

4.4 Power Spectral Density

Test Procedures

Maximum Power Spectral Density (KDB 789033, Method SA-1)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 1 MHz, 500 KHz (UNII 3)
- b) VBW = 3 MHz, 1.5 MHz (UNII 3)
- c) Sweep time = auto
- d) Detector = power averaging (rms)
- e) Trace mode = Average at least 100

Limit

UNII 1 band : the maximum power spectral density shall **not exceed 11 dBm** in any 1 megahertz band.

UNII 3 band : the maximum power spectral density shall **not exceed 30 dBm** in any 500-kHz band.

Test Data

802.11a

ANT 0

Frequency Band	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
UNII 1	Low	5 180	2.20	11	Complies
	Middle	5 200	2.29		
	High	5 240	3.03		
UNII 3	Low	5 745	-2.53	30	Complies
	Middle	5 785	-3.26		
	High	5 825	-3.40		

ANT 1

Frequency Band	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
UNII 1	Low	5 180	-0.32	11	Complies
	Middle	5 200	-0.14		
	High	5 240	0.50		
UNII 3	Low	5 745	0	30	Complies
	Middle	5 785	-0.49		
	High	5 825	-0.92		

802.11n(HT20)

ANT 0 + ANT 1

Frequency Band	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
UNII 1	5 180	1.88	-0.42	3.89	11	Complies
	5 200	2.01	-0.38	3.99		
	5 240	2.56	0.92	4.83		
UNII 3	5 745	-2.56	-0.05	1.88	30	Complies
	5 785	-3.26	-0.65	1.25		
	5 825	-3.77	-0.75	1.01		

802.11n(HT40)

ANT 0 + ANT 1

Frequency Band	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
UNII 1	5 190	-4.60	-6.37	-2.39	11	Complies
	5 230	-3.83	-5.81	-1.70		
UNII 3	5 755	-8.47	-5.88	-3.97	30	Complies
	5 795	-9.23	-6.42	-4.59		

802.11ac(VHT20)

ANT 0 + ANT 1

Frequency Band	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
UNII 1	5 180	1.81	0.01	4.01	11	Complies
	5 200	1.98	-0.32	3.99		
	5 240	2.16	0.33	4.35		
UNII 3	5 745	-3.03	-0.05	1.72	30	Complies
	5 785	-3.91	-0.92	0.85		
	5 825	-3.94	-1.34	0.56		

802.11ac(VHT40)

ANT 0 + ANT 1

Frequency Band	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
UNII 1	5 190	-2.38	-4.48	-0.29	11	Complies
	5 230	-1.85	-3.91	0.25		
UNII 3	5 755	-6.95	-4.52	-2.56	30	Complies
	5 795	-7.66	-5.00	-3.12		

802.11ac(VHT80)

