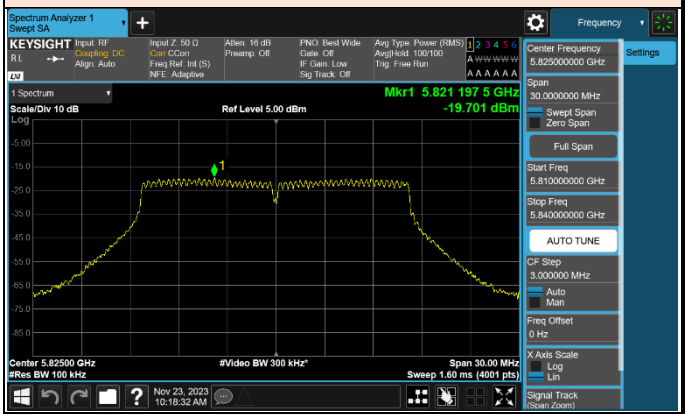
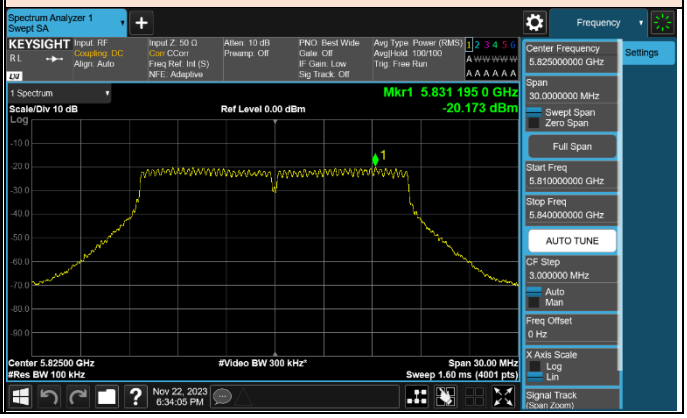
Band	Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
NII 1	11.00	3.43	11.00
NII 3	30.00	1.74	30.00

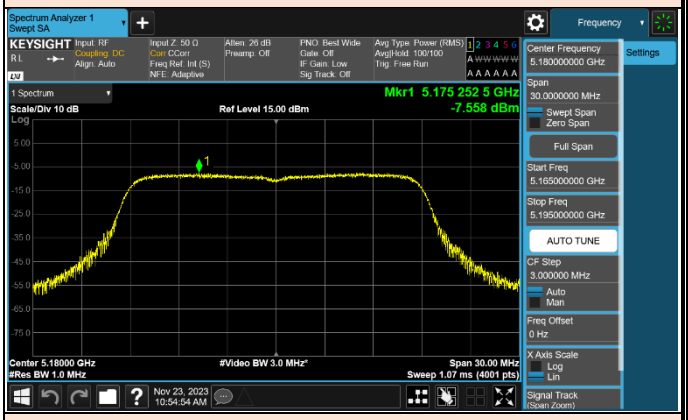
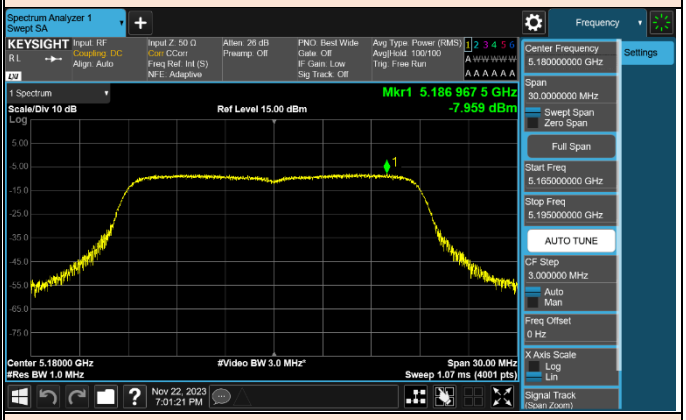
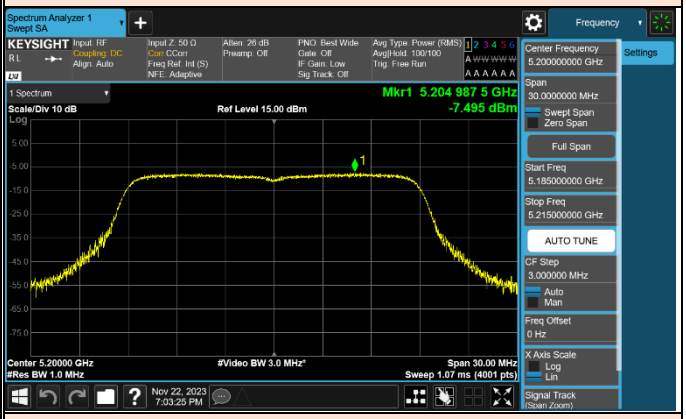
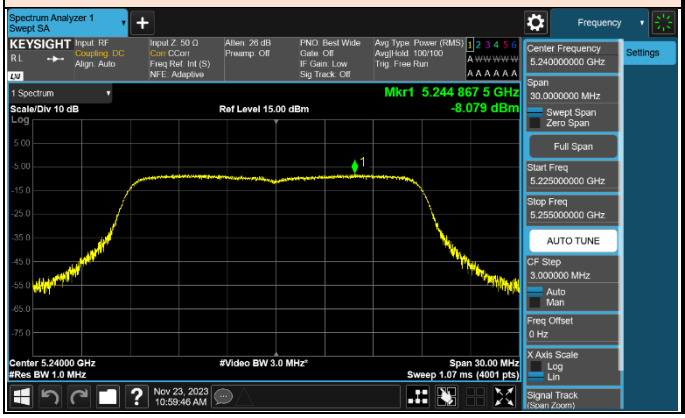
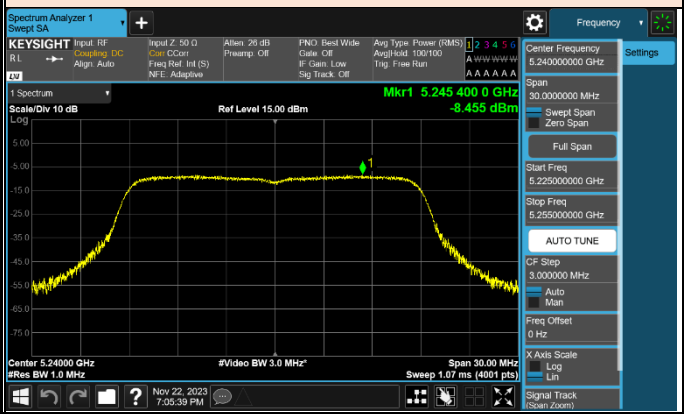
Test Mode	Band	Tested Frequency	Measured Power [dBm]					
			12 V			24 V		
			Reading	T.F	Result	Reading	T.F	Result
TM 1	NII 1	5 180	-7.00	NA	-7.00	-7.60	NA	-7.60
		5 200	-6.59		-6.59	-7.09		-7.09
		5 240	-6.43		-6.43	-6.93		-6.93
	NII 3	5 745	-18.38	6.99	-11.39	-18.41	6.99	-11.42
		5 785	-19.31		-12.32	-19.57		-19.57
		5 825	-19.70		-12.71	-20.17		-20.17
TM 2	NII 1	5 180	-7.56	NA	-7.56	-7.96	NA	-7.96
		5 200	-7.12		-7.12	-7.50		-7.50
		5 240	-8.08		-8.08	-8.46		-8.46
	NII 3	5 745	-19.36	6.99	-12.37	-19.83	6.99	-12.84
		5 785	-19.62		-19.62	-19.90		-19.90
		5 825	-19.64		-19.64	-20.62		-20.62
TM 3	NII 1	5 190	-11.23	NA	-11.23	-11.73	NA	-11.73
		5 230	-11.22		-11.22	-11.97		-11.97
	NII 3	5 755	-22.64	6.99	-15.65	-23.42	6.99	-16.43
		5 795	-23.77		-16.78	-24.02		-24.02
TM 4	NII 1	5 210	-13.84	NA	-13.84	-14.18	NA	-14.18
	NII 3	5 775	-25.10	6.99	-18.11	-25.18	6.99	-18.19

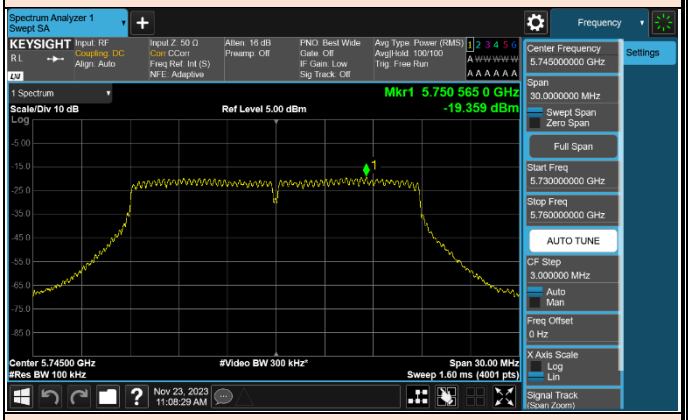
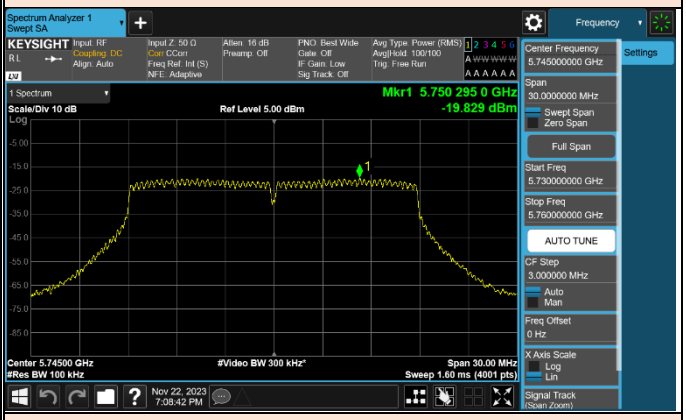
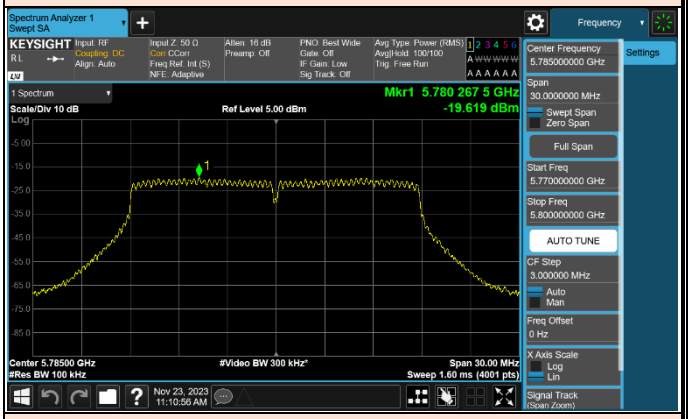
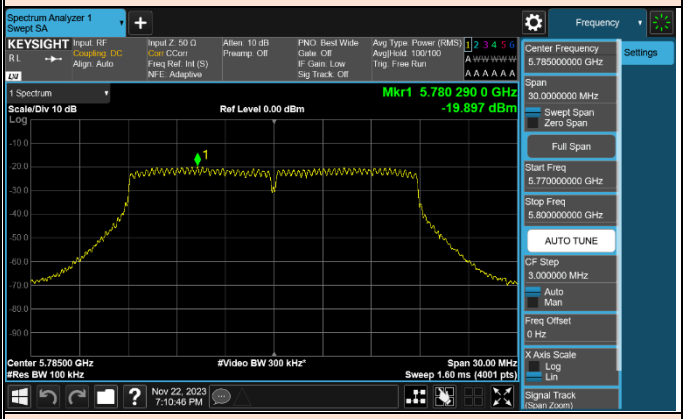
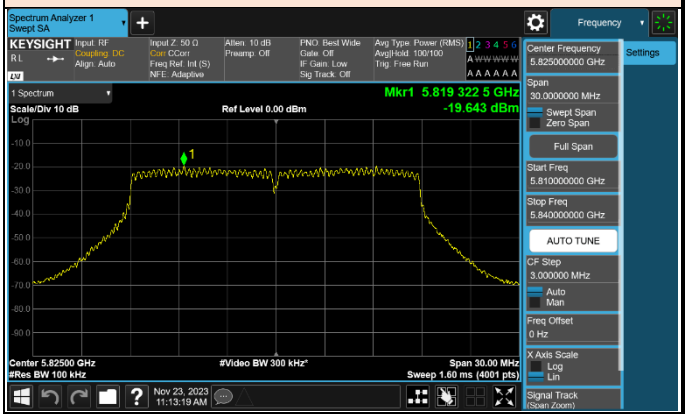
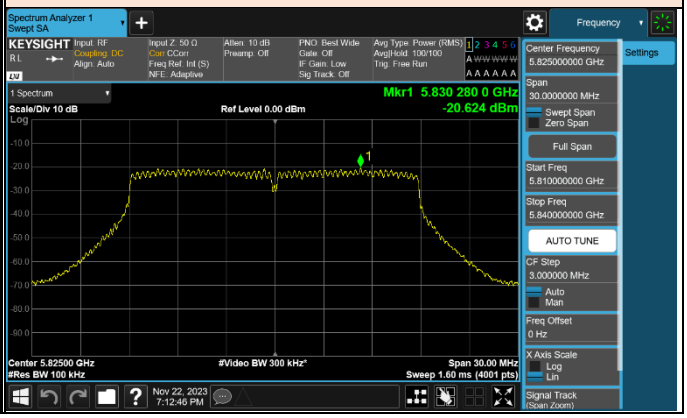
Note 1: The intent is to test at 100 % duty cycle.
Note 2: NII 3 [T.F] = 10*LOG(500kHz/100kHz) + DCCF"
Note 3: Test Result = Measurement Data + T.F

