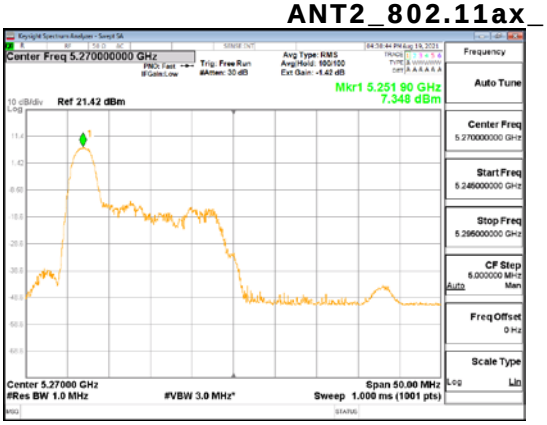
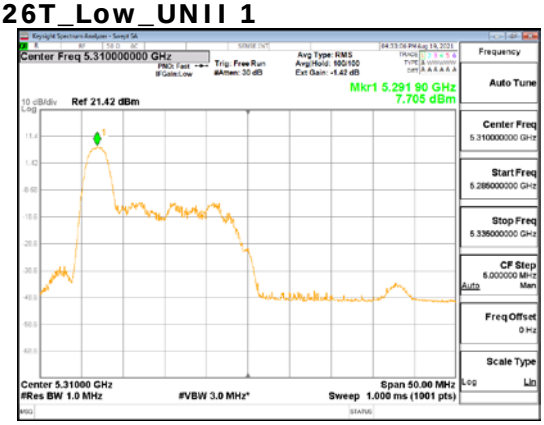
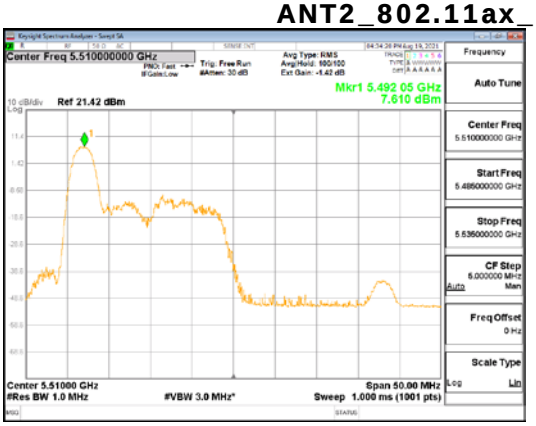
ANT1_802.11ax_HE40_26T_Low_UNII 3