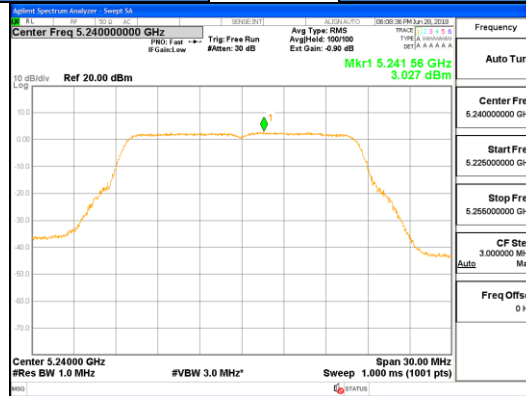
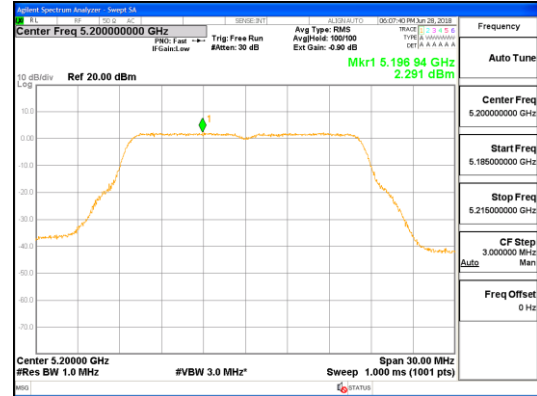
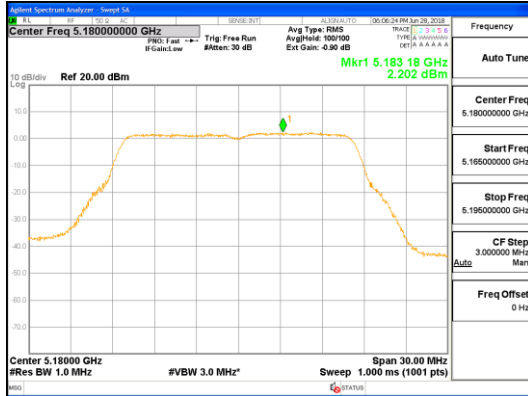
ANT 0 + ANT 1

Frequency Band	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
UNII 1	5 210	-7.20	-9.57	-5.21	11	Complies
UNII 3	5 775	-11.87	-9.74	-7.67	30	Complies

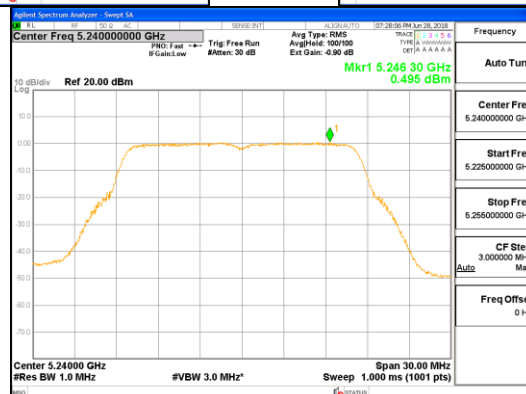
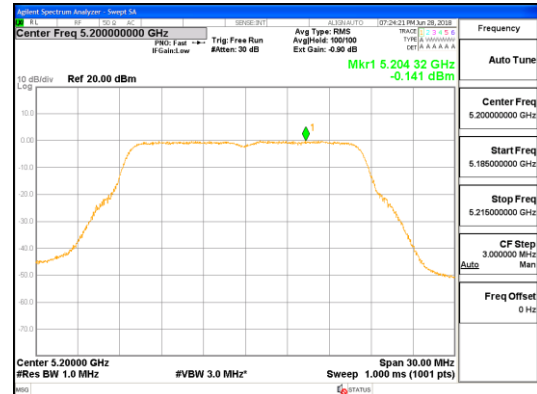
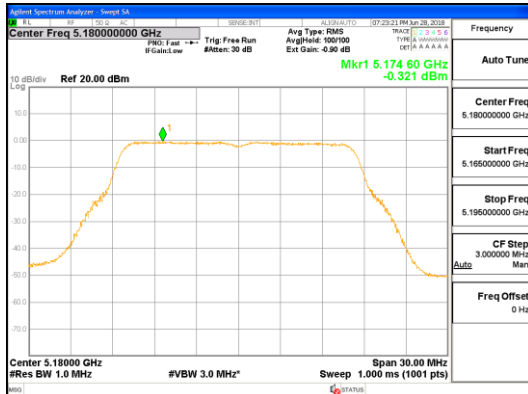
See next pages for actual measured spectrum plots.