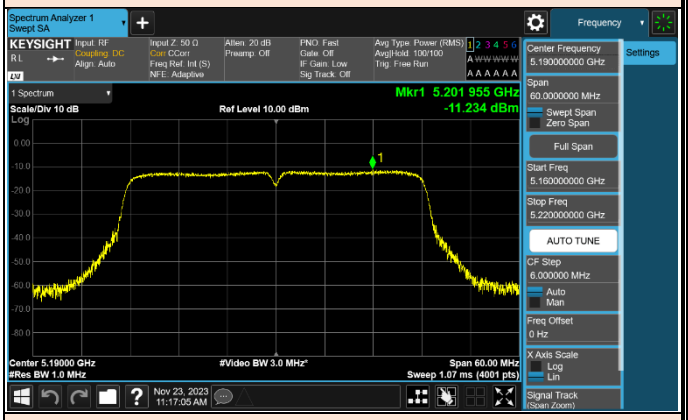
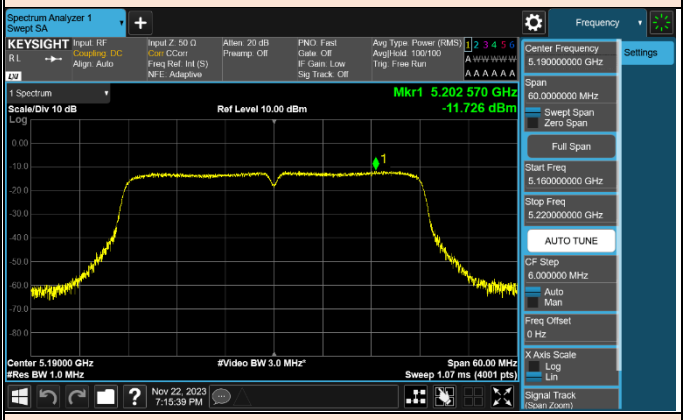
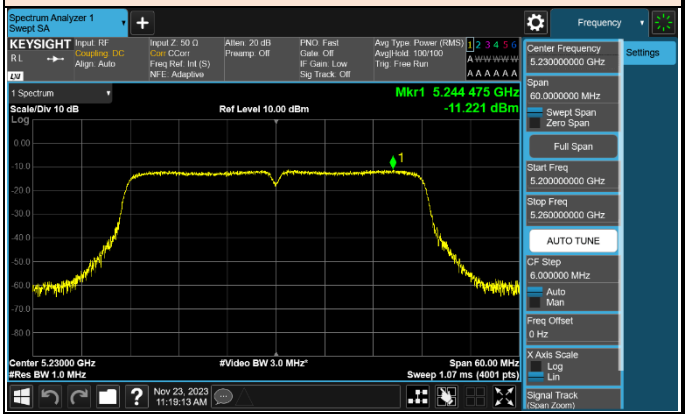
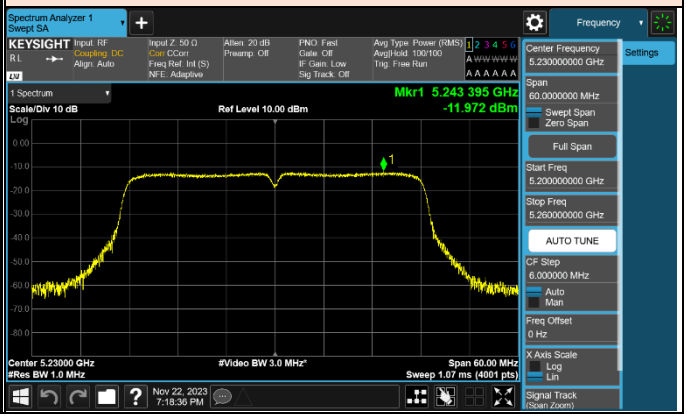
[Test Plot of Maximum Power Spectral Density]

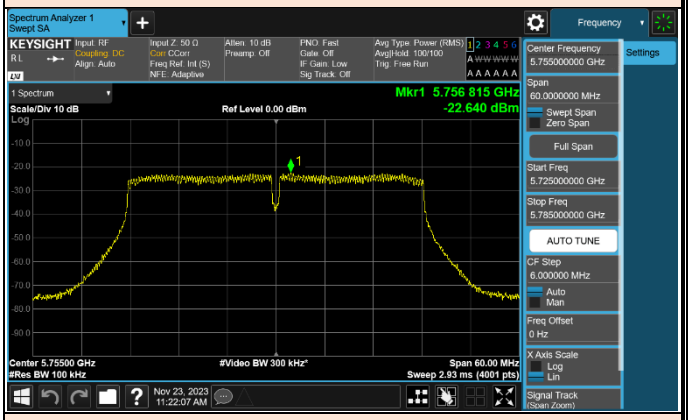
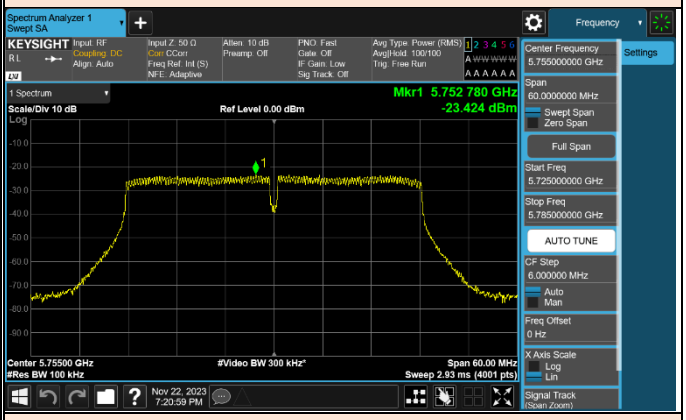
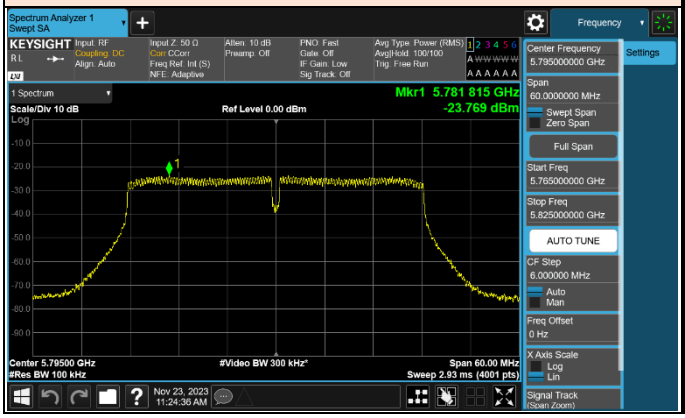
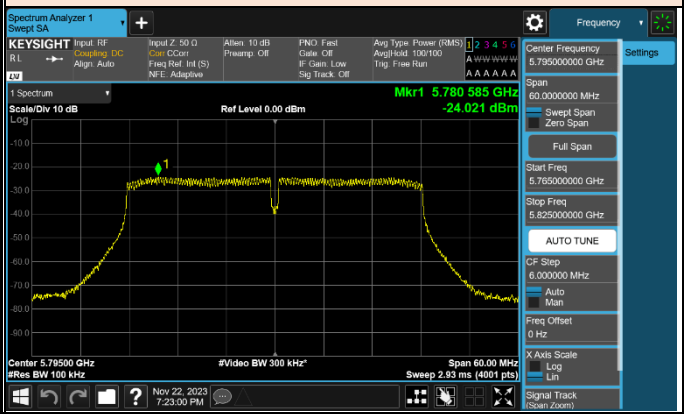
TM 1 _ NII 1	
12 V	24 V
5 180 MHz	5 180 MHz
	
5 200 MHz	5 200 MHz
	
5 240 MHz	5 240 MHz
	

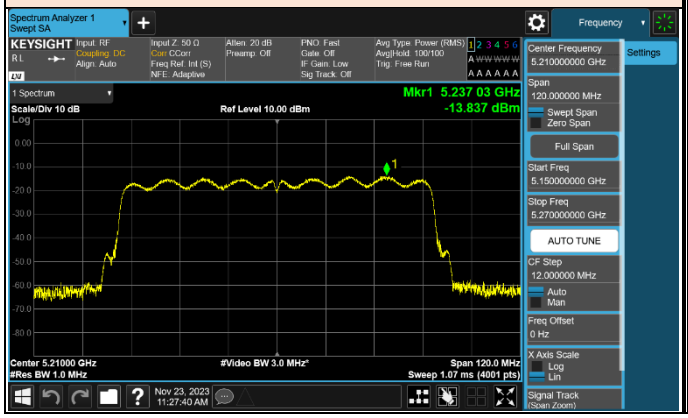
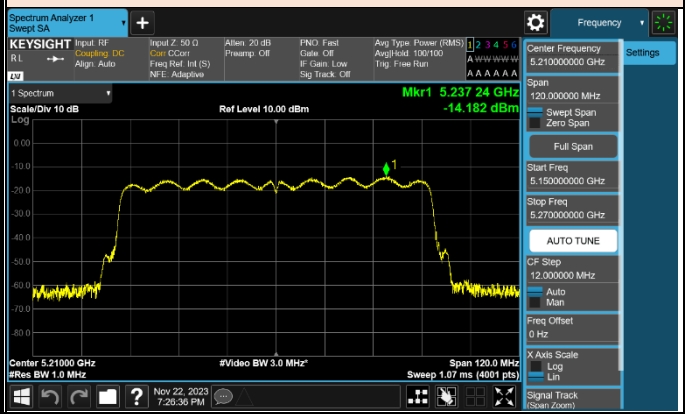
TM 1 _ NII 3	
12 V	24 V
5 745 MHz	5 745 MHz
	