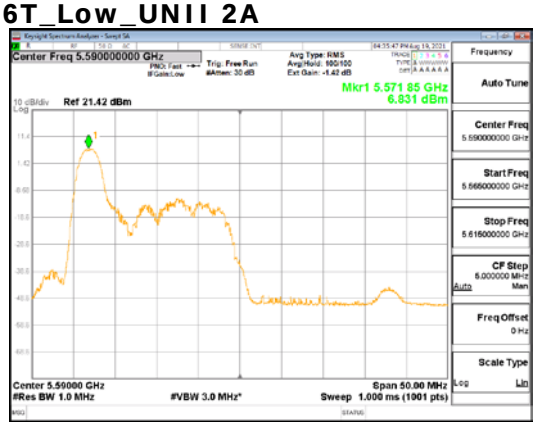
ANT2_802.11ax_HE40_26T_Low_UNII 1

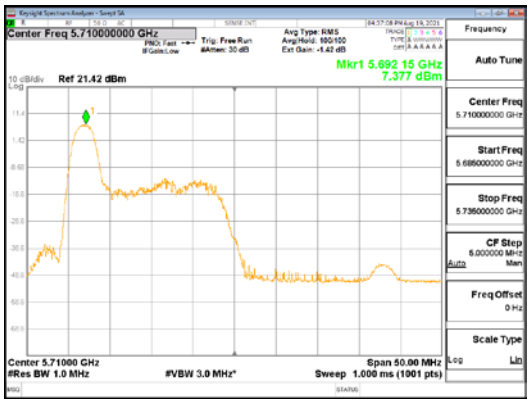




ANT2_802.11ax_HE40_26T_Low_UNII 2A

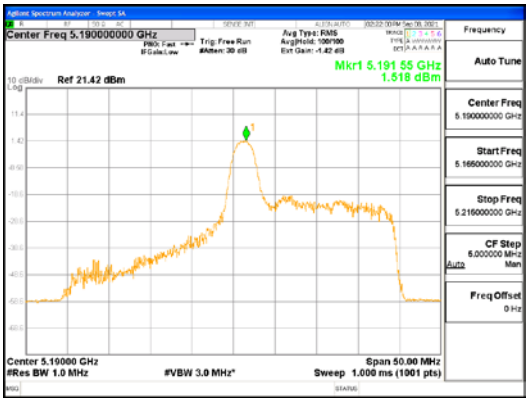


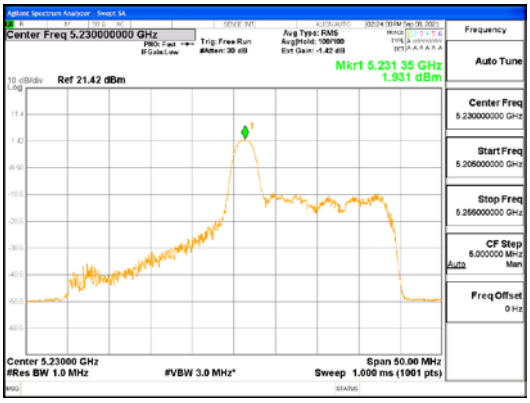




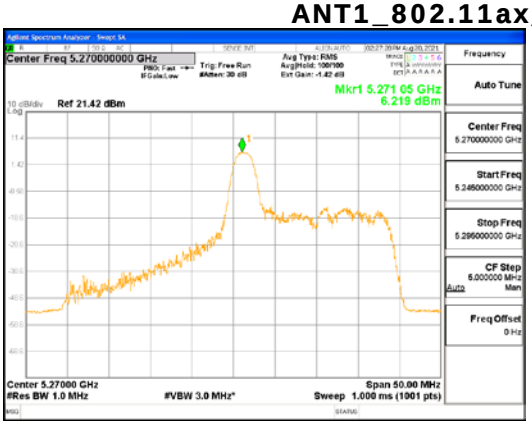
ANT2_802.11ax_HE40_26T_Low_UNII 2C

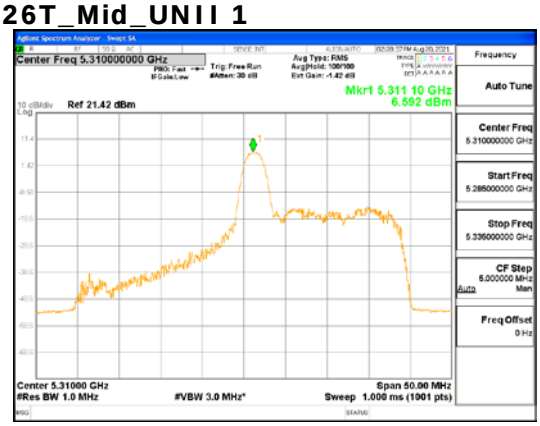
ANT2_802.11ax_HE40_26T_Low_UNII 3



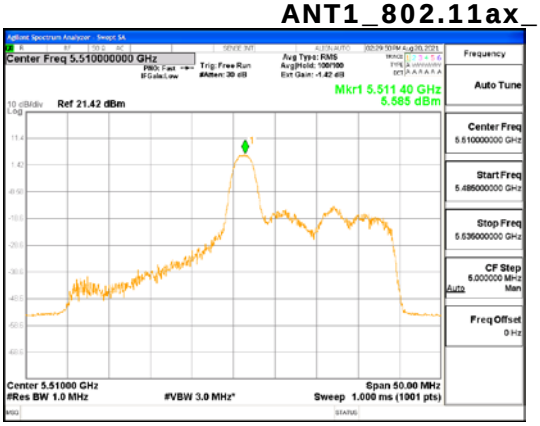


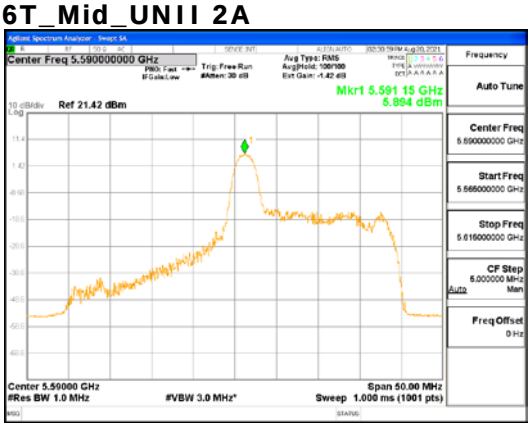
ANT1_802.11ax_HE40_26T_Mid_UNII 1





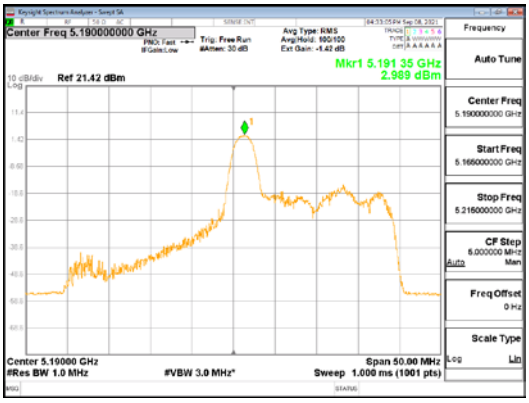
ANT1_802.11ax_HE40_26T_Mid_UNII 2A



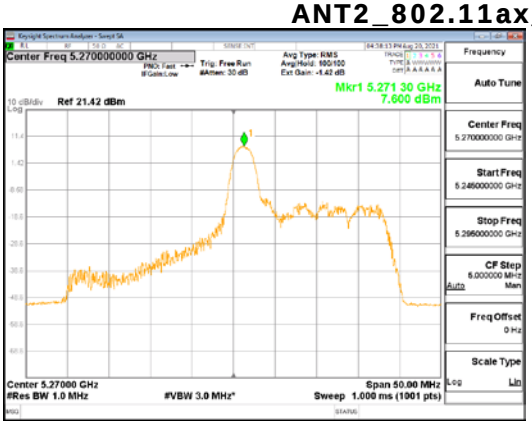


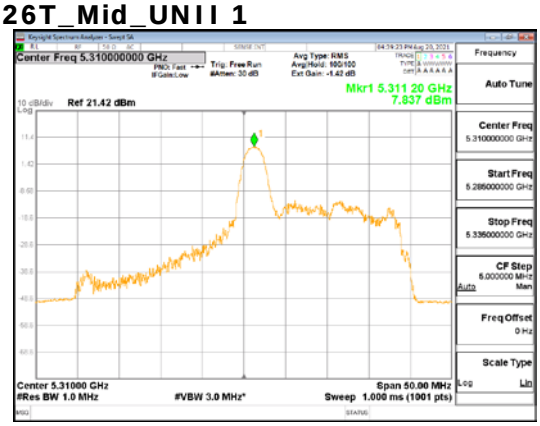
ANT1_802.11ax_HE40_26T_Mid_UNII 2C

ANT1_802.11ax_HE40_26T_Mid_UNII 3

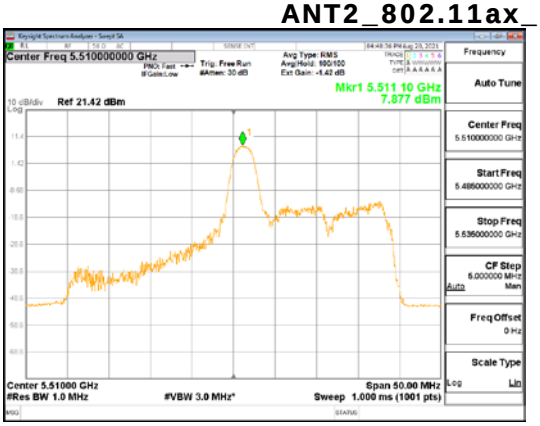


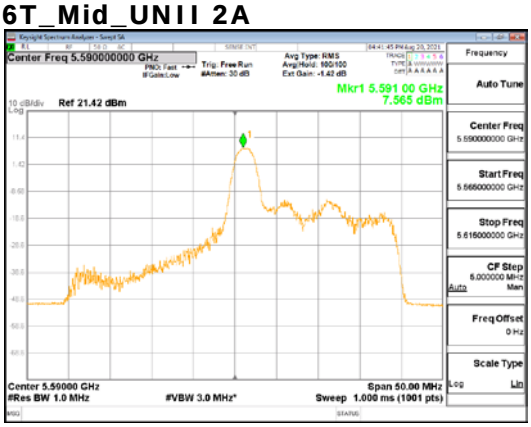
ANT2_802.11ax_HE40_26T_Mid_UNII 1

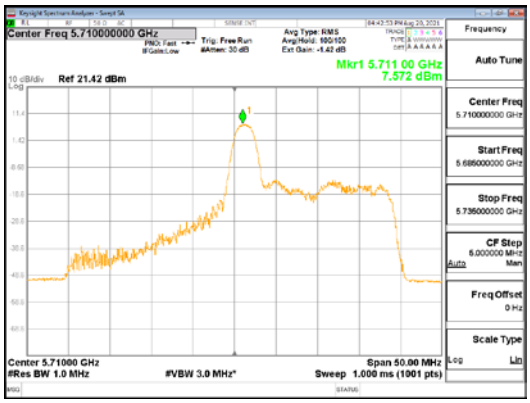




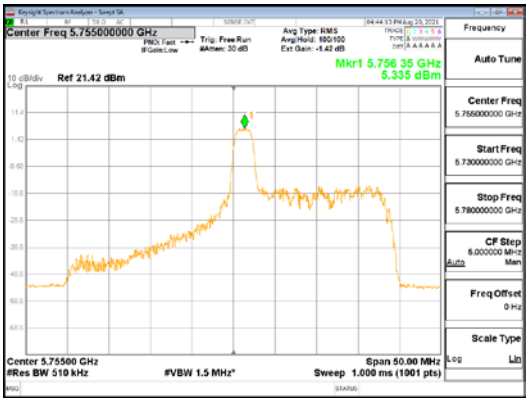
ANT2_802.11ax_HE40_26T_Mid_UNII 2A





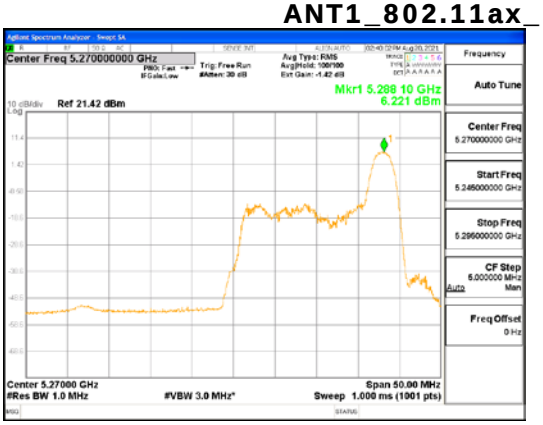


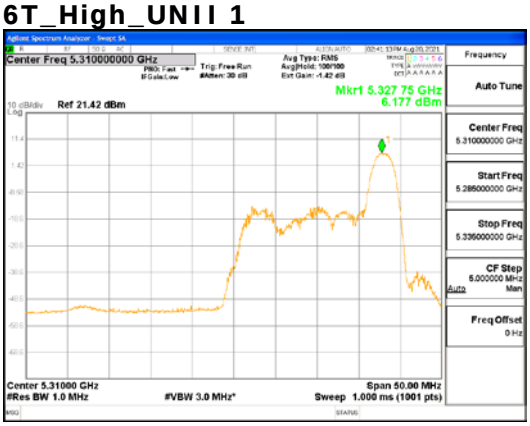
ANT2_802.11ax_HE40_26T_Mid_UNII 2C



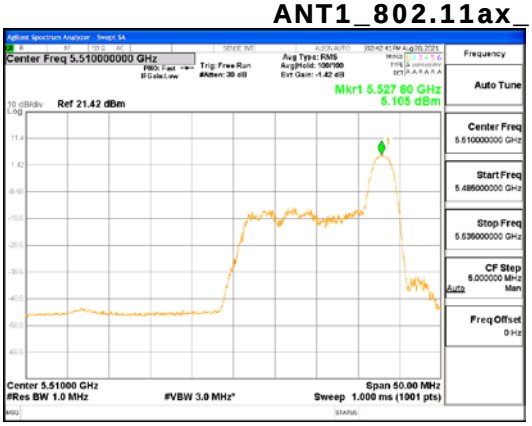
ANT2_802.11ax_HE40_26T_Mid_UNII 3

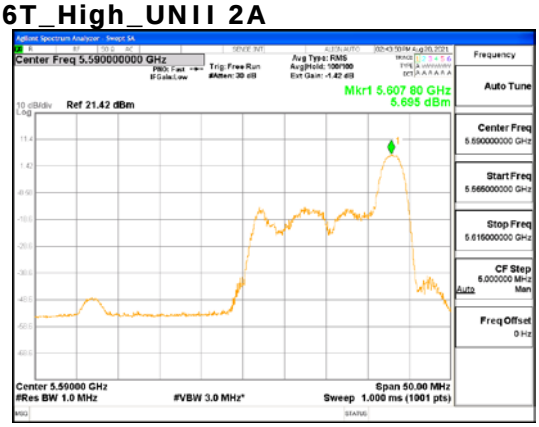
ANT1_802.11ax_HE40_26T_High_UNII 1





ANT1_802.11ax_HE40_26T_High_UNII 2A

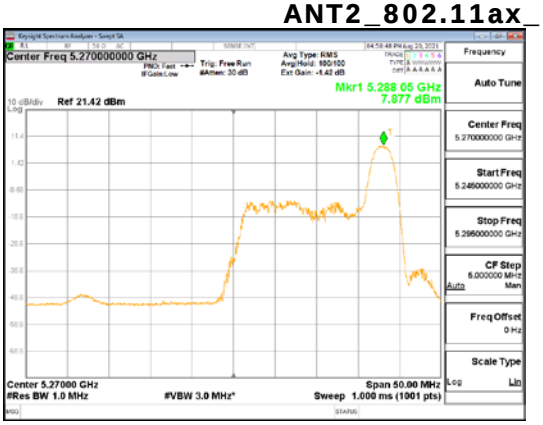


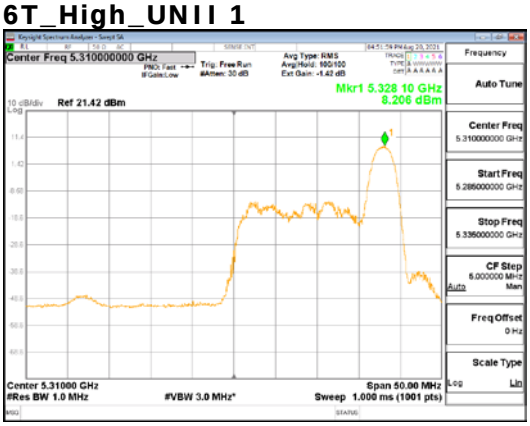


ANT1_802.11ax_HE40_26T_High_UNII 2C

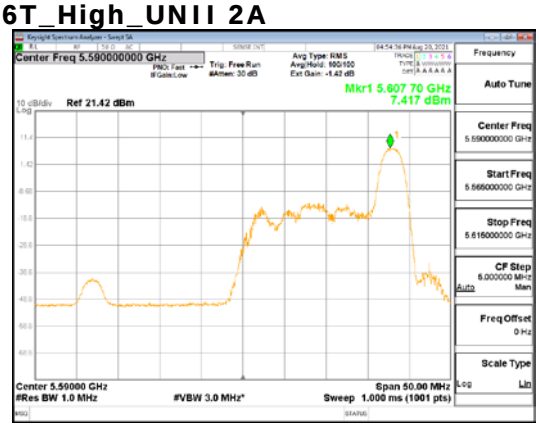
ANT1_802.11ax_HE40_26T_High_UNII 3

ANT2_802.11ax_HE40_26T_High_UNII 1



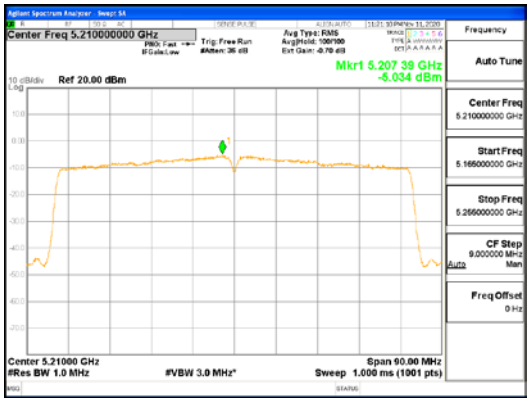


ANT2_802.11ax_HE40_26T_High_UNII 2A

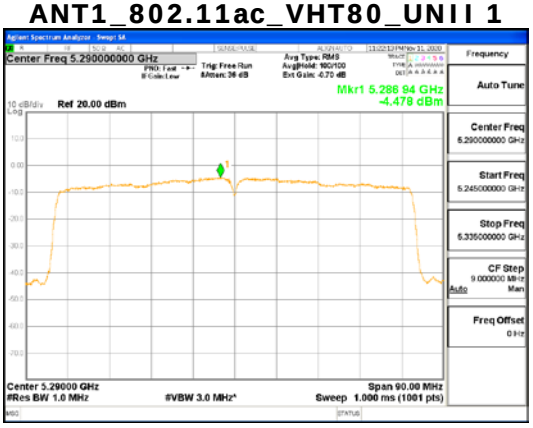


ANT2_802.11ax_HE40_26T_High_UNII 2C

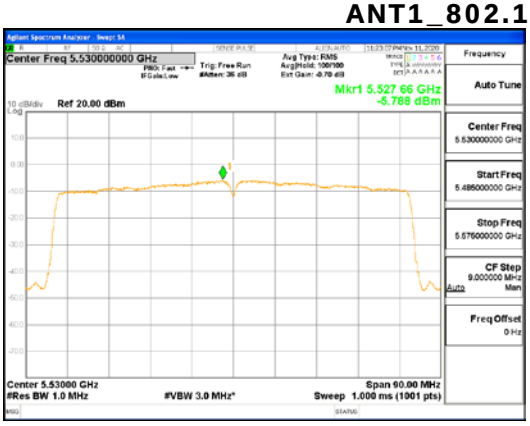
ANT2_802.11ax_HE40_26T_High_UNII 3

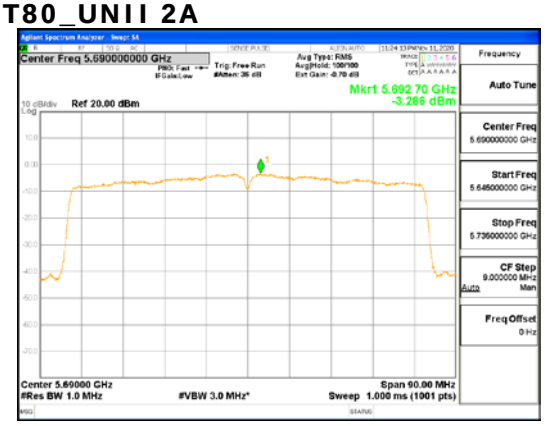


ANT1_802.11ac_VHT80_UNII 1



ANT1_802.11ac_VHT80_UNII 2A





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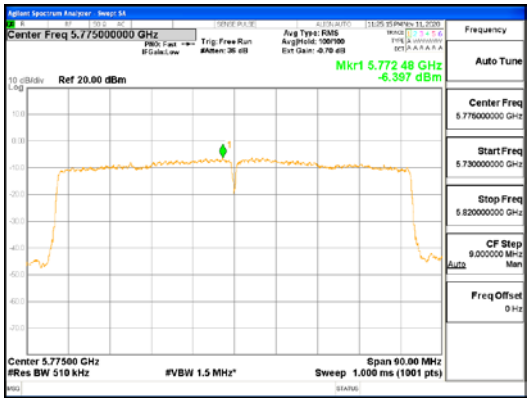
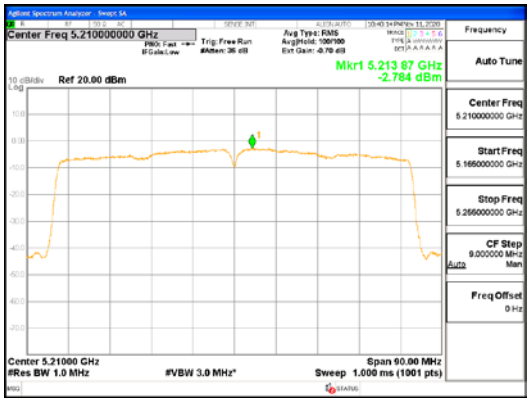