802.11a_UNII 1 Band

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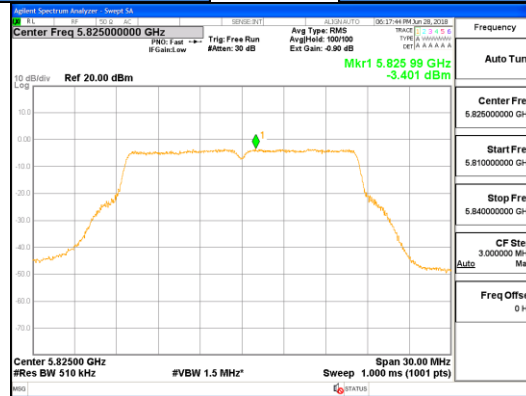
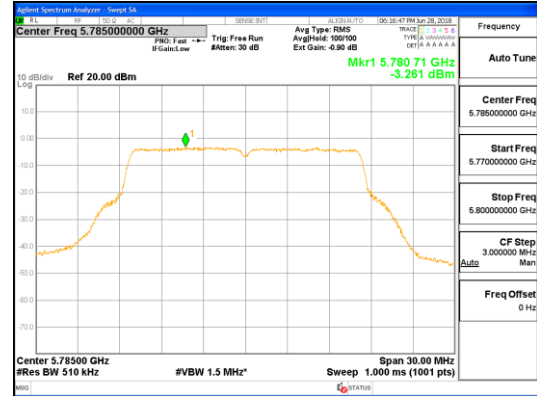
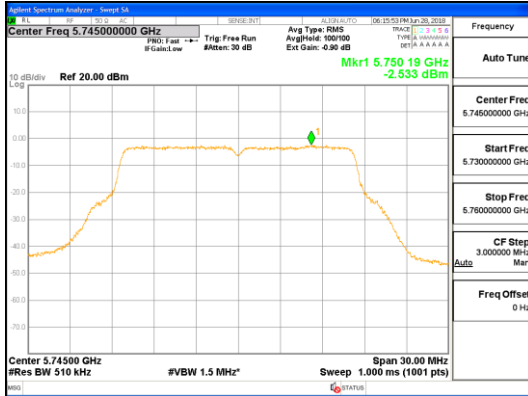


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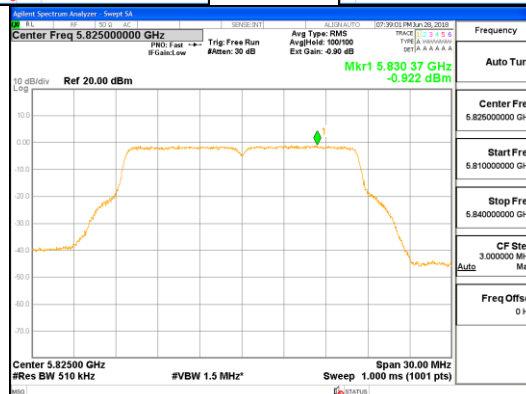
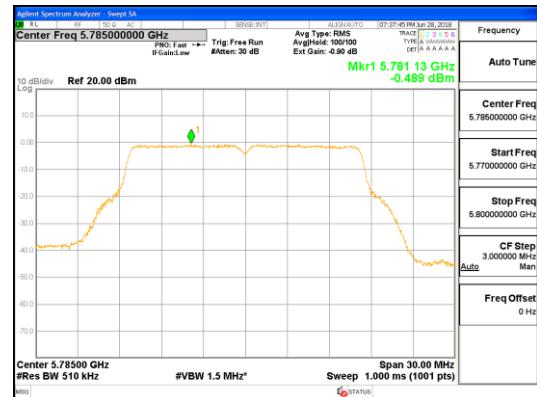
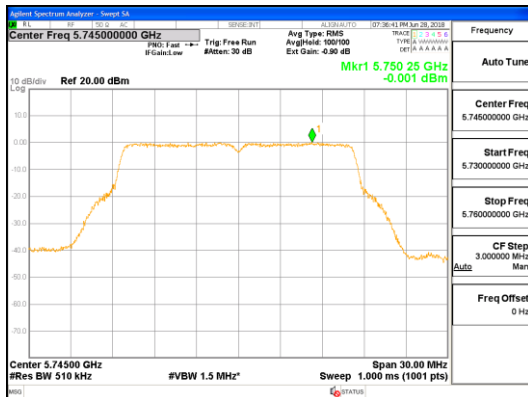