5 785 MHz	5 785 MHz
	
5 825 MHz	5 825 MHz
	

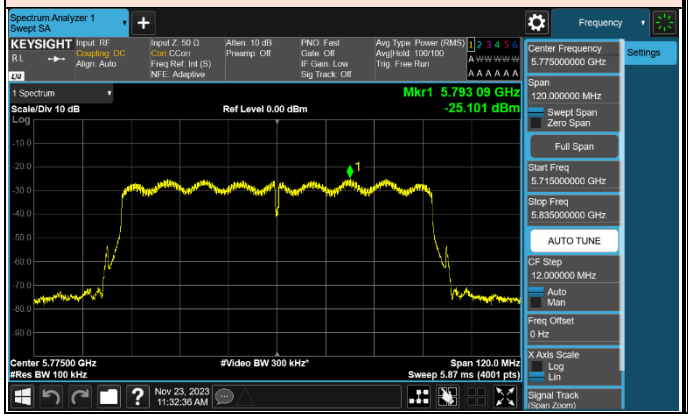
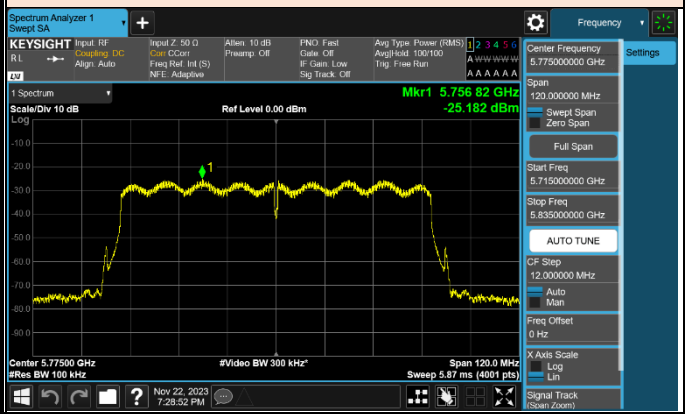
TM 2_ NII 1	
12 V	**24 V**
5 180 MHz	**5 180 MHz**
	
5 200 MHz	**5 200 MHz**
	
5 240 MHz	**5 240 MHz**
	

TM 2_ NII 3	
12 V	24 V
5 745 MHz	5 745 MHz
	
5 785 MHz	5 785 MHz
	
5 825 MHz	5 825 MHz
	

TM 3 _ NII 1	
12 V	24 V
5 190 MHz	5 190 MHz
	
5 230 MHz	5 230 MHz
	

TM 3 _ NII 3	
ANT 1	**ANT 2**
5 755 MHz	**5 755 MHz**
	
5 795 MHz	**5 795 MHz**
	

TM 4 _ NII 1	
12 V	24 V
5 210 MHz	5 210 MHz
	

TM 4 _ NII 3	
12 V	24 V
5 775 MHz	5 775 MHz
	

3.6 Duty Cycle

3.6.1 Test Procedure

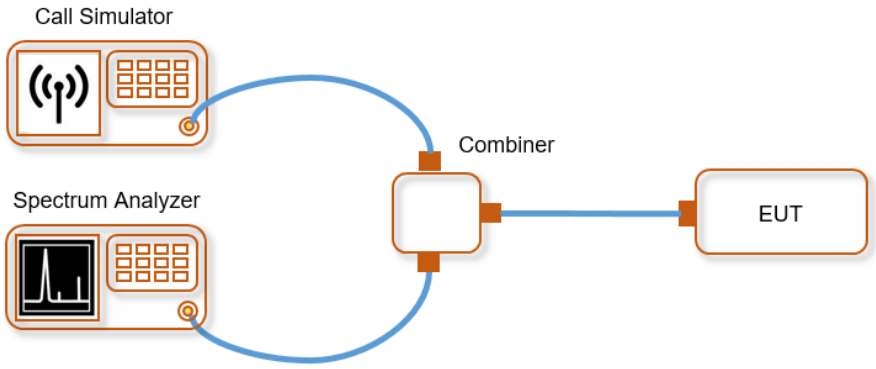
Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure of KDB789033 D02v02r01

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)

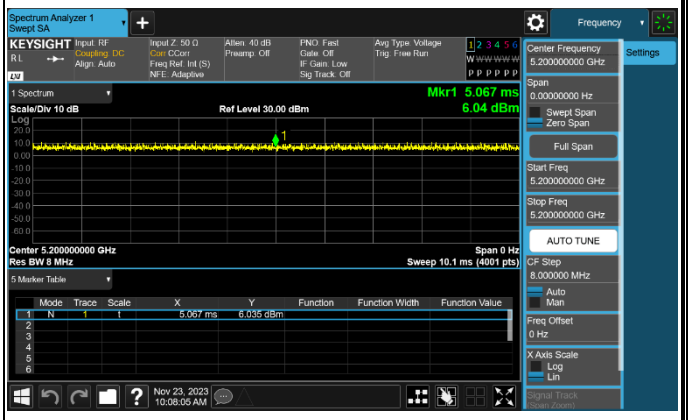
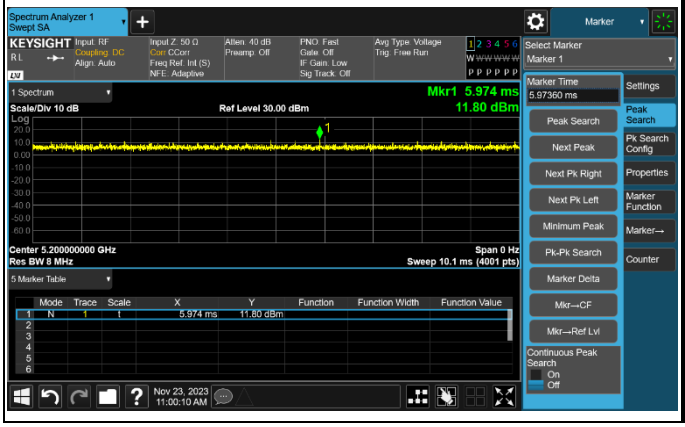
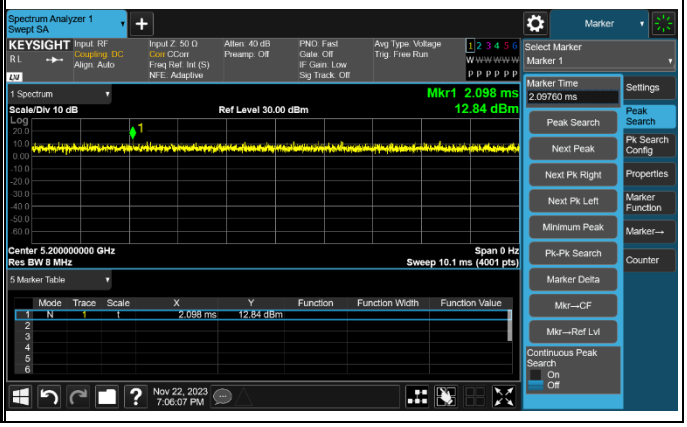
3.6.2 Test Setup

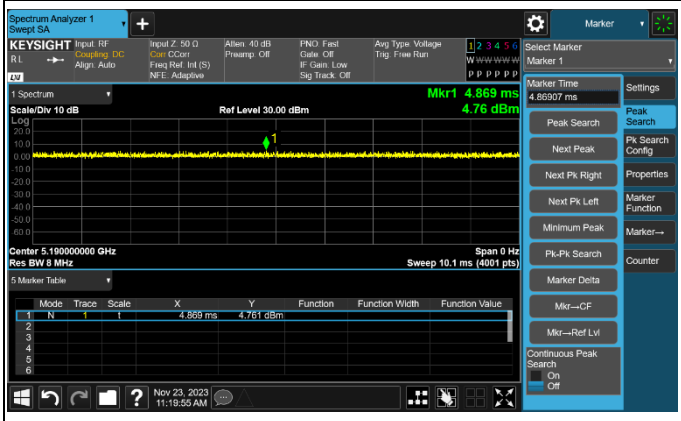
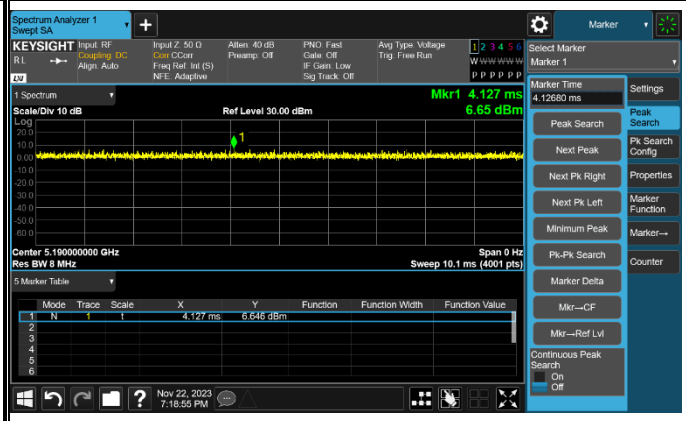
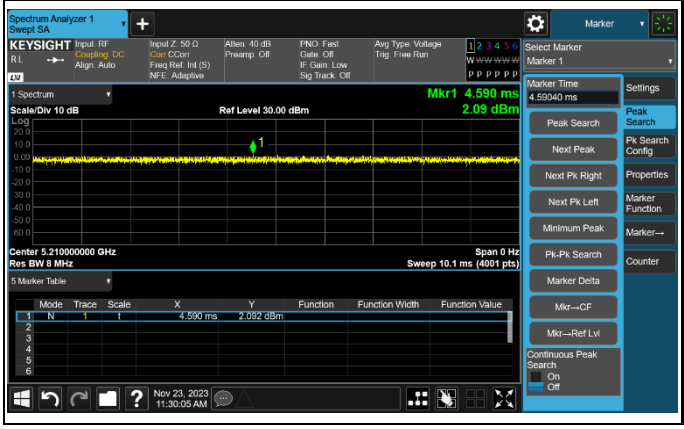
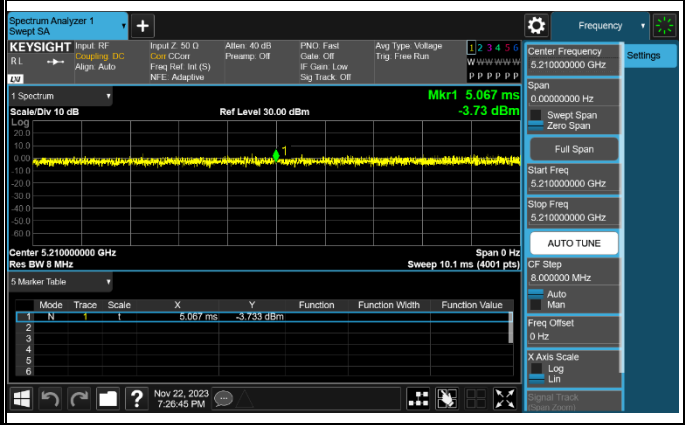


3.6.3 Test Result

Test Mode	On Time [ms]	Period [ms]	Duty Cycle [X]	Duty Cycle [D]	DCCF [dB]
TM 1	1	1	1.000	100.00	0.00
TM 2	1	1	1.000	100.00	0.00
TM 3	1	1	1.000	100.00	0.00
TM 4	1	1	1.000	100.00	0.00

[Test Plot of Duty Cycle]

12V	24V
TM 1	TM 1
	
TM 2	TM 2
	

12V	24V
TM 3	TM 3
	
TM 4	TM 4
	

3.7 Spurious Emission, Band edge and Restricted Bands

3.7.1 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)(7) 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 in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

3.7.2 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.