ANT1_802.11ac_VHT80_UNII 3



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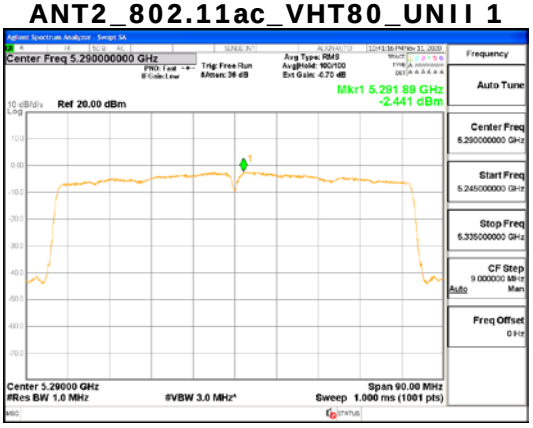
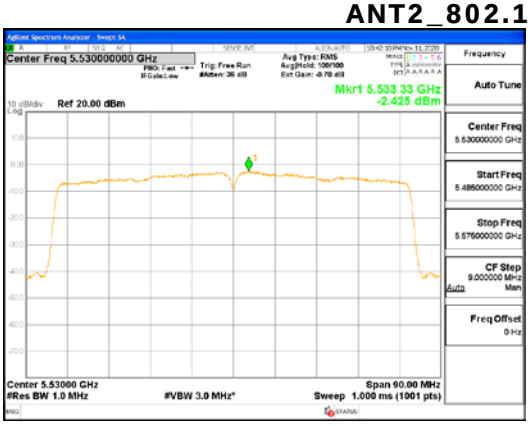
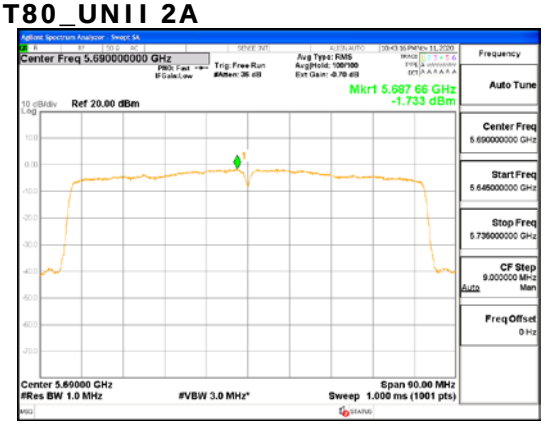
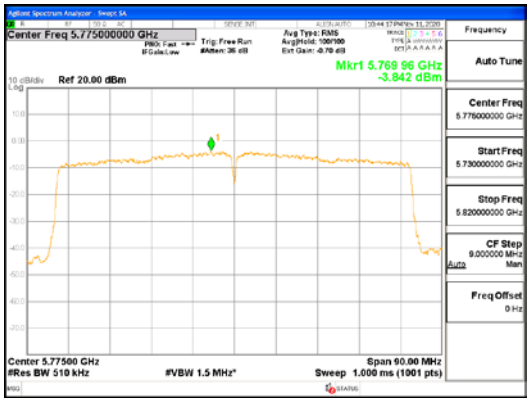


ANT2_802.11ac_VHT80_UNII 2A

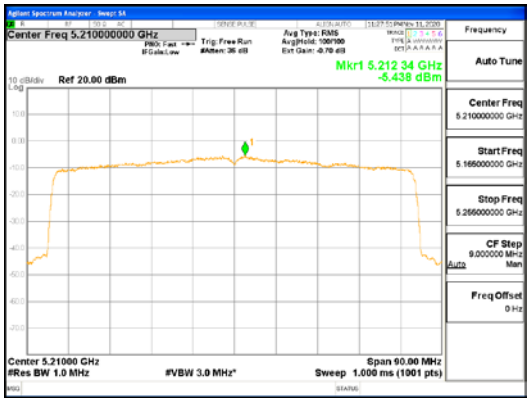




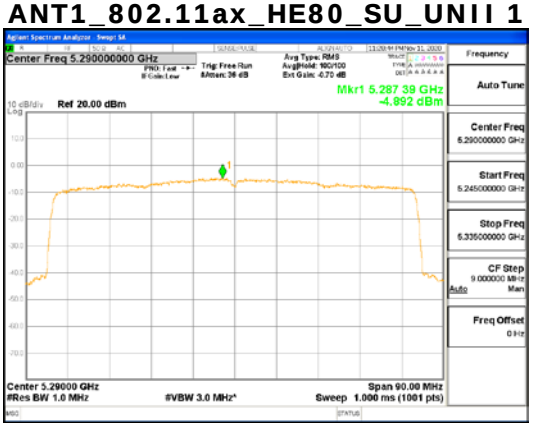
ANT2_802.11ac_VHT80_UNII 2C



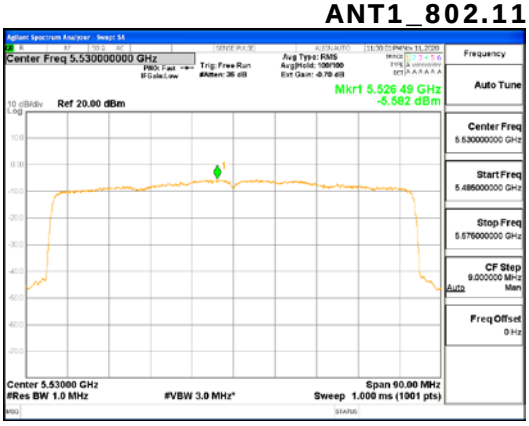
ANT2_802.11ac_VHT80_UNII 3

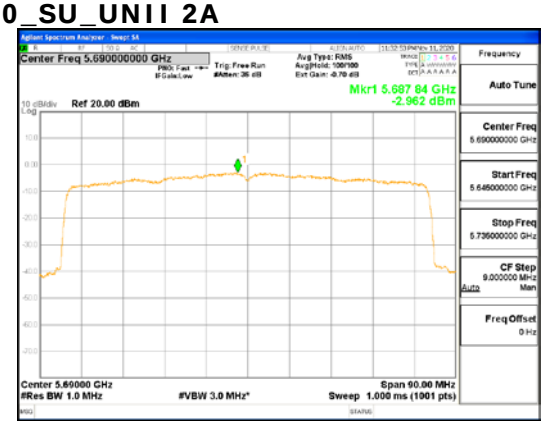


ANT1_802.11ax_HE80_SU_UNII 1

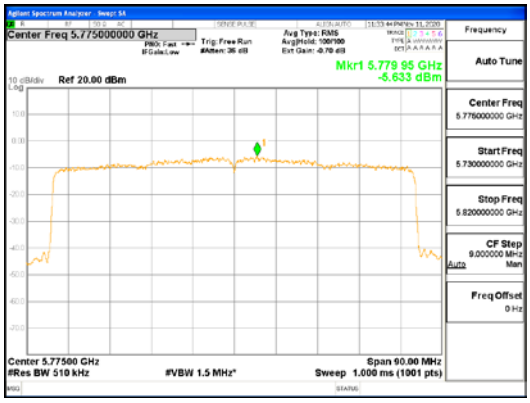


ANT1_802.11ax_HE80_SU_UNII 2A

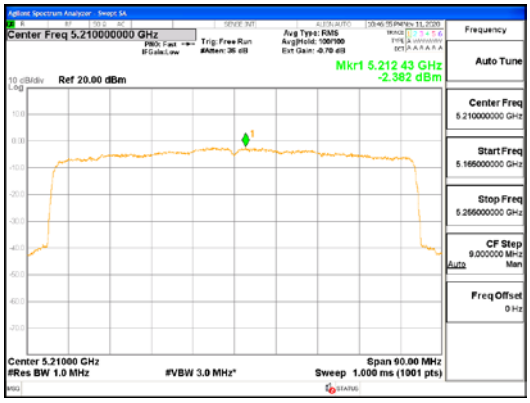




ANT1_802.11ax_HE80_SU_UNII 2C



ANT1_802.11ax_HE80_SU_UNII 3



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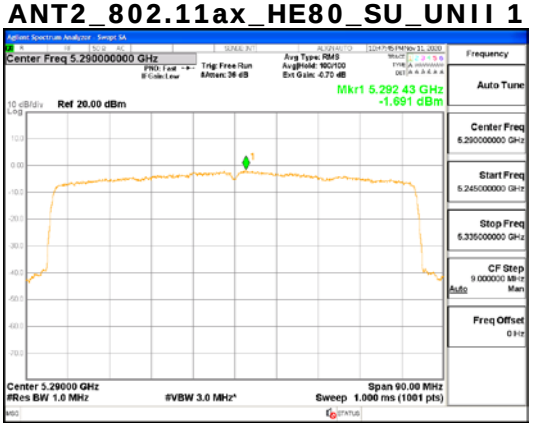
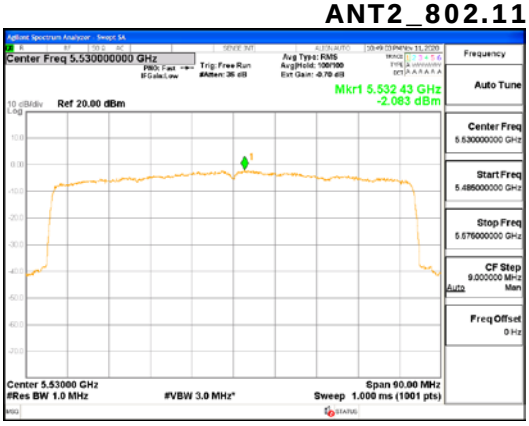
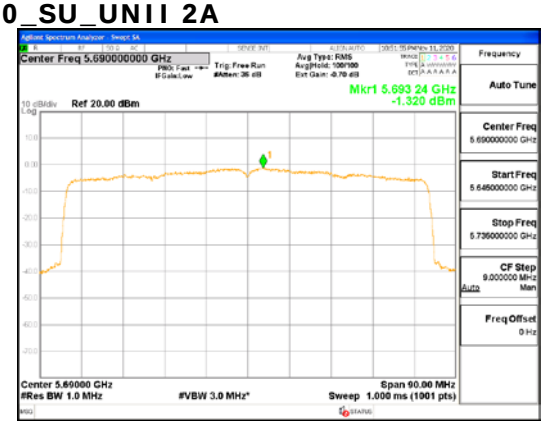
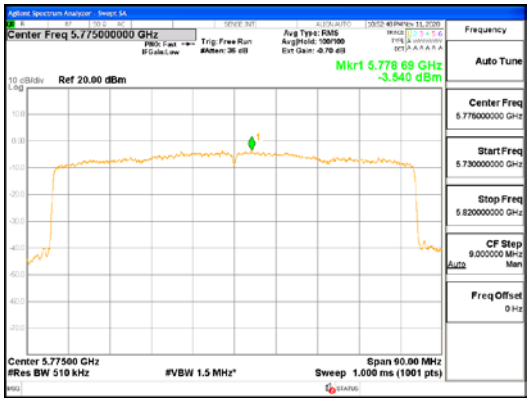