802.11a_UNII 3 Band

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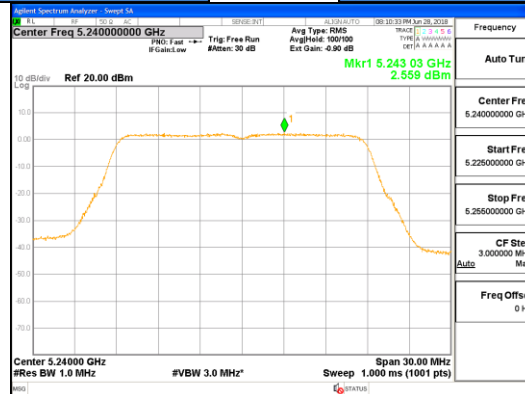
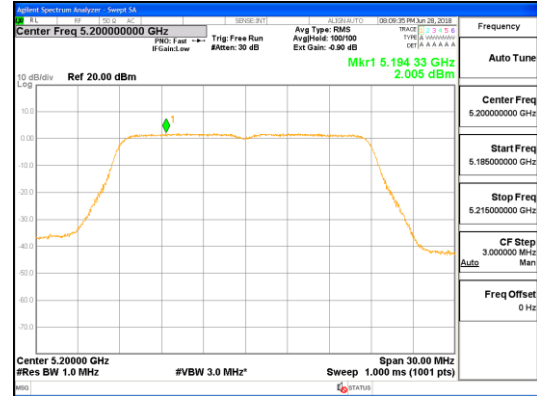
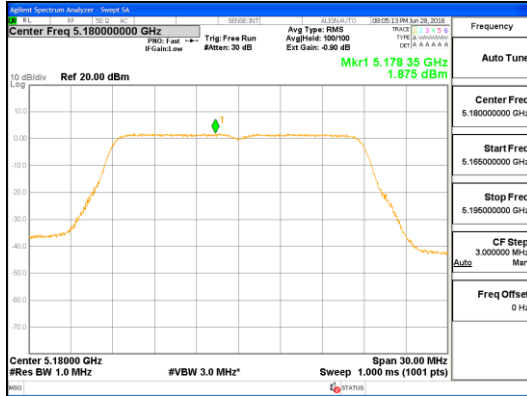


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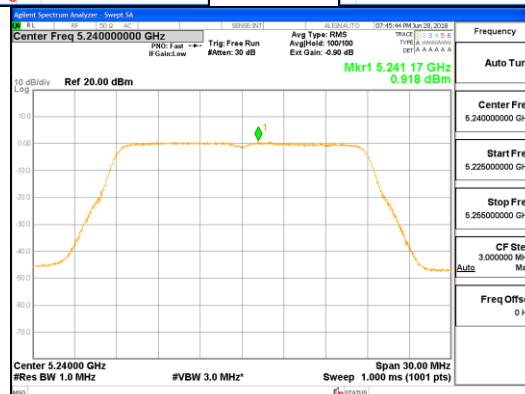
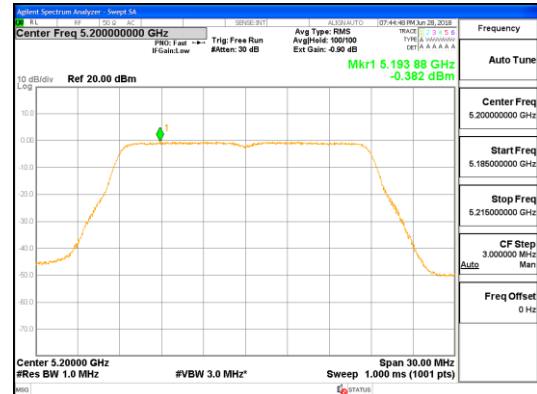
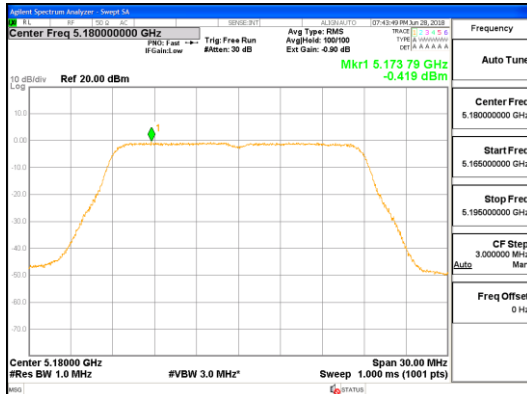