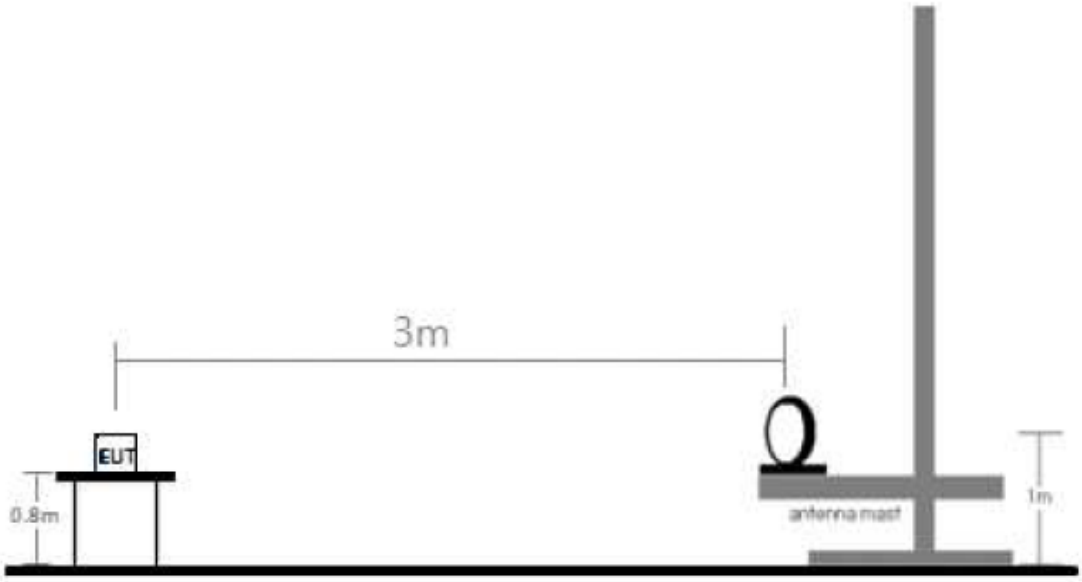
(v) Sweep time = Auto.

(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.

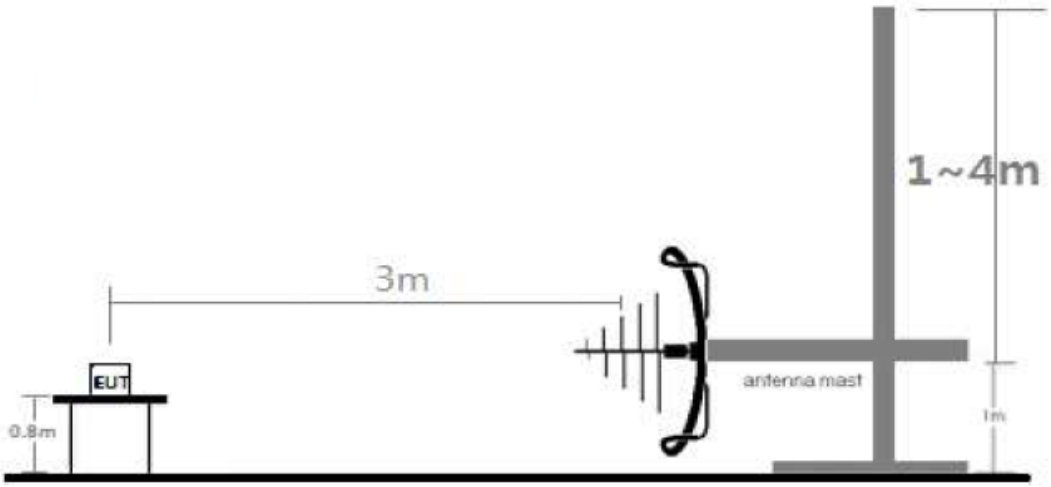
- Sample Calculation

- Field Strength Level [dBµV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m] + Duty Cycle Correction [dB]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable loss [dB]
- Margin [dB] = Field Strength Level [dBµV/m] – Limit [dBµV/m]

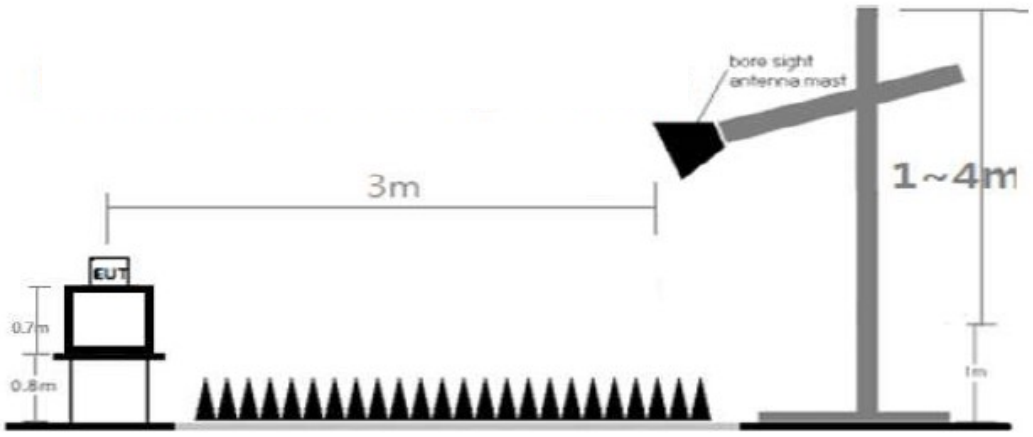
3.7.3 Test Setup

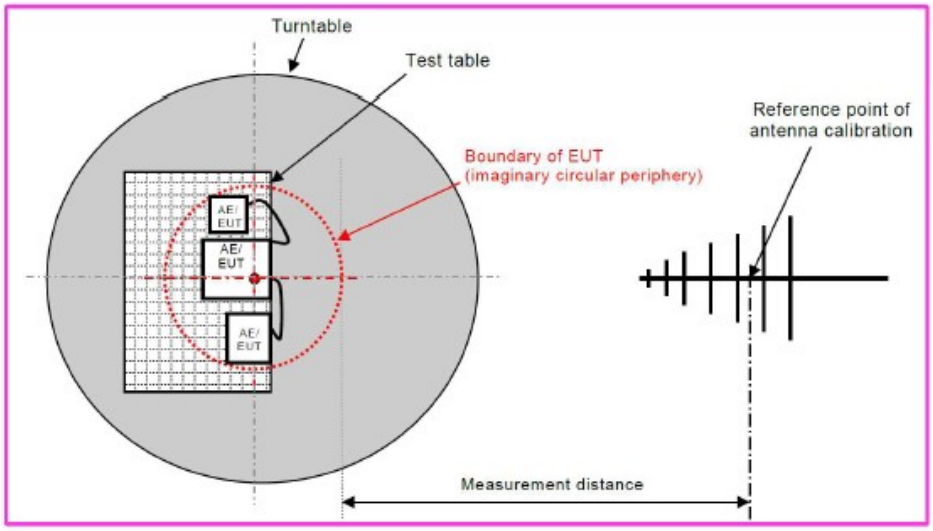


[Radiated Emission Test Setup Below 30 MHz]



[Radiated Emission Test Setup Below 1 GHz]





[Radiated Emission Test Setup Above 1 GHz]

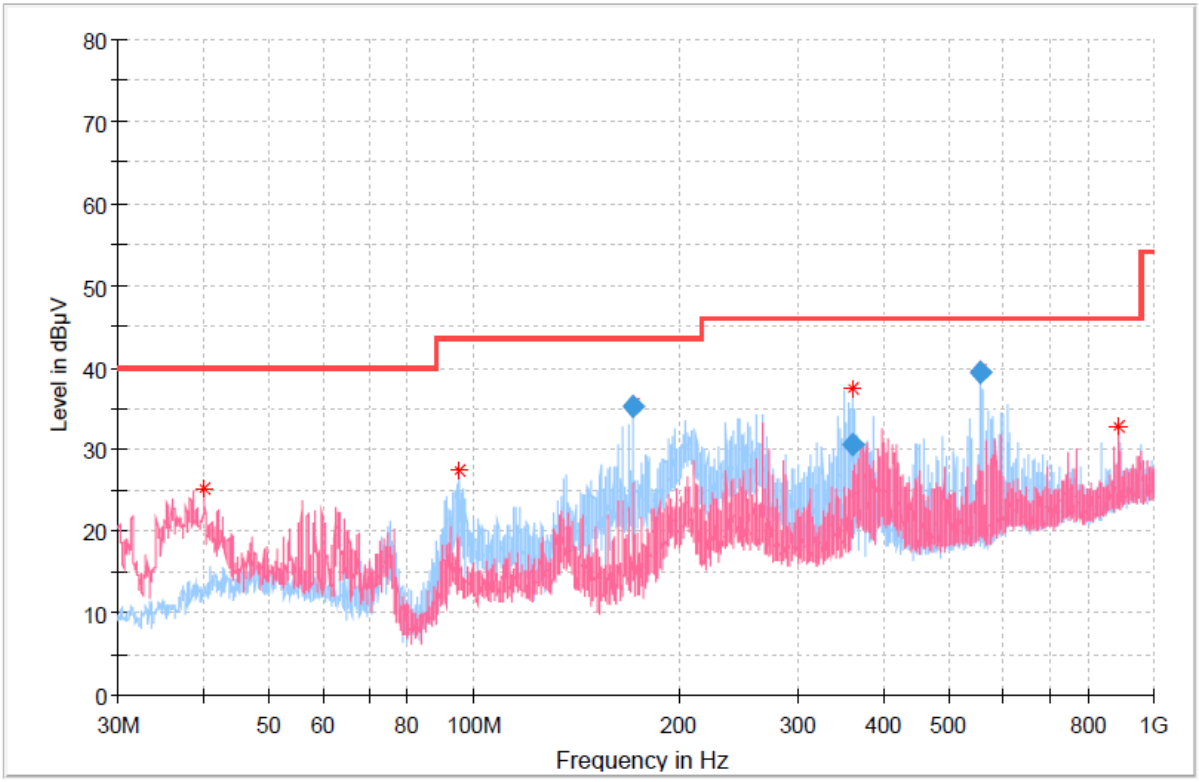
3.7.4 Test Result of Radiated Spurious Emission

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.
5. DCCF = Duty Cycle Correction Factor.
6. No other spurious and harmonic emissions were found greater than listed emissions on above table
7. If the measured peak value satisfies the AVG LIMIT, the AVG value was not written.