ANT2_802.11ax_HE80_SU_UNII 2A



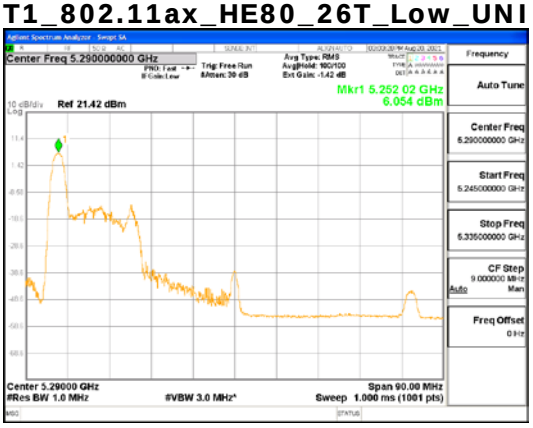


ANT2_802.11ax_HE80_SU_UNII 2C

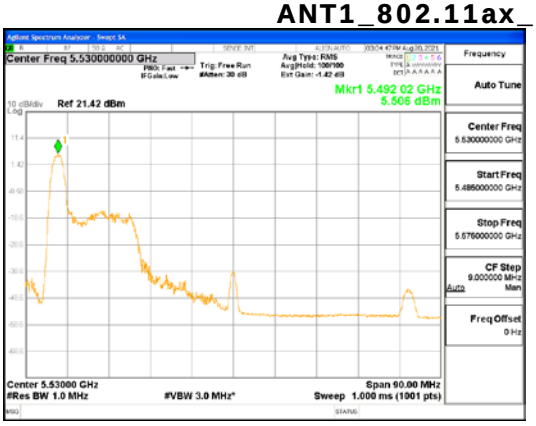


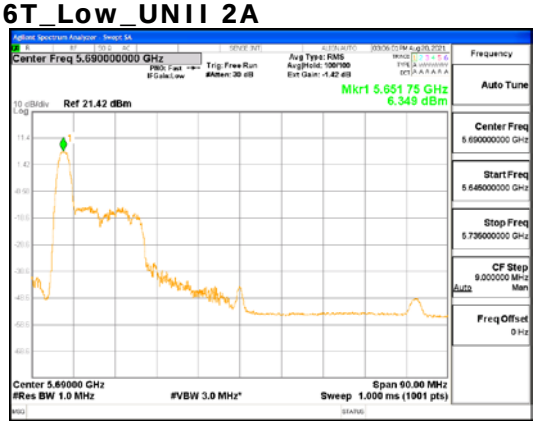
ANT2_802.11ax_HE80_SU_UNII 3

ANT1_802.11ax_HE80_26T_Low_UNII 1



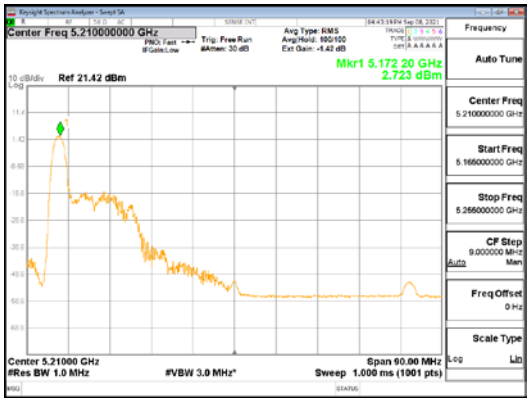
ANT1_802.11ax_HE80_26T_Low_UNII 2A



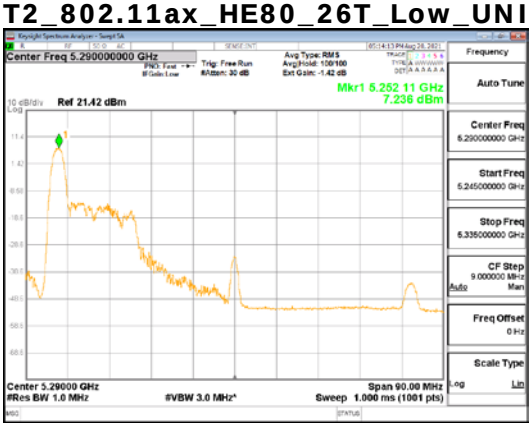


ANT1_802.11ax_HE80_26T_Low_UNII 2C

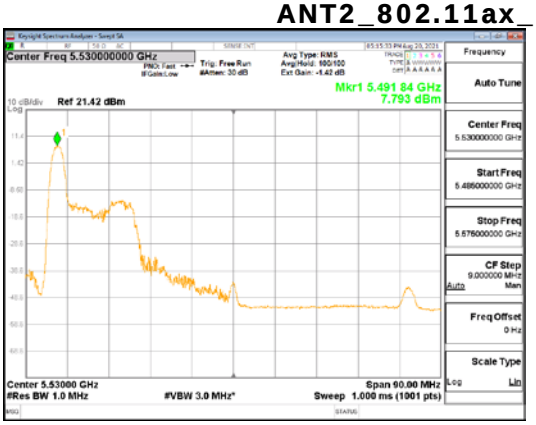
ANT1_802.11ax_HE80_26T_Low_UNII 3

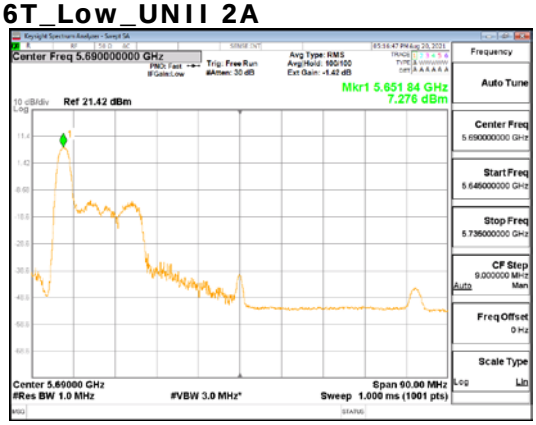


ANT2_802.11ax_HE80_26T_Low_UNII 1



ANT2_802.11ax_HE80_26T_Low_UNII 2A

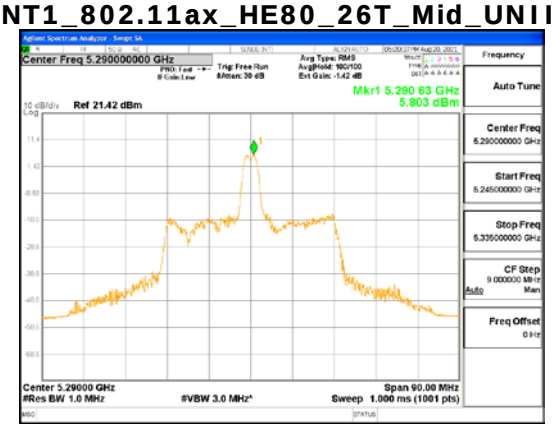




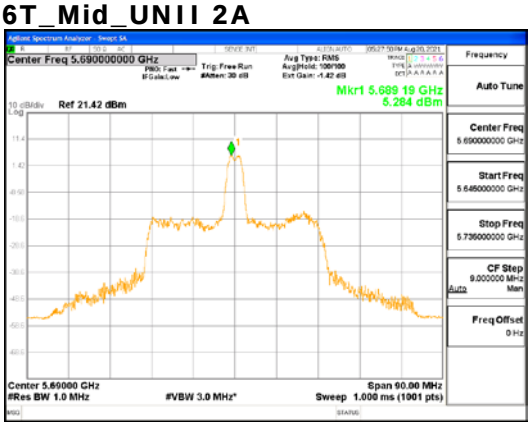
ANT2_802.11ax_HE80_26T_Low_UNII 2C

ANT2_802.11ax_HE80_26T_Low_UNII 3

ANT1_802.11ax_HE80_26T_Mid_UNII 1

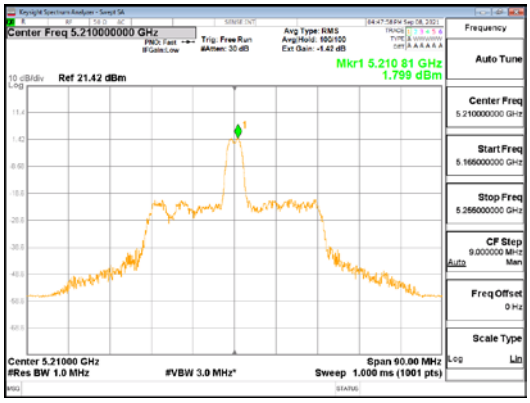


ANT1_802.11ax_HE80_26T_Mid_UNII 2A



ANT1_802.11ax_HE80_26T_Mid_UNII 2C

ANT1_802.11ax_HE80_26T_Mid_UNII 3



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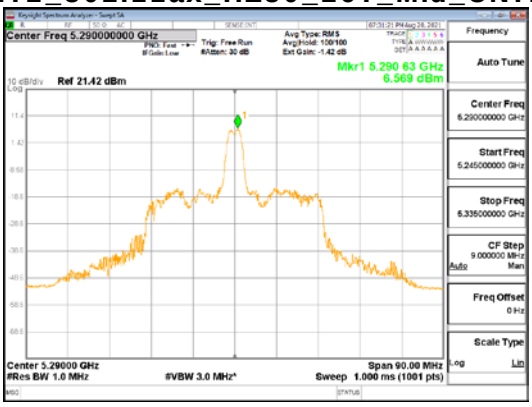
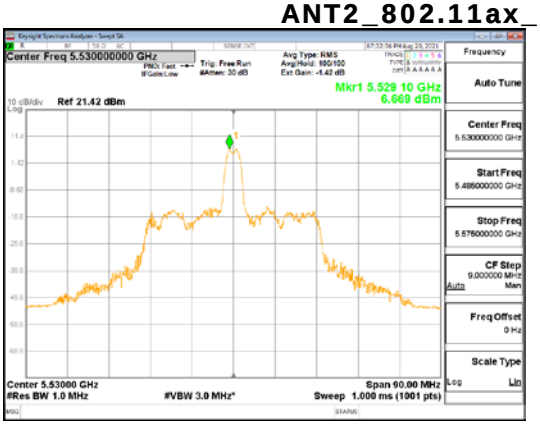
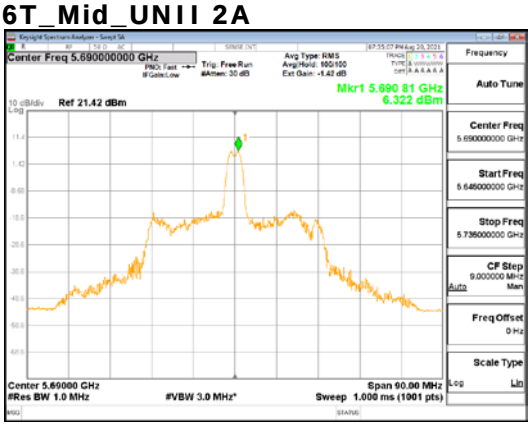