802.11n(HT20)_UNII 1 Band

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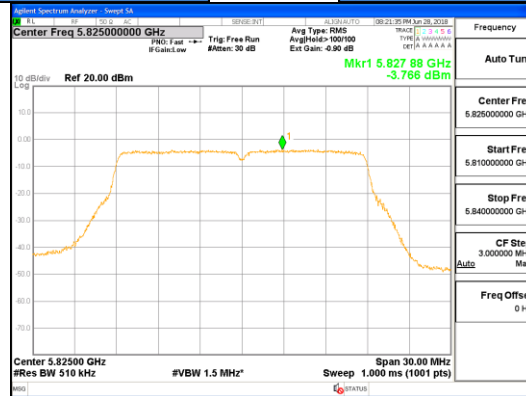
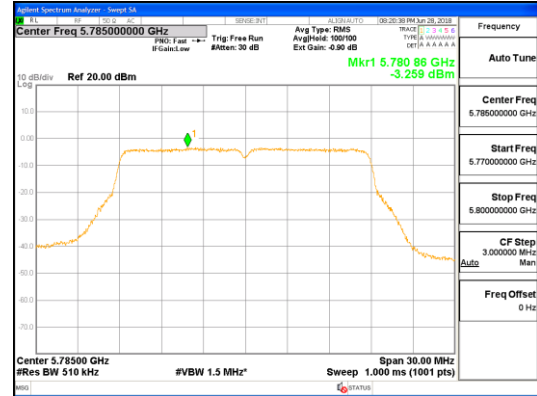
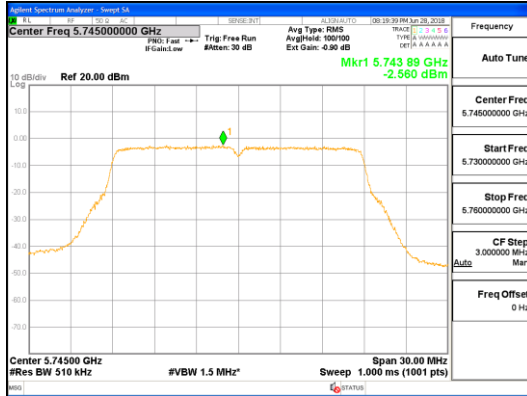


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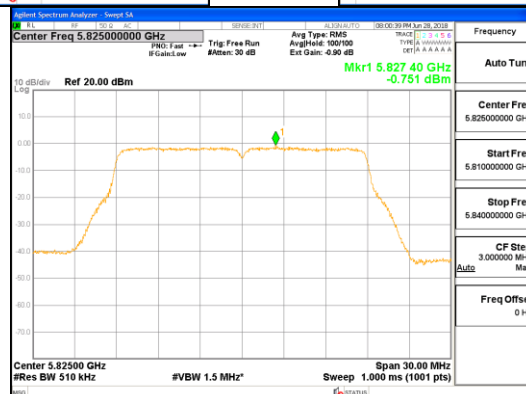