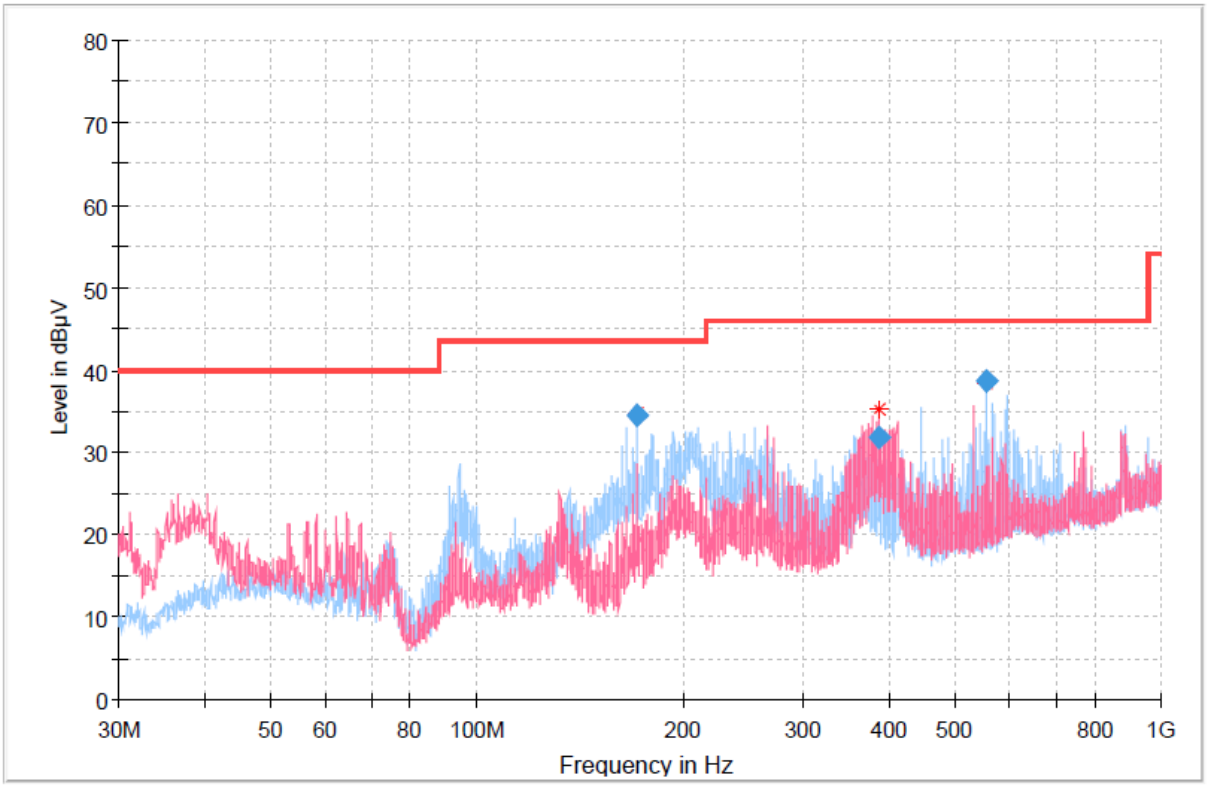
3.7.4.1 Radiated Emissions (Below 1 GHz)

Worst case – RSE (Below 1 GHz)_TM 1_SISO (NII 1)



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]
5 240	0.6201	20.89	H	X	Quasi Peak	0.00	-19.70	1.19	31.75	30.56
	1.5865	6.22	V	X	Quasi Peak	0.00	-19.60	-13.38	23.60	36.98
	555.3035	53.22	H	X	Quasi Peak	0.00	-13.90	39.32	46.00	6.68

Worst case – RSE (Below 1 GHz)_TM 1_SISO (NII 3)



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]
5 745	0.6201	20.53	H	X	Quasi Peak	0.00	-19.70	0.83	31.75	30.93
	1.2171	6.81	V	X	Quasi Peak	0.00	-19.70	-12.89	25.90	38.79
	555.3520	52.53	H	X	Quasi Peak	0.00	-13.90	38.63	46.00	7.37

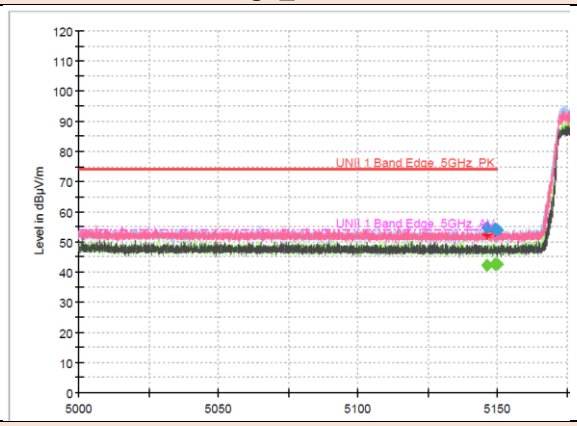
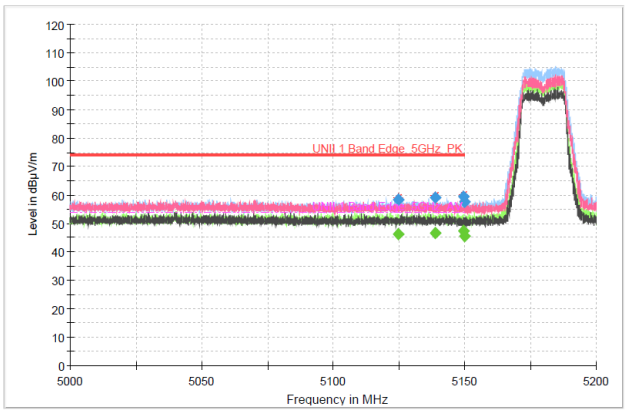
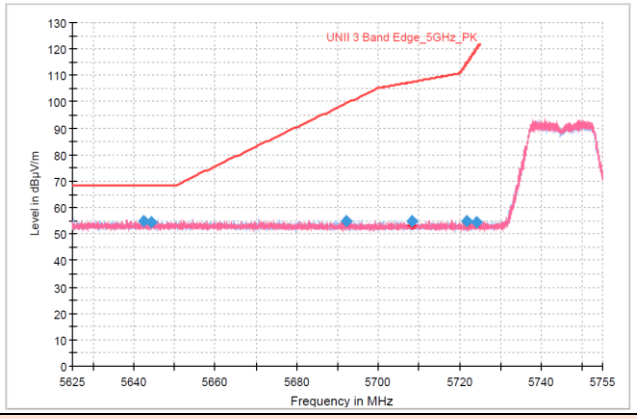
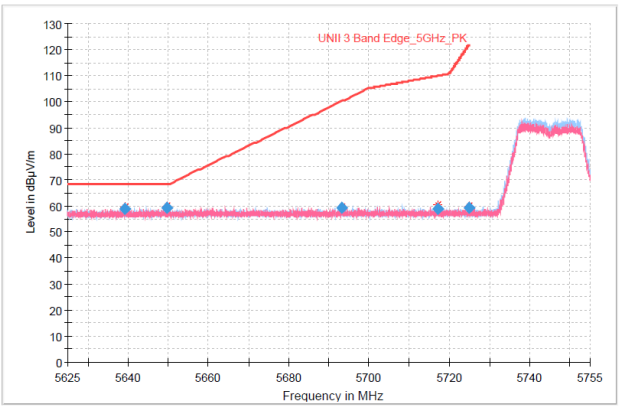
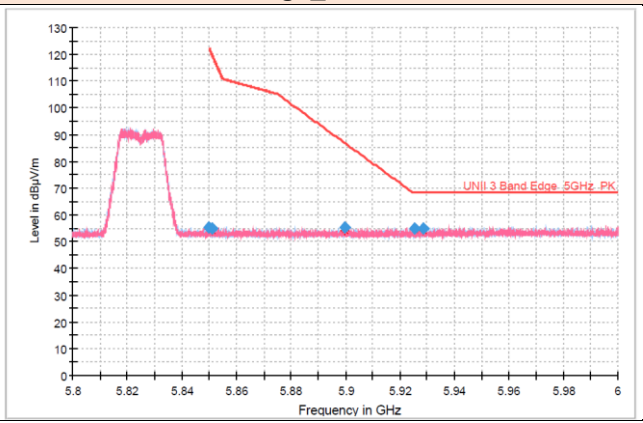
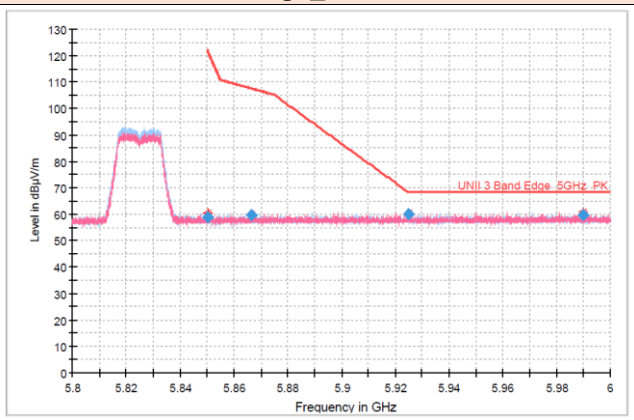
3.7.4.2 Radiated Emissions (Above 1 GHz)

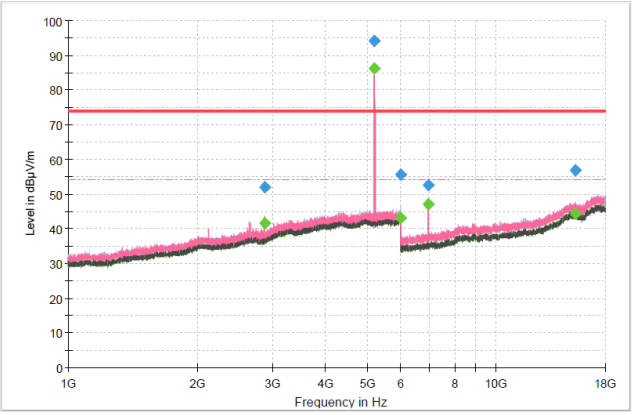
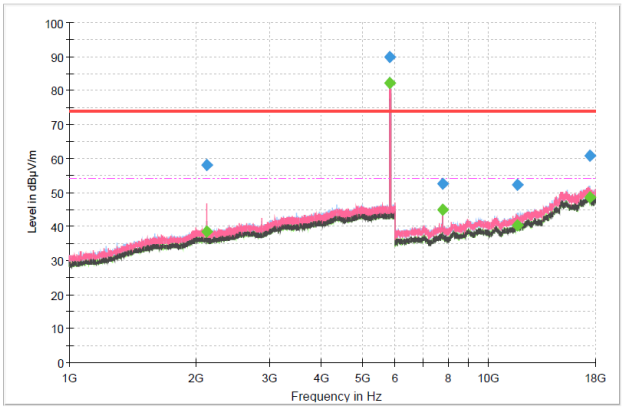
TM 1_12 V

5 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 1	5 180	5 146.10	42.64	V	X	Peak	0.00	11.90	54.54	74.00	19.46
		5 149.22	30.54	V	X	Average	0.00	11.90	42.44	54.00	11.56
		5 760.16	43.06	V	X	Peak	0.00	12.70	55.76	74.00	18.24
		6 906.38	39.66	V	X	Average	0.00	7.00	46.66	54.00	7.34
		14 570.25	36.76	V	X	Peak	0.00	19.00	55.76	74.00	18.24
	5 200	6 933.38	40.07	V	X	Average	0.00	7.10	47.17	54.00	**6.83**
		15 294.00	37.22	V	X	Peak	0.00	19.60	56.82	74.00	17.18
	5 240	17 530.88	36.33	H	X	Peak	0.00	22.60	58.93	74.00	15.07
		17 530.88	24.18	H	X	Average	0.00	22.60	46.78	54.00	7.22
NII 3	5 745	5 642.41	41.83	V	X	Peak	0.00	12.90	54.73	68.20	13.47
		5 724.20	41.66	V	X	Peak	0.00	12.70	54.36	120.38	66.02
		15 300.75	38.23	H	X	Peak	0.00	19.60	57.83	74.00	16.17
		15 300.75	24.72	H	X	Average	0.00	19.60	44.32	54.00	9.68
	5 785	14 891.63	37.12	H	X	Peak	0.00	19.40	56.52	74.00	17.48
		14 891.63	24.88	H	X	Average	0.00	19.40	44.28	54.00	9.72
	5 825	5 850.06	42.27	H	X	Peak	0.00	12.80	55.07	122.06	66.99
		5 925.46	41.82	V	X	Peak	0.00	13.10	54.92	68.20	13.28
		17 450.25	37.45	V	X	Peak	0.00	22.70	60.15	74.00	13.85
		17 450.25	24.31	V	X	Average	0.00	22.70	47.01	54.00	**6.99**