ANT2_802.11ax_HE80_26T_Mid_UNII 2A

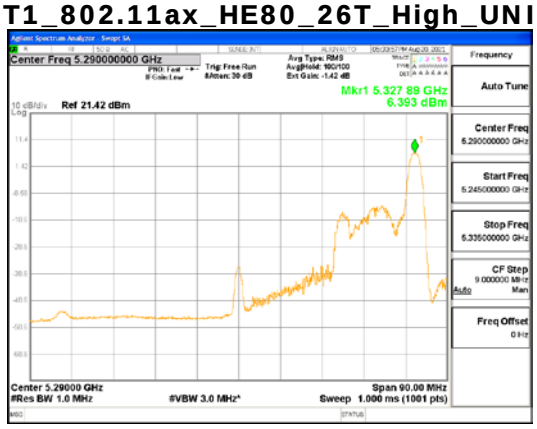




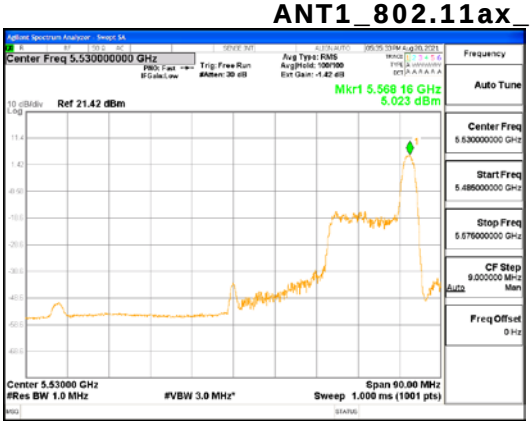
ANT2_802.11ax_HE80_26T_Mid_UNII 2C

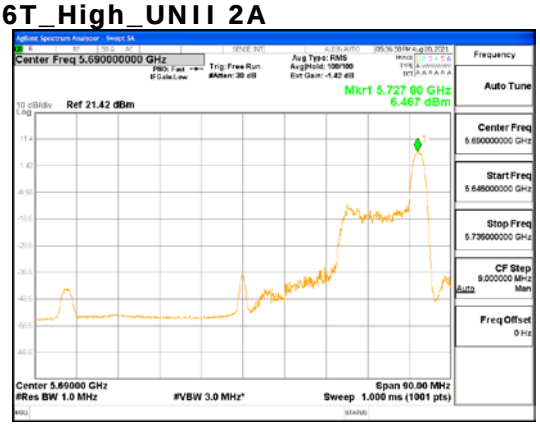
ANT2_802.11ax_HE80_26T_Mid_UNII 3

ANT1_802.11ax_HE80_26T_High_UNII 1



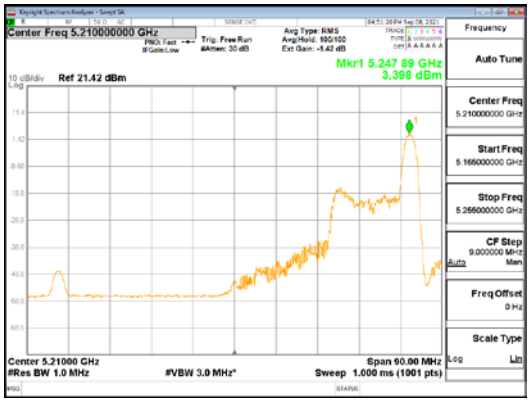
ANT1_802.11ax_HE80_26T_High_UNII 2A



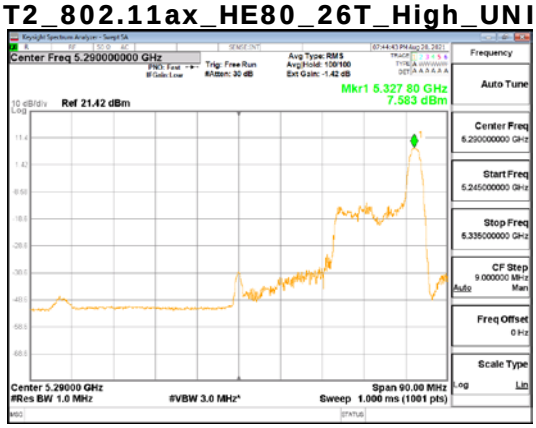


ANT1_802.11ax_HE80_26T_High_UNII 2C

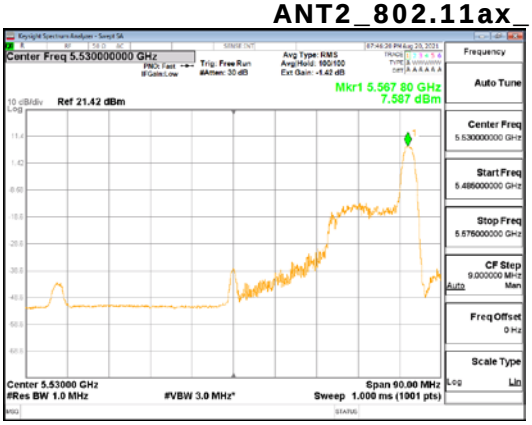
ANT1_802.11ax_HE80_26T_High_UNII 3

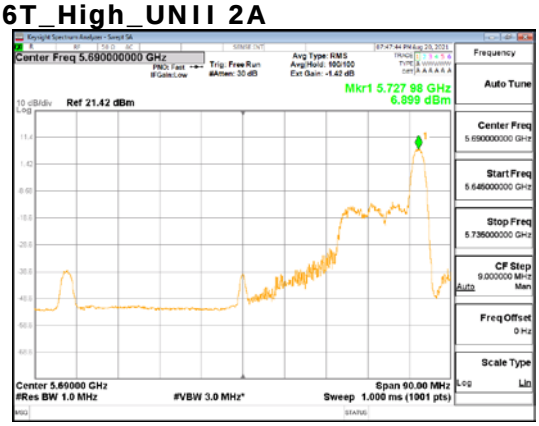


ANT2_802.11ax_HE80_26T_High_UNII 1

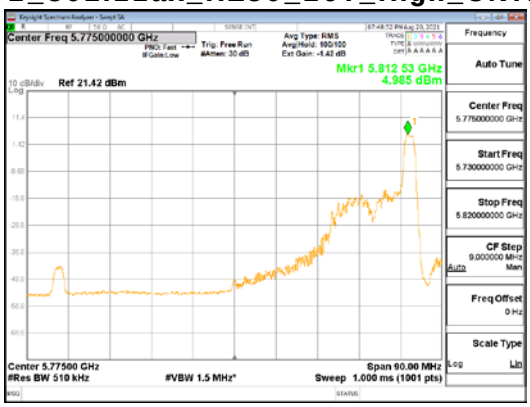


ANT2_802.11ax_HE80_26T_High_UNII 2A





ANT2_802.11ax_HE80_26T_High_UNII 2C



ANT2_802.11ax_HE80_26T_High_UNII 3

4.5 Frequency Stability

Test Procedures

KDB 789033 – Section A.3

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -20 ℃ and +50 ℃(Declaration by the Manufacturer). The temperature was incremented by 10 ℃ intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

Data for the worst case channel is shown below.

Temperature (℃)	-20	-10	0	10	20	30	40	50
Frequency	Measured Frequency Error (kHz)							
5 180 MHz	10.671	8.447	-2.331	-20.019	-40.109	-60.624	-76.750	-86.879
5 200 MHz	10.975	8.410	-2.687	-20.059	-39.902	-59.384	-76.773	-87.040
5 240 MHz	10.874	8.589	-3.191	-19.822	-39.588	-60.270	-77.268	-87.126
5 260 MHz	11.103	8.683	-2.830	-19.724	-40.519	-60.211	-77.549	-87.416
5 300 MHz	11.065	8.838	-2.878	-20.343	-40.618	-60.653	-77.980	-88.129
5 320 MHz	11.219	9.055	-2.856	-19.849	-40.582	-60.692	-78.322	-88.489
5 500 MHz	11.502	9.143	-2.688	-19.887	-41.829	-62.834	-81.040	-91.410
5 600 MHz	11.588	9.935	-1.667	-18.518	-40.907	-62.160	-81.281	-92.287
5 720 MHz	11.954	10.391	-1.251	-18.361	-41.263	-63.402	-82.255	-94.179
5 745 MHz	11.961	15.047	-0.958	-19.279	-41.252	-63.197	-82.390	-94.038
5 785 MHz	11.925	10.525	-1.075	-19.640	-42.086	-63.401	-82.821	-94.912
5 825 MHz	11.977	10.624	-0.533	-19.614	-42.235	-64.252	-83.474	-95.393

Note :

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature range as tested.

4.6 Unwanted Emissions

Test Location

☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

Test Procedures

KDB 789033 - Section G

1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
2) In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

Test Settings:

Frequency Range = 9 kHz ~ 1 GHz

a) RBW = 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ RBW

c) Detector = CISPR Quasi-peak

d) Sweep time = auto couple

- Peak

Frequency Range = 1 GHz ~ 40 GHz

a) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Detector = Peak

d) Sweep time = auto

e) Trace mode = max hold

- Average (duty cycle ≥ 98%)

Frequency Range = 1 GHz ~ 40 GHz

a) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Detector = RMS

d) Sweep time = auto

e) Averaging type = power (i.e., RMS)

f) Trace mode = average (at least 100 traces)

- Average (duty cycle < 98%)

Frequency Range = 1 GHz ~ 40 GHz

a) RBW = 1 MHz

b) VBW ≥ 3 x RBW

c) Detector = RMS

d) Sweep time = auto

e) Averaging type = power (i.e., RMS)

f) Trace mode = average (at least 100 traces)
If power averaging (RMS) mode, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

Test mode	Duty Cycle Factor (dB)
802.11a	0.13
802.11n_HT20	0.14
802.11n_HT40	0.27
802.11ac_VHT20	0.26
802.11ac_VHT40	0.49
802.11ac_VHT80	0.89
802.11ax_HE20_SU	0.31
802.11ax_HE40_SU	0.53
802.11ax_HE80_SU	0.85
802.11ax HE20/40/80 26T	0.24

Limit

- **15.209(a)**

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Deasurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