TM 1_24 V

5 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 1	5 180	5 149.64	46.84	H	X	Peak	0.00	12.60	59.44	74.00	14.56
		5 149.64	34.68	H	X	Average	0.00	12.60	47.28	54.00	**6.72**
		15 545.63	38.57	H	X	Peak	0.00	20.10	58.67	74.00	15.33
		15 545.63	26.80	H	X	Average	0.00	20.10	46.90	54.00	7.10
	5 200	15 586.50	38.34	H	X	Peak	0.00	20.10	58.44	74.00	15.56
		15 586.50	26.47	H	X	Average	0.00	20.10	46.57	54.00	7.43
	5 240	15 678.00	38.56	H	X	Peak	0.00	20.10	58.66	74.00	15.34
		15 678.00	26.92	H	X	Average	0.00	20.10	47.02	54.00	6.98
NII 3	5 745	5 649.77	45.52	H	X	Peak	0.00	13.60	59.12	68.20	9.08
		5 724.84	45.79	H	X	Peak	0.00	13.50	59.29	121.84	62.55
		17 253.38	38.83	H	X	Peak	0.00	22.40	61.23	74.00	12.77
		17 253.38	26.08	H	X	Average	0.00	22.40	48.48	54.00	5.52
	5 785	17 346.75	37.63	V	X	Peak	0.00	22.40	60.03	74.00	13.97
		17 346.75	25.55	V	X	Average	0.00	22.40	47.95	54.00	6.05
	5 825	5 850.14	45.42	H	X	Peak	0.00	13.60	59.02	121.88	62.86
		5 925.08	46.08	H	X	Peak	0.00	14.00	60.08	68.20	8.12
		17 450.25	38.24	H	X	Peak	0.00	22.50	60.74	74.00	13.26
		17 450.25	26.13	H	X	Average	0.00	22.50	48.63	54.00	**5.37**

TM 1	
12 V	**24 V**
Bandedge_5 180 MHz	**Bandedge_5 180 MHz**
	
Bandedge_5 745 MHz	**Bandedge_5 745 MHz**
	
Bandedge_5 825 MHz	**Bandedge_5 825 MHz**
	

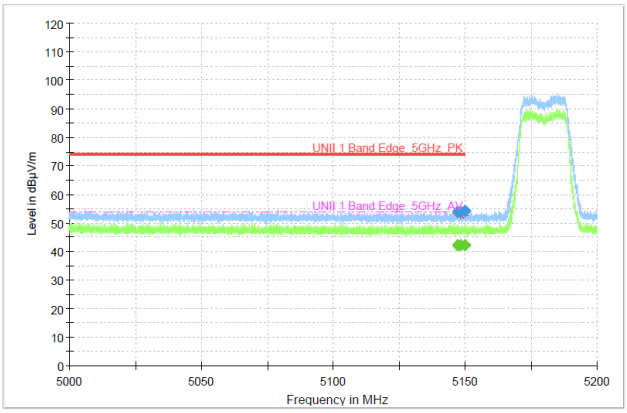
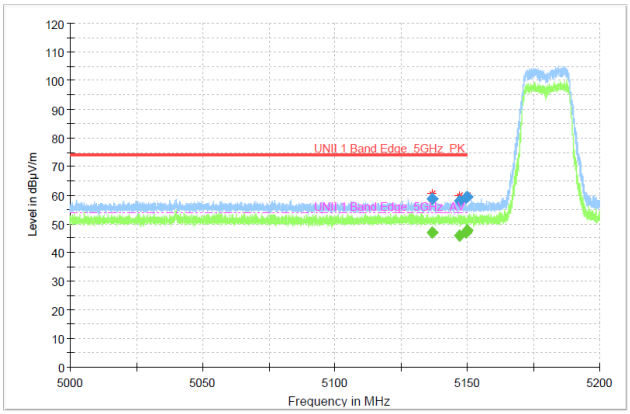
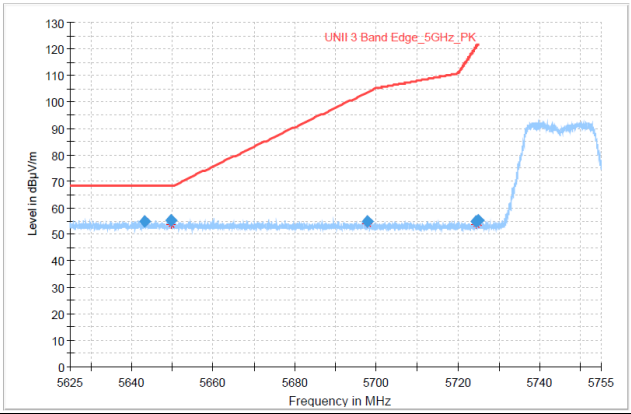
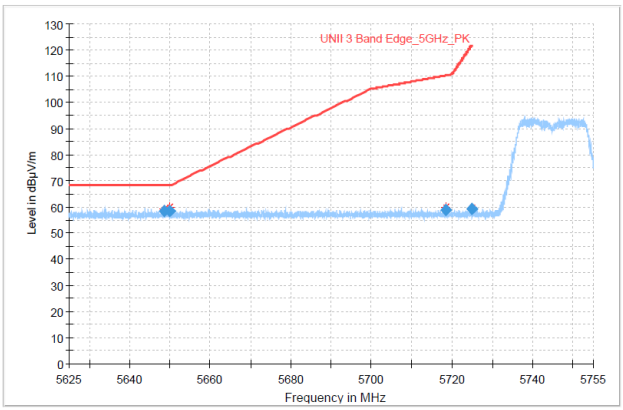
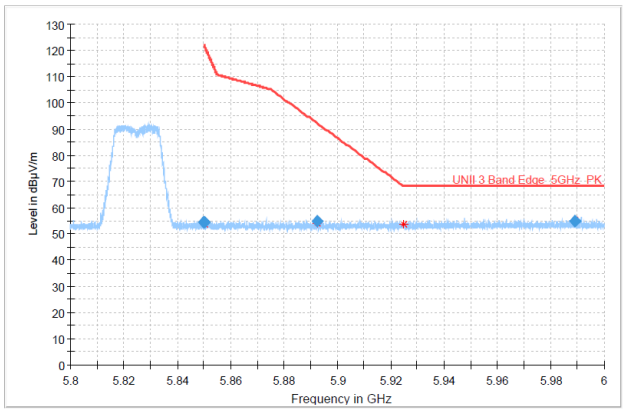
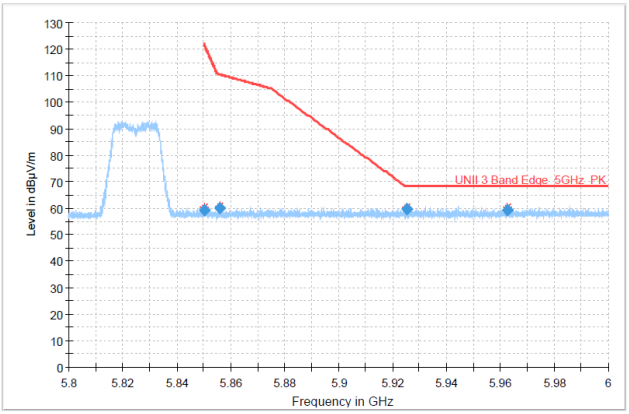
TM 1	
12 V	**24 V**
Spurious_5 200 MHz	**Spurious_5 825 MHz**
	

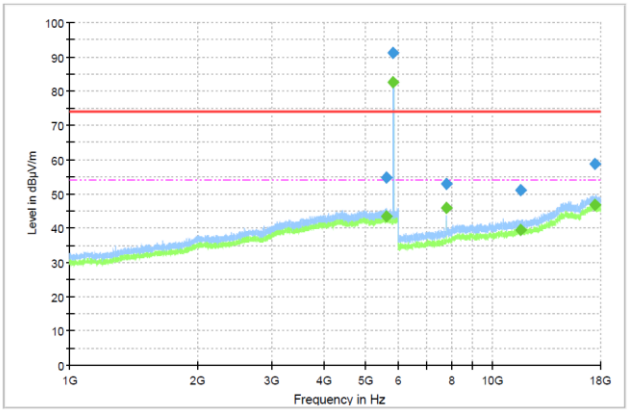
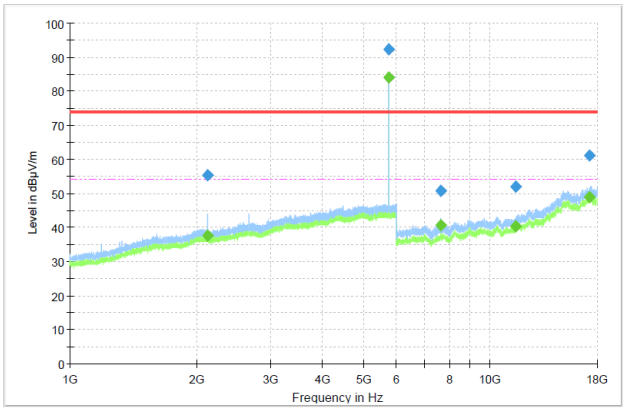
TM 2_12 V

5 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 1	5 180	5 149.80	42.35	H	X	Peak	0.00	11.90	54.25	74.00	19.75
		5 149.80	30.46	H	X	Average	0.00	11.90	42.36	54.00	11.64
		5 996.09	41.82	H	X	Peak	0.00	13.40	55.22	74.00	18.78
		6 906.38	39.29	H	X	Average	0.00	7.00	46.29	54.00	7.71
	5 200	5 955.78	42.19	H	X	Peak	0.00	13.20	55.39	74.00	18.61
		6 933.00	38.39	H	X	Average	0.00	7.10	45.49	54.00	8.51
	5 240	5 760.31	43.51	H	X	Peak	0.00	12.70	56.21	74.00	17.79
		6 986.63	38.92	H	X	Average	0.00	7.40	46.32	54.00	**7.68**
NII 3	5 745	5 649.74	42.30	H	X	Peak	0.00	12.90	55.20	68.20	13.00
		5 724.84	42.50	H	X	Peak	0.00	12.70	55.20	121.84	66.64
		17 233.50	36.13	H	X	Peak	0.00	22.30	58.43	74.00	15.57
		17 233.50	24.34	H	X	Average	0.00	22.30	46.64	54.00	7.36
	5 785	17 358.38	37.05	H	X	Peak	0.00	22.50	59.55	74.00	14.45
		17 358.38	24.28	H	X	Average	0.00	22.50	46.78	54.00	7.22
	5 825	5 850.04	41.49	H	X	Peak	0.00	12.80	54.29	122.11	67.82
		5 989.08	41.74	H	X	Peak	0.00	13.30	55.04	68.20	13.16
		17 470.50	36.03	H	X	Peak	0.00	22.70	58.73	74.00	15.27
		17 470.50	24.20	H	X	Average	0.00	22.70	46.90	54.00	**7.10**