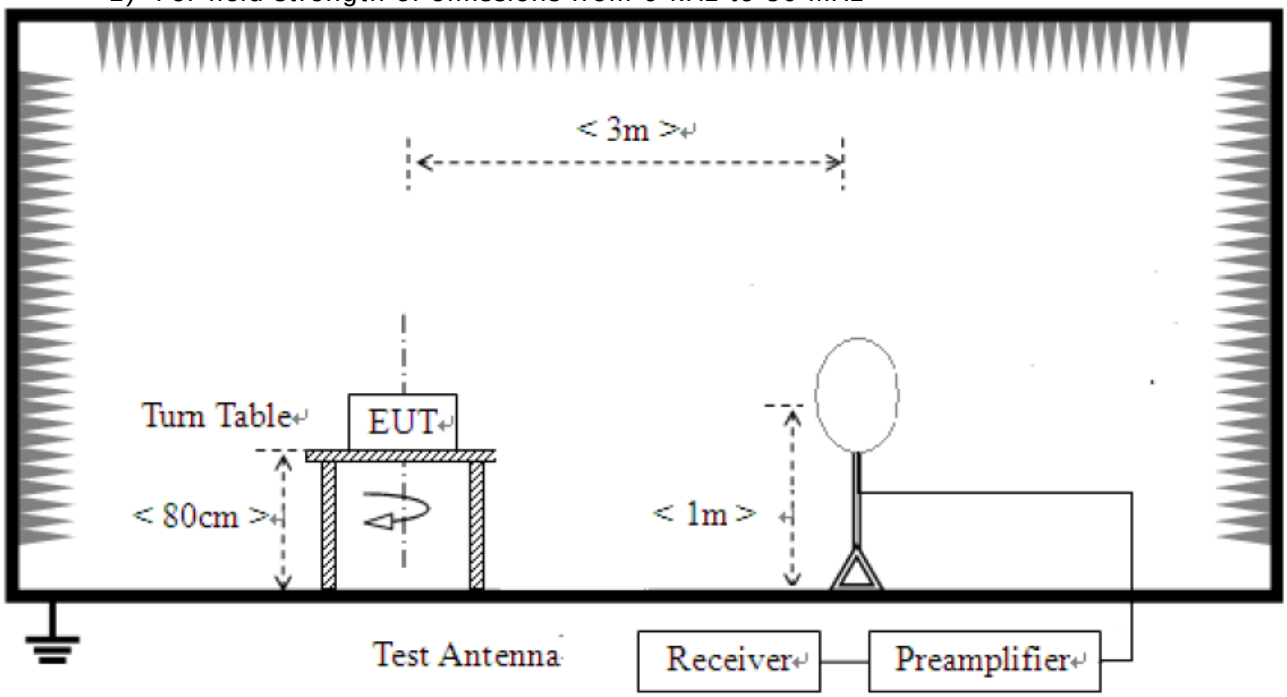
- **15.407, KDB 789033**

E.I.R.P -27 dBm/MHz

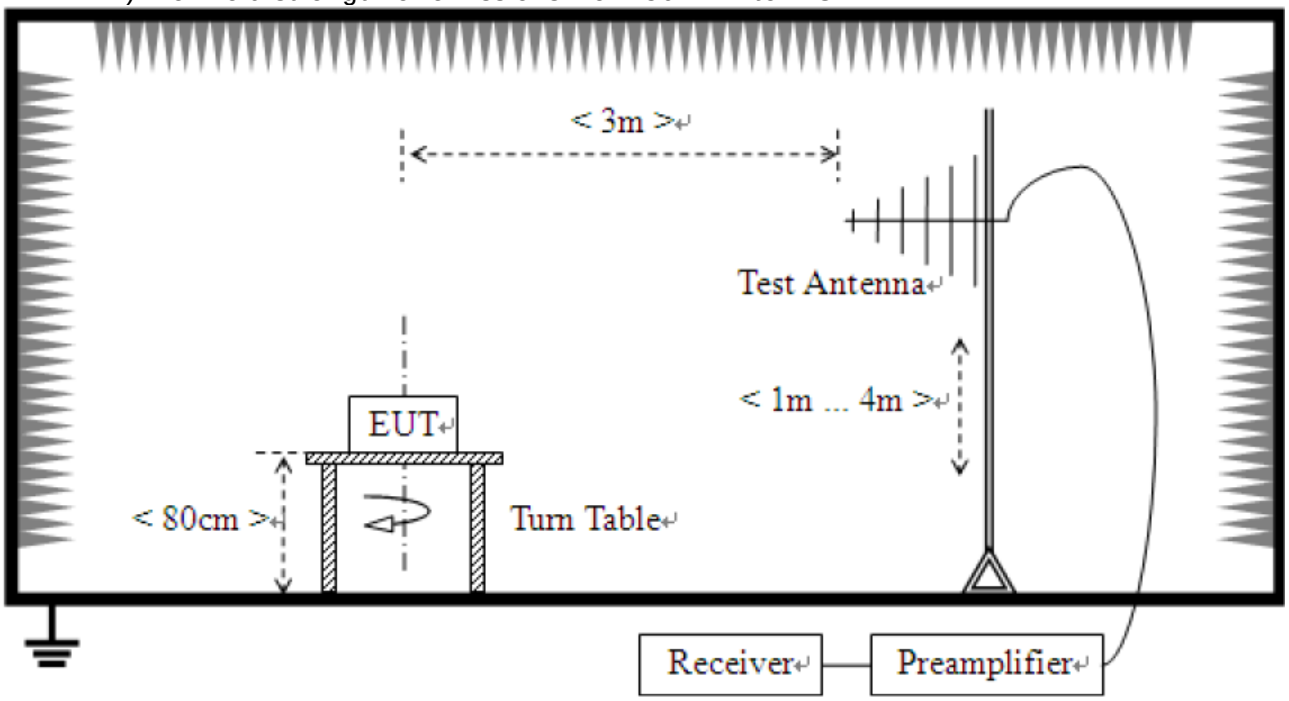
E[dBuV/m] = EIRP[dBm] + 95.2, for d = 3m

Test Setup:

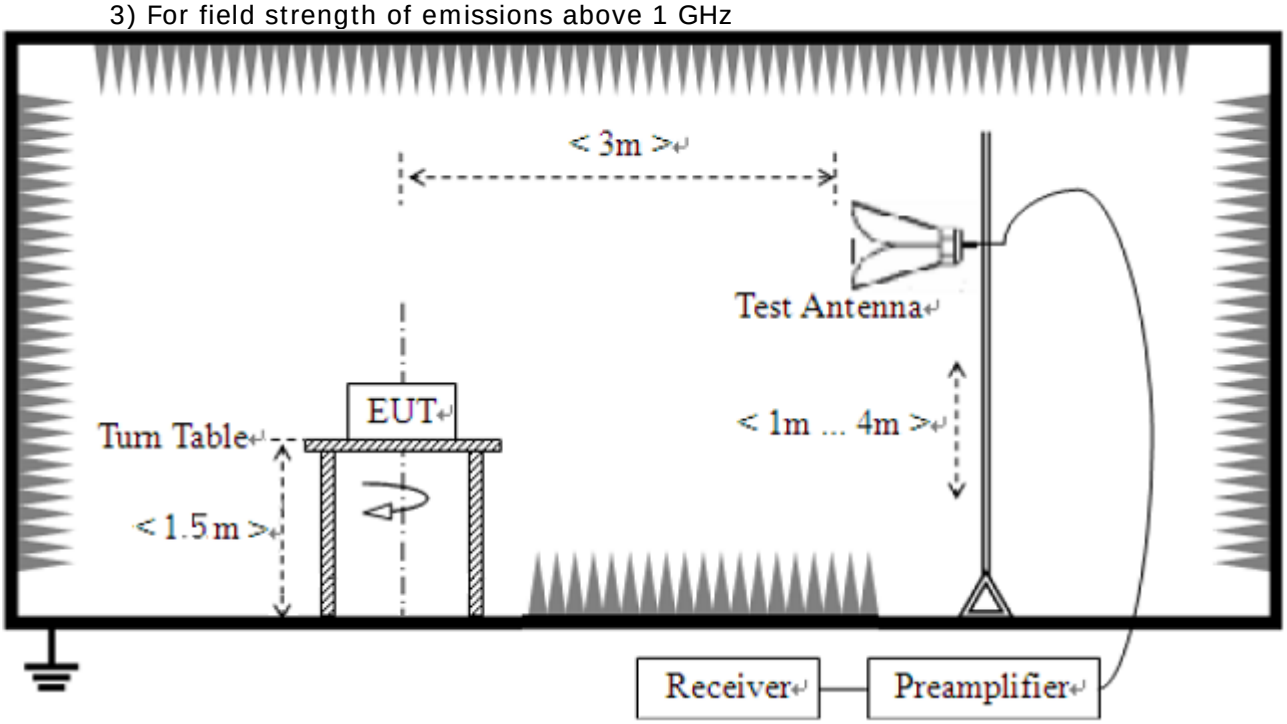
1) For field strength of emissions from 9 kHz to 30 MHz



2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test Mode

We have done all test mode.
The worst case antenna configuration and Test mode are determined to be as follows.

802.11a : ANT1 + ANT2 (MIMO)
802.11n : ANT1 + ANT2 (MIMO)
802.11ac : ANT1 + ANT2 (MIMO)
802.11ax : ANT1 + ANT2 (MIMO)

So the results are only attached worst cases.

802.11ax Test RU Index for Tones

Mode	Bandwidth (MHz)	Frequency (MHz)	Tones	Test RU Index	
				Band Edge	Spurious Emission
802.11ax	20	5 180	26T	0	-
				-	4
				-	-
			SU	61	61
		5 200	26T	-	-
				-	4
				-	-
			SU	-	61
		5 240	26T	-	-
				-	4
				-	-
			SU	-	61
		5 260	26T	-	-
				-	4
				-	-
			SU	-	61
		5 300	26T	-	-
				-	4
				-	-
			SU	-	61
		5 320	26T	-	-
				-	4
				8	-
			SU	61	61
		5 500	26T	0	-
				-	4
				-	-
			SU	61	61
		5 600	26T	-	-
				-	4
				-	-
			SU	-	61
		5 720	26T	-	-
				-	4
				-	-
			SU	-	61
		5 745	26T	0	-
				-	4
				-	-
			SU	61	61
		5 785	26T	-	-
				-	4
				-	-
			SU	-	61
		5 825	26T	-	-
				-	4
				8	-
			SU	61	61

Mode	Bandwidth (MHz)	Frequency (MHz)	Tones	Test RU Index	
				Band Edge	Spurious Emission
802.11ax	40	5 190	26T	0	-
				-	9
				-	-
			SU	65	65
		5 230	26T	-	-
				-	9
				-	-
			SU	-	65
		5 270	26T	-	-
				-	9
				-	-
			SU	-	65
		5 310	26T	-	-
				-	9
				17	-
			SU	65	65
		5 510	26T	0	-
				-	9
				-	-
			SU	65	65
		5 590	26T	-	-
				-	9
				-	-
			SU	-	65
		5 710	26T	-	-
				-	9
				-	-
			SU	-	65
		5 755	26T	0	-
				-	9
				-	-
			SU	65	65
		5 795	26T	-	-
				-	9
				17	-
			SU	65	65

Mode	Bandwidth (MHz)	Frequency (MHz)	Tones	Test RU Index	
				Band Edge	Spurious Emission
802.11ax	80	5 210	26T	0	-
				-	18
				-	-
			SU	67	67
		5 290	26T	-	-
				-	18
				36	-
			SU	67	67
		5 530	26T	0	-
				-	18
				-	-
			SU	67	67
		5 690	26T	-	-
				-	18
				17	-
			SU	-	67
		5 775	26T	0	-
				-	18
				67	-
			SU	67	67

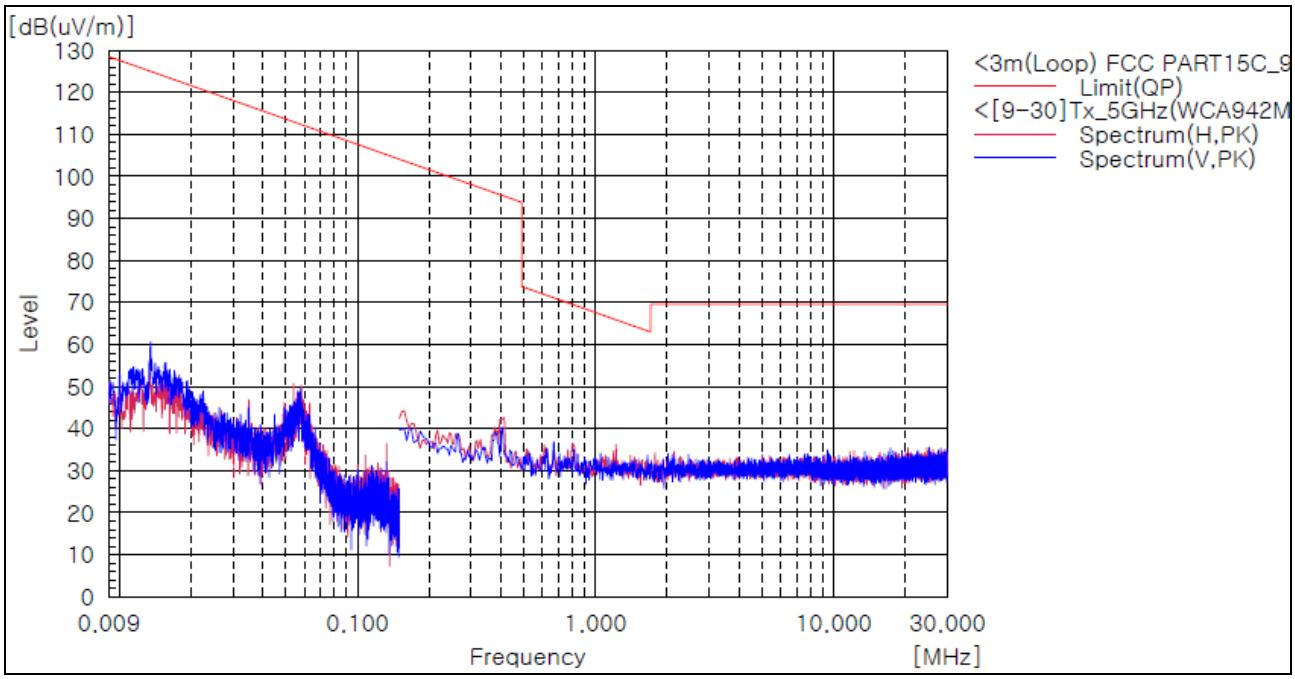
Test Results

1) 9 kHz to 30 MHz

Test mode : Transmitter (Worst Case)