TM 2_24 V

5 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 1	5 180	5 149.98	46.85	H	X	Peak	0.00	12.60	59.45	74.00	14.55
		5 149.98	35.09	H	X	Average	0.00	12.60	47.69	54.00	**6.31**
		15 541.50	39.08	H	X	Peak	0.00	20.10	59.18	74.00	14.82
		15 541.50	26.63	H	X	Average	0.00	20.10	46.73	54.00	7.27
	5 200	15 600.75	38.56	H	X	Peak	0.00	20.10	58.66	74.00	15.34
		15 600.75	26.57	H	X	Average	0.00	20.10	46.67	54.00	7.33
	5 240	5 995.00	45.20	H	X	Peak	0.00	13.40	58.60	74.00	15.40
		5 995.00	33.62	H	X	Average	0.00	13.40	47.02	54.00	6.98
NII 3	5 745	5 648.57	44.87	H	X	Peak	0.00	13.60	58.47	68.20	9.73
		5 724.98	45.92	H	X	Peak	0.00	13.50	59.42	122.16	62.74
		17 243.25	38.99	H	X	Peak	0.00	22.30	61.29	74.00	12.71
		17 243.25	26.77	H	X	Average	0.00	22.30	49.07	54.00	**4.93**
	5 785	17 345.63	38.04	H	X	Peak	0.00	22.40	60.44	74.00	13.56
		17 345.63	26.01	H	X	Average	0.00	22.40	48.41	54.00	5.59
	5 825	5 850.20	45.82	H	X	Peak	0.00	13.60	59.42	121.74	62.32
		5 925.20	45.81	H	X	Peak	0.00	14.00	59.81	68.20	8.39
		17 479.88	37.70	H	X	Peak	0.00	22.50	60.20	74.00	13.80
		17 479.88	26.25	H	X	Average	0.00	22.50	48.75	54.00	5.25

TM 2	
12 V	**24 V**
Bandedge_5 180 MHz	**Bandedge_5 180 MHz**
	
Bandedge_5 745 MHz	**Bandedge_5 745 MHz**
	
Bandedge_5 825 MHz	**Bandedge_5 825 MHz**
	

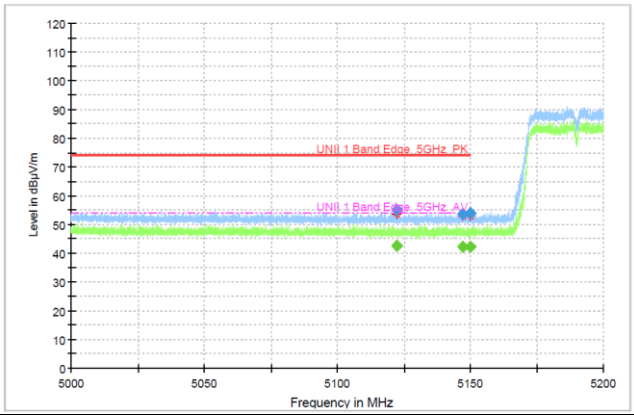
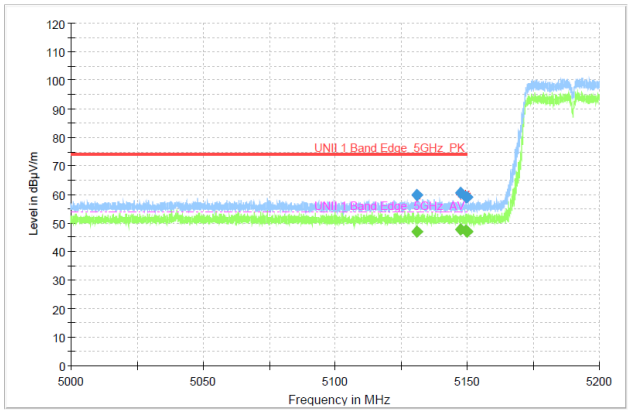
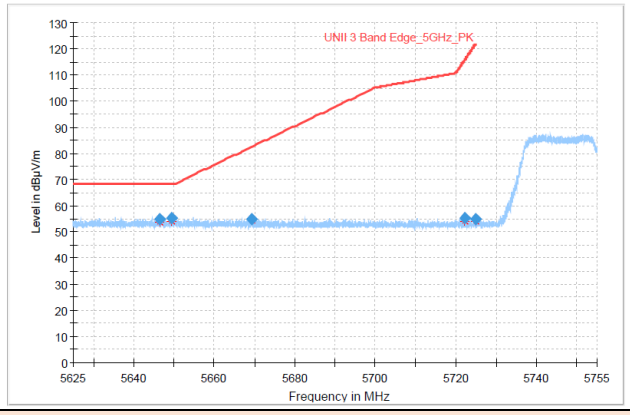
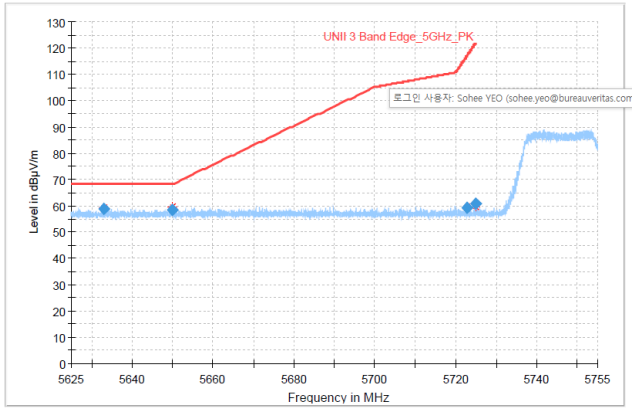
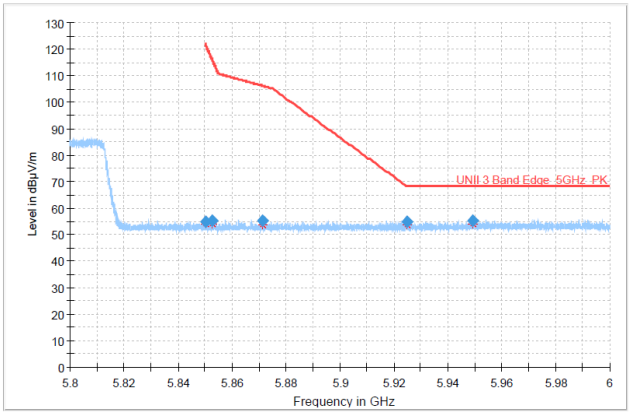
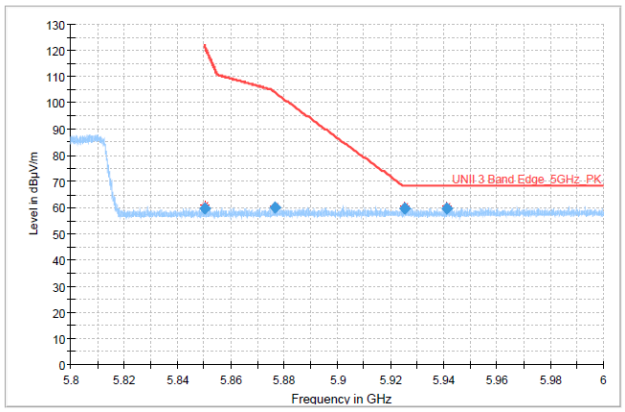
TM 2	
12 V	**24 V**
Spurious_5 825 MHz	**Spurious_5 745 MHz**
	

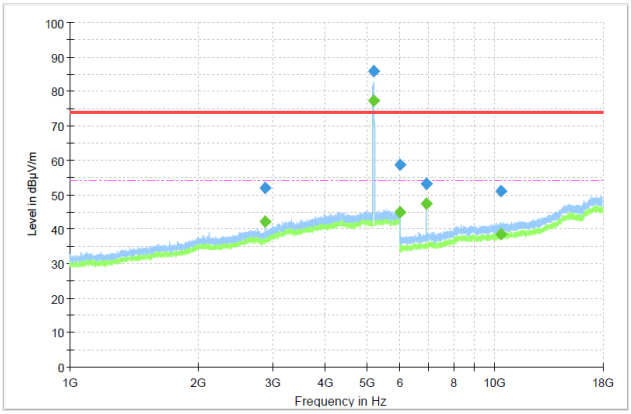
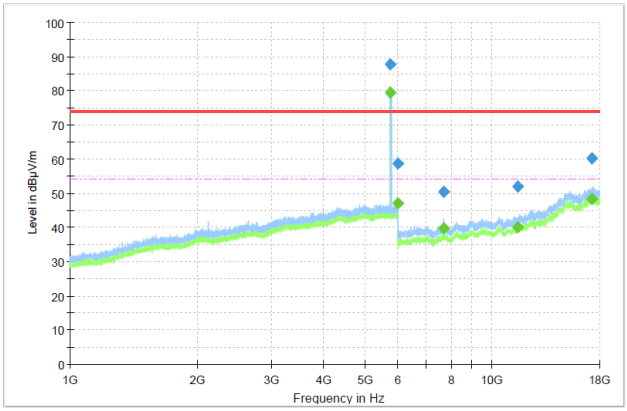
TM 3_12 V

5 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 1	5 190	5 122.38	43.10	H	X	Peak	0.00	11.90	55.00	74.00	19.00
		5 122.38	30.49	H	X	Average	0.00	11.90	42.39	54.00	11.61
		5 987.66	45.32	H	X	Peak	0.00	13.30	58.62	74.00	15.38
		6 919.88	40.34	H	X	Average	0.00	7.10	47.44	54.00	**6.56**
	5 230	5 982.19	42.39	H	X	Peak	0.00	13.30	55.69	74.00	18.31
		6 973.13	39.67	H	X	Average	0.00	7.30	46.97	54.00	7.03
NII 3	5 755	5 649.53	42.32	H	X	Peak	0.00	12.90	55.22	68.20	12.98
		5 724.96	42.24	H	X	Peak	0.00	12.70	54.94	122.10	67.16
		17 277.00	36.01	H	X	Peak	0.00	22.40	58.41	74.00	15.59
		17 277.00	24.03	H	X	Average	0.00	22.40	46.43	54.00	7.57
	5 795	5 850.32	41.97	H	X	Peak	0.00	12.80	54.77	121.47	66.70
		5 949.10	42.25	H	X	Peak	0.00	13.20	55.45	68.20	12.75
		17 370.75	36.62	H	X	Peak	0.00	22.50	59.12	74.00	14.88
		17 370.75	24.21	H	X	Average	0.00	22.50	46.71	54.00	**7.29**

TM 3_24 V

5 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 1	5 190	5 147.42	48.09	H	X	Peak	0.00	12.60	60.69	74.00	13.31
		5 147.42	35.12	H	X	Average	0.00	12.60	47.72	54.00	**6.28**
		15 570.00	38.53	H	X	Peak	0.00	20.10	58.63	74.00	15.37
		15 570.00	26.48	H	X	Average	0.00	20.10	46.58	54.00	7.42
	5 230	5 836.56	45.82	H	X	Peak	0.00	12.80	58.62	74.00	15.38
		15 694.50	26.82	H	X	Average	0.00	20.10	46.92	54.00	7.08
NII 3	5 755	5 632.98	45.23	H	X	Peak	0.00	13.60	58.83	68.20	9.37
		5 724.94	47.20	H	X	Peak	0.00	13.50	60.70	122.07	61.37
		17 270.25	37.90	H	X	Peak	0.00	22.40	60.30	74.00	13.70
		17 270.25	26.06	H	X	Average	0.00	22.40	48.46	54.00	**5.54**
	5 795	5 850.14	45.94	H	X	Peak	0.00	13.60	59.54	121.88	62.34
		5 941.02	45.77	H	X	Peak	0.00	14.00	59.77	68.20	8.43
		17 387.25	38.27	H	X	Peak	0.00	22.40	60.67	74.00	13.33

TM 3	
12 V	**24 V**
Bandedge_5 190 MHz	**Bandedge_5 190 MHz**
	
Bandedge_5 755 MHz	**Bandedge_5 755 MHz**
	
Bandedge_5 795 MHz	**Bandedge_5 795 MHz**
	

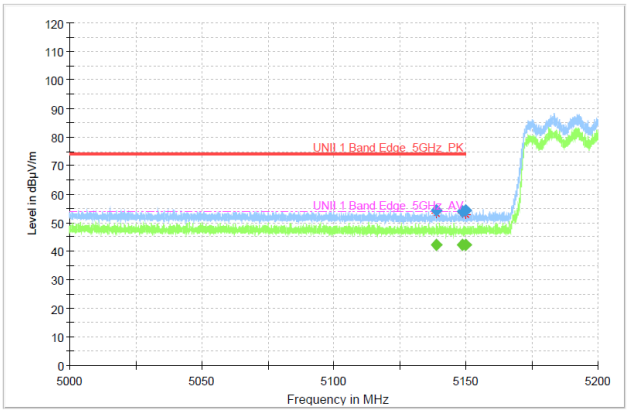
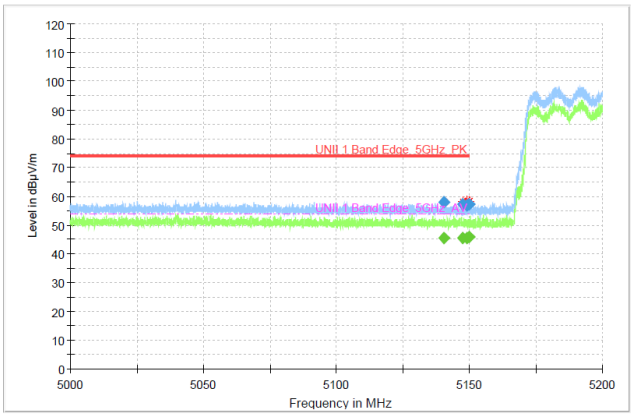
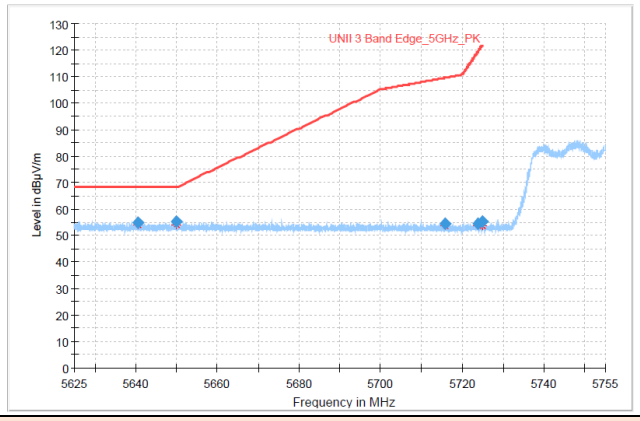
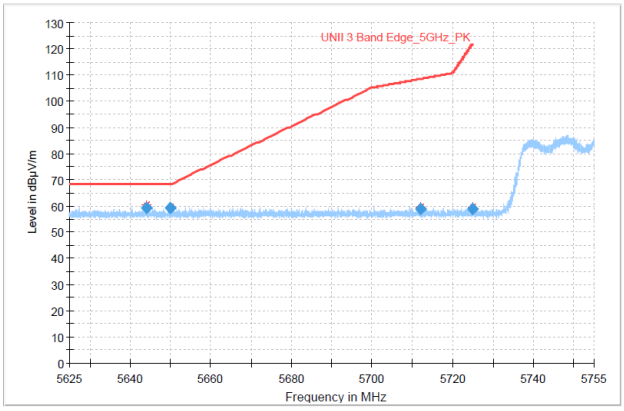
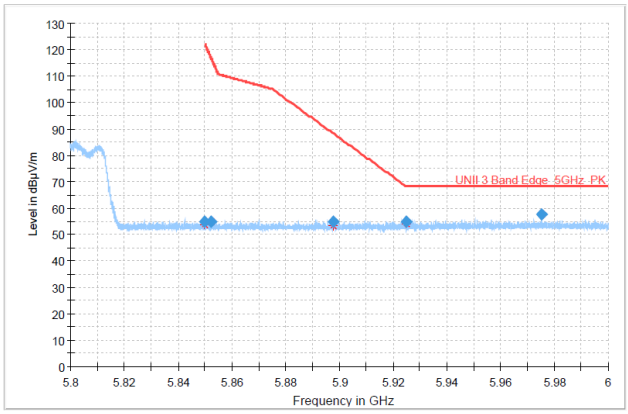
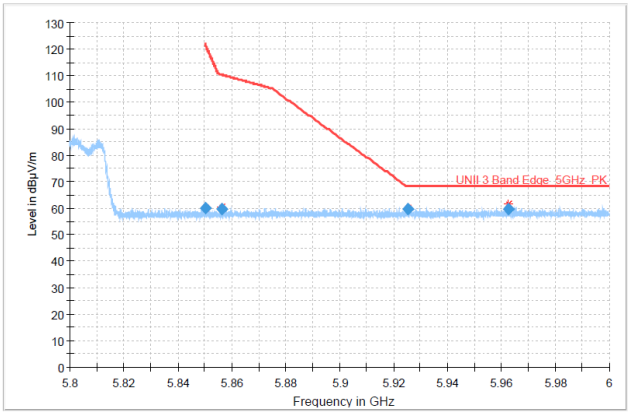
TM 3	
12 V	**24 V**
Spurious_5 190 MHz	**Spurious_5 755 MHz**
	

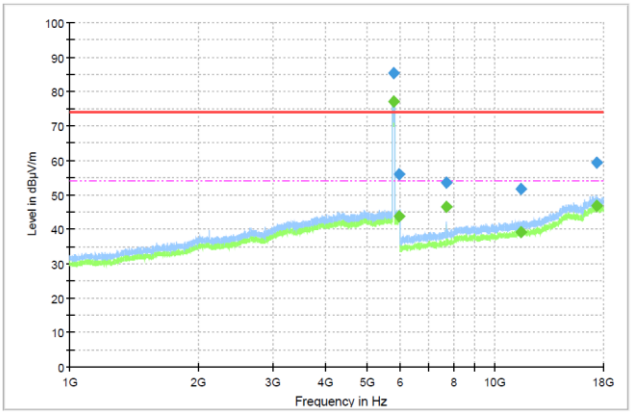
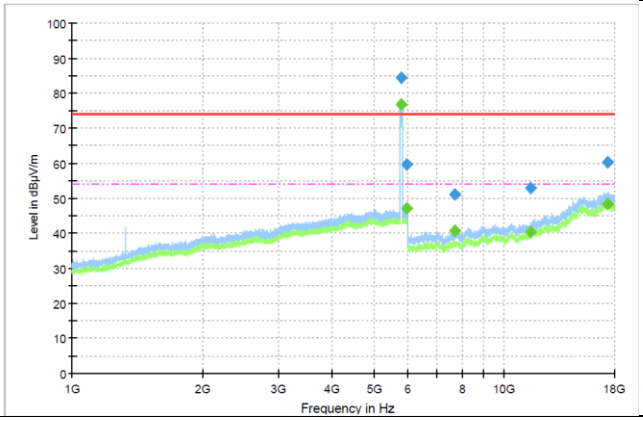
TM 4_12 V

5 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 1	5 210	5 138.86	42.57	H	X	Peak	0.00	11.90	54.47	74.00	19.53
		5 149.90	30.24	H	X	Average	0.00	11.90	42.14	54.00	11.86
		5 760.16	43.52	H	X	Peak	0.00	12.70	56.22	74.00	17.78
		6 946.50	39.27	H	X	Average	0.00	7.10	46.37	54.00	**7.63**
NII 3	5 775	5 650.03	42.20	H	X	Peak	0.00	12.90	55.10	68.22	13.12
		5 724.93	42.70	H	X	Peak	0.00	12.70	55.40	122.04	66.64
		5 850.04	42.23	H	X	Peak	0.00	12.80	55.03	122.11	67.08
		5 975.22	44.32	H	X	Peak	0.00	13.30	57.62	68.20	10.58
		17 346.75	36.79	H	X	Peak	0.00	22.50	59.29	74.00	14.71
		17 346.75	24.31	H	X	Average	0.00	22.50	46.81	54.00	**7.19**

TM 4_24 V

5 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 1	5 210	5 140.50	45.37	H	X	Peak	0.00	12.60	57.97	74.00	16.03
		5 149.98	33.18	H	X	Average	0.00	12.60	45.78	54.00	8.22
		15 291.38	26.50	H	X	Average	0.00	20.30	46.80	54.00	**7.20**
		15 330.75	38.35	H	X	Peak	0.00	20.20	58.55	74.00	15.45
NII 3	5 775	5 649.96	45.65	H	X	Peak	0.00	13.60	59.25	68.20	8.95
		5 724.98	45.24	H	X	Peak	0.00	13.50	58.74	122.16	63.42
		5 850.24	46.37	H	X	Peak	0.00	13.60	59.97	121.65	61.68
		5 962.54	45.52	H	X	Peak	0.00	14.10	59.62	68.20	8.58
		17 325.75	37.71	H	X	Peak	0.00	22.40	60.11	74.00	13.89
		17 325.75	26.02	H	X	Average	0.00	22.40	48.42	54.00	**5.58**

TM 4	
12 V	**24 V**
Bandedge_5 210 MHz	**Bandedge_5 210 MHz**
	
Bandedge_5 775 MHz_Low	**Bandedge_5 775 MHz_Low**
	
Bandedge_5 775 MHz_High	**Bandedge_5 775 MHz_High**
	

TM 4	
12 V	**24 V**
Spurious_5 775 MHz	**Spurious_5 775 MHz**
	

3.8 AC Conducted Emissions (150 kHz to 30 MHz)

3.8.1 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.

3.8.2 Test Procedure

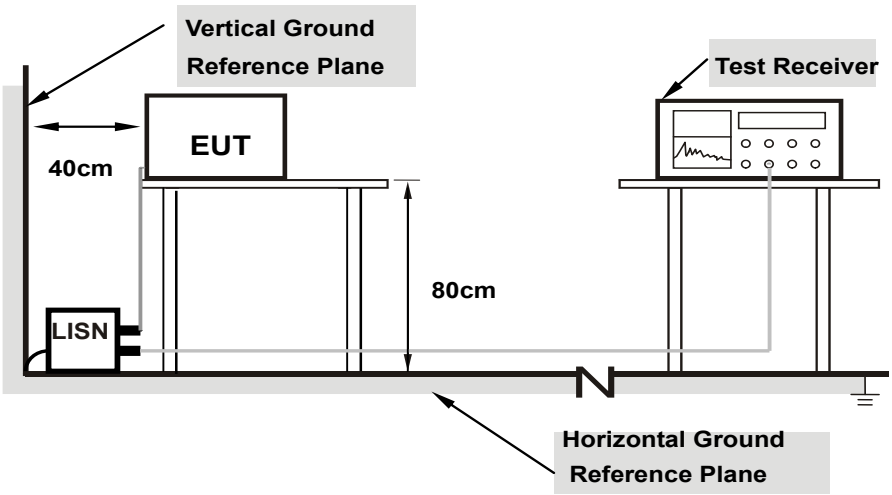
a) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50 μH of coupling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

3.8.3 Test Setup



3.8.4 Test Result

- N/A

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 -