The requirements are:
☒ Complies

Test Data



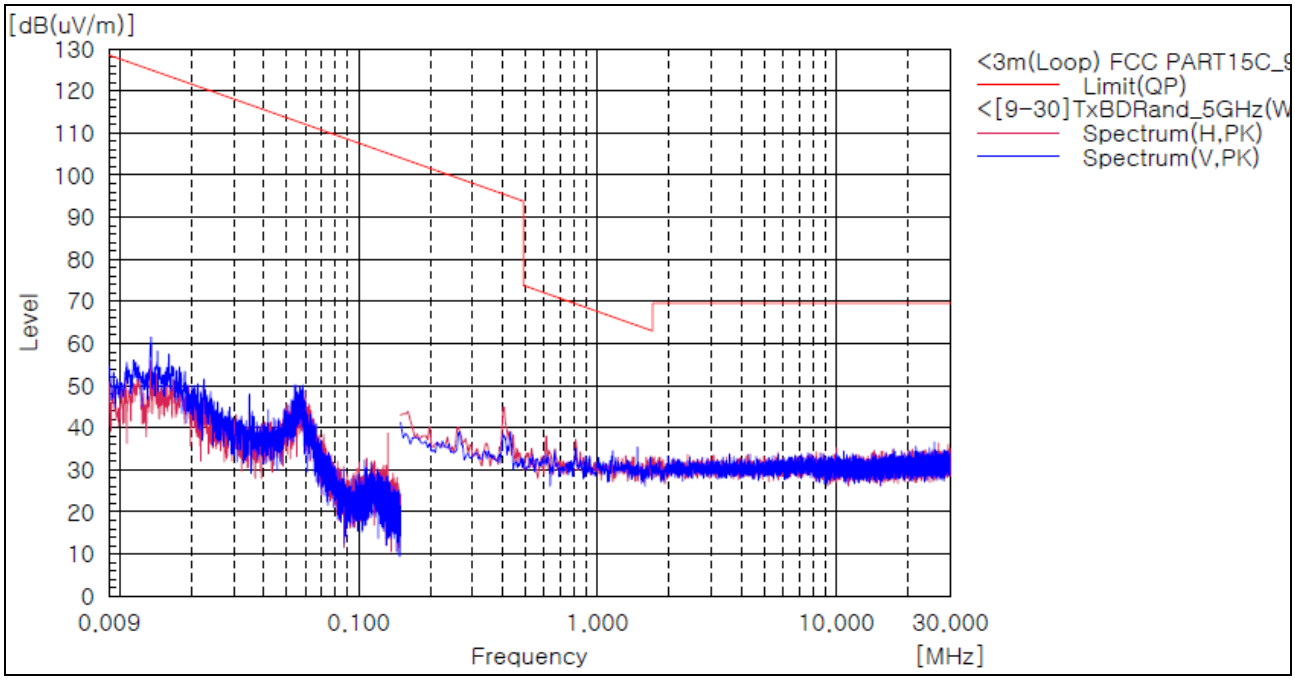
Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]
The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.						

Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

Test mode : Transmitter (simultaneous transmissions BDR+ NII)

The requirements are:
☒ Complies

Test Data



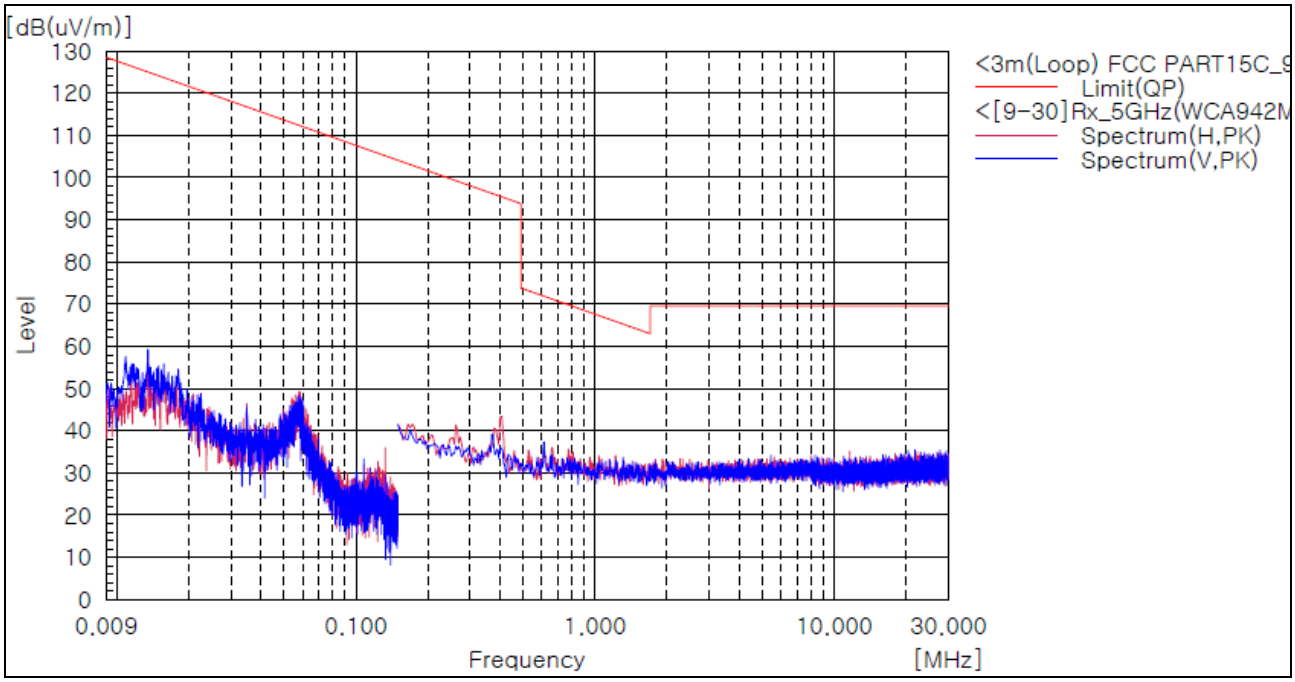
Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]
The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.						

Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

Test mode : Receiver (Worst Case)

The requirements are:
☒ Complies

Test Data



Frequency [MHz]	(P)	Reading [dBuV]	c.f [dB(1/m)]	Level [dB(uV/m)]	Limit [dB(uV/m)]	Margin [dB]
The emissions 9 kHz to 30 MHz were 20 dB lower than the limit.						

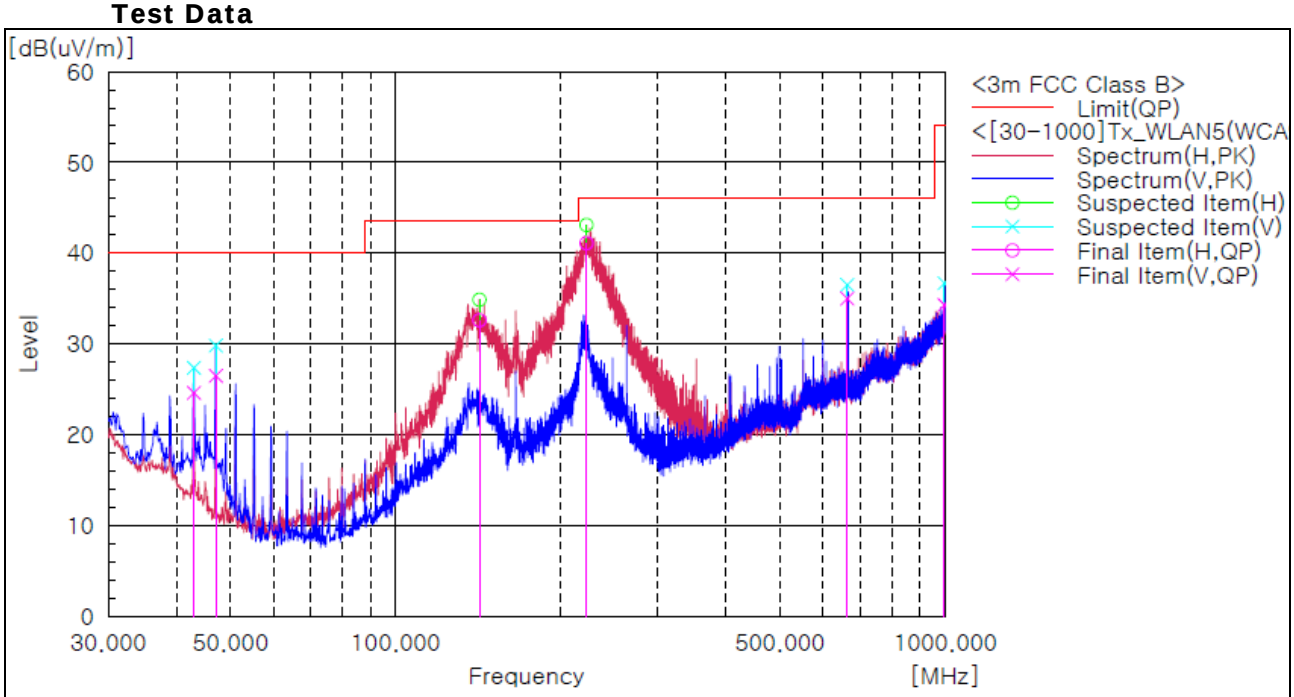
Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.

2) 30 MHz to 1 GHz

Test mode : Transmitter (Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

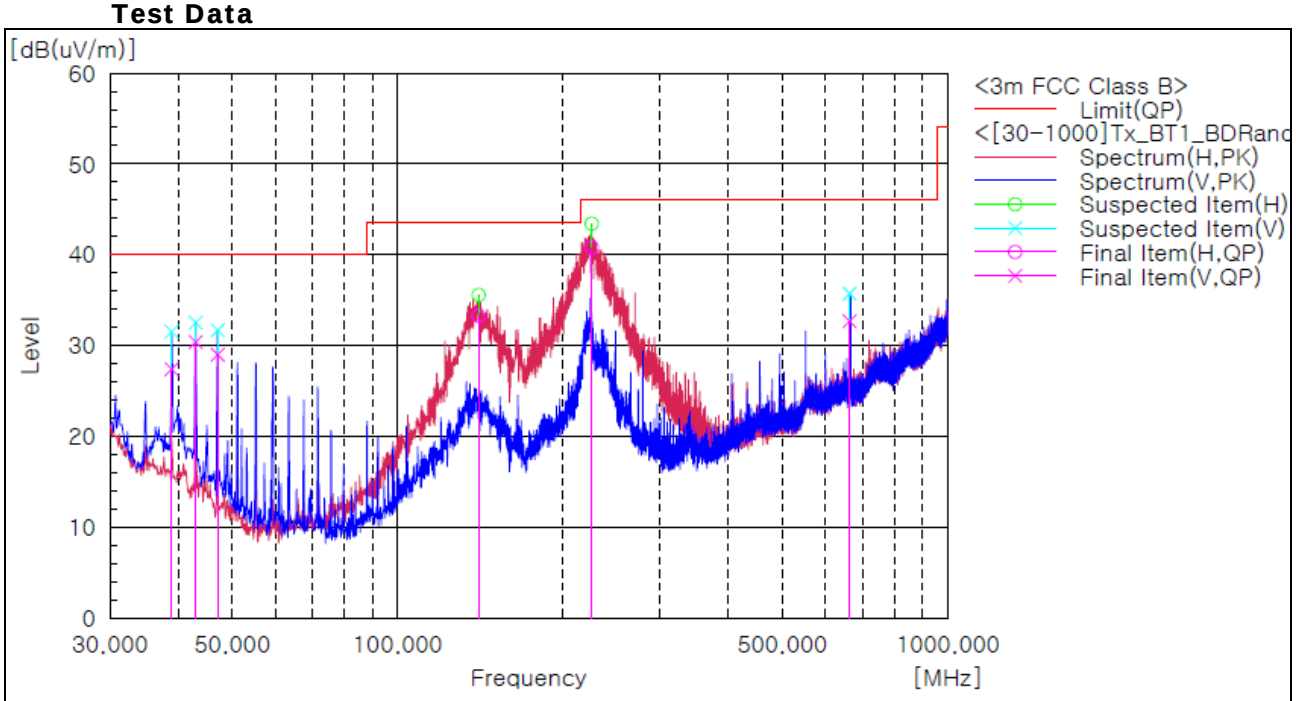
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	42.974	V	37.4	-12.8	24.6	40.0	15.4	100.0	81.0
2	47.096	V	41.6	-15.1	26.5	40.0	13.5	100.0	273.0
3	142.156	H	44.5	-11.9	32.6	43.5	10.9	209.0	206.0
4	222.666	H	54.1	-13.0	41.1	46.0	4.9	209.0	37.0
5	664.016	V	34.0	1.0	35.0	46.0	11.0	192.0	214.0
6	997.575	V	25.7	8.6	34.3	54.0	19.7	100.0	269.0

Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

Test mode : Transmitter (simultaneous transmissions BDR + NII)

The requirements are:
☒ Complies

Test Data



Final Result

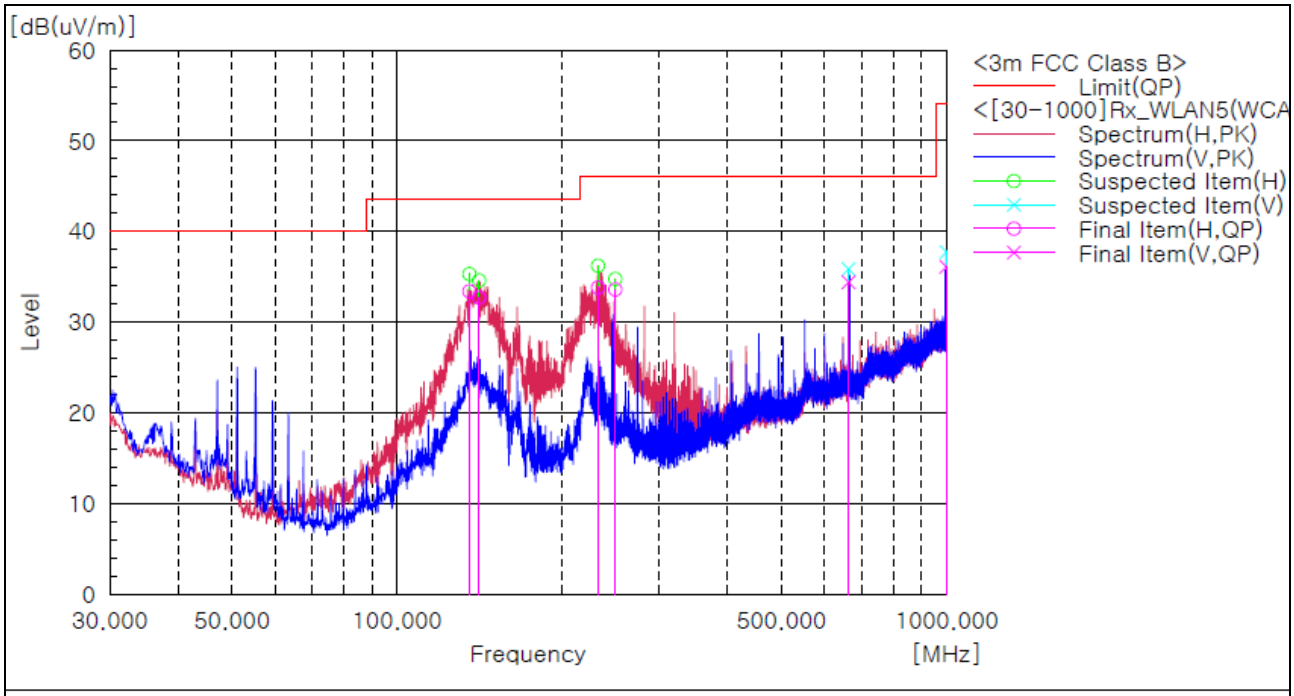
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	38.851	V	37.5	-10.1	27.4	40.0	12.6	101.0	356.0
2	42.974	V	43.2	-12.8	30.4	40.0	9.6	101.0	355.0
3	47.096	V	44.1	-15.1	29.0	40.0	11.0	101.0	321.0
4	140.459	H	45.2	-11.9	33.3	43.5	10.2	209.0	211.0
5	225.576	H	53.6	-12.8	40.8	46.0	5.2	101.0	221.0
6	663.774	V	31.7	1.0	32.7	46.0	13.3	191.0	192.0

Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

Test mode : Receiver (Worst Case)

The requirements are:
☒ Complies

Test Data



Final Result

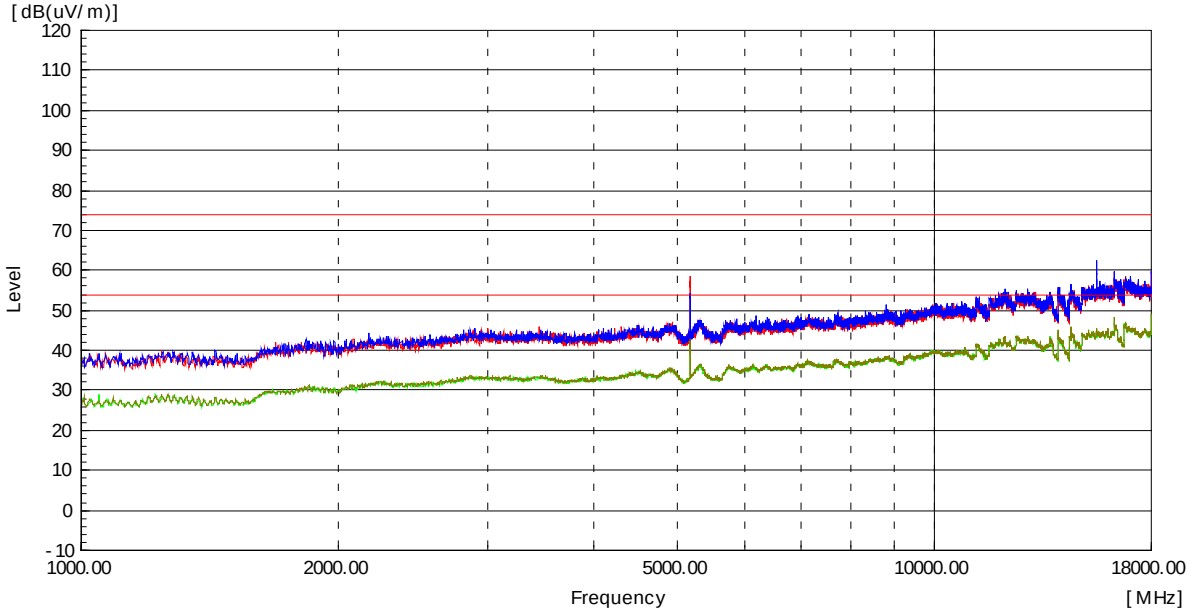
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	135.488	H	45.1	-11.7	33.4	43.5	10.1	205.0	195.0
2	141.065	H	44.6	-11.9	32.7	43.5	10.8	205.0	178.0
3	232.245	H	45.9	-12.1	33.8	46.0	12.2	101.0	356.0
4	249.584	H	43.1	-9.5	33.6	46.0	12.4	205.0	323.0
5	663.774	V	33.4	1.0	34.4	46.0	11.6	195.0	168.0
6	999.273	V	27.5	8.6	36.1	54.0	17.9	101.0	270.0

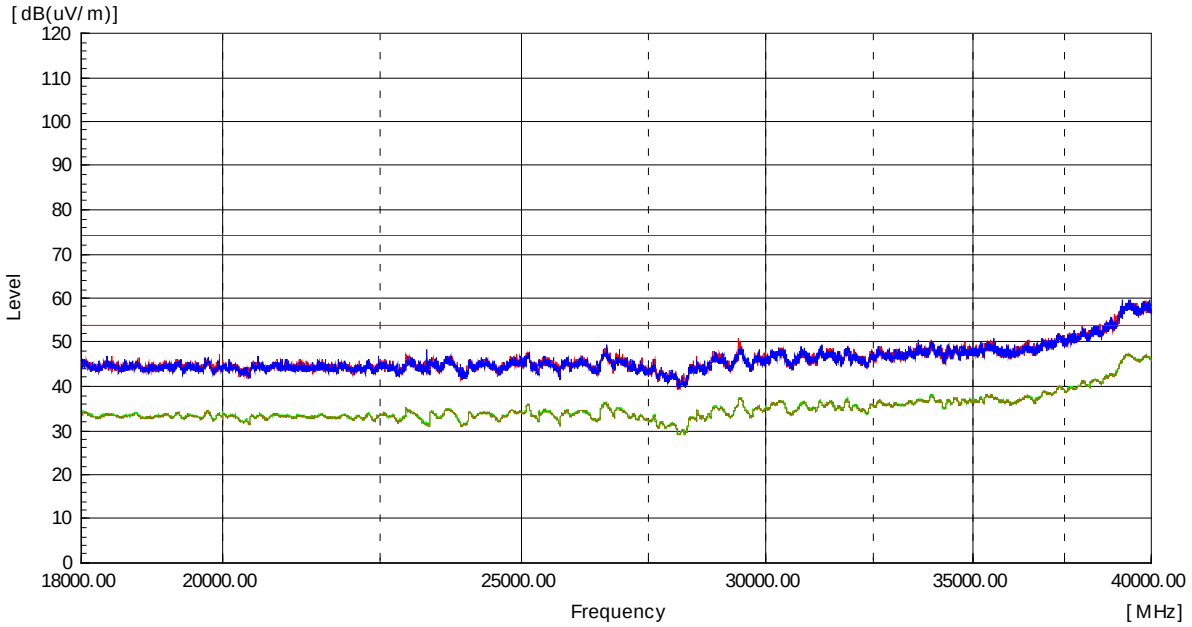
Remark :
1. The unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down positon(X,Y axis). The worst emission was found in lie-down positon(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

3) above 1 GHz

The requirements are:
☒ Complies

Test Data





Test mode : Transmitter, 802.11a

The requirements are:
☒ Complies

Test Data

Ch.36(5 180 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Duty Cycle Factor [dB]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
10 358.69	H	45.8	-----	6.7	52.5	-----	-----	74.0	-----	21.5	-----
10 364.59	H	-----	35.1	6.7	-----	41.8	0.1	-----	54.0	-----	12.1
10 368.64	V	47.0	-----	6.7	53.7	-----	-----	74.0	-----	20.3	-----
10 360.38	V	-----	35.9	6.7	-----	42.6	0.1	-----	54.0	-----	11.3
15 543.92	H	48.0	-----	11.1	59.1	-----	-----	74.0	-----	14.9	-----
15 546.91	H	-----	36.5	11.1	-----	47.6	0.1	-----	54.0	-----	6.3
15 541.67	V	52.7	-----	11.1	63.8	-----	-----	74.0	-----	10.2	-----
15 541.92	V	-----	37.8	11.1	-----	48.9	0.1	-----	54.0	-----	5.0

Ch.40(5 200 MHz)

Frequency [MHz]	(P)	Reading PK [dBuV]	Reading AV [dBuV]	c.f [dB(1/m)]	Level PK [dB(uV/m)]	Level AV [dB(uV/m)]	Duty Cycle Factor [dB]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin AV [dB]
10 408.64	H	45.7	-----	6.7	52.4	-----	-----	74.0	-----	21.6	-----
10 398.85	H	-----	34.9	6.7	-----	41.6	0.1	-----	54.0	-----	12.3
10 393.11	V	48.0	-----	6.7	54.7	-----	-----	74.0	-----	19.3	-----
10 400.20	V	-----	35.5	6.7	-----	42.2	0.1	-----	54.0	-----	11.7
15 632.19	H	48.1	-----	11.2	59.3	-----	-----	74.0	-----	14.7	-----
15 608.75	H	-----	37.1	11.1	-----	48.2	0.1	-----	54.0	-----	5.7
15 600.02	V	51.3	-----	11.1	62.4	-----	-----	74.0	-----	11.6	-----
15 599.03	V	-----	37.3	11.1	-----	48.4	0.1	-----	54.0	-----	5.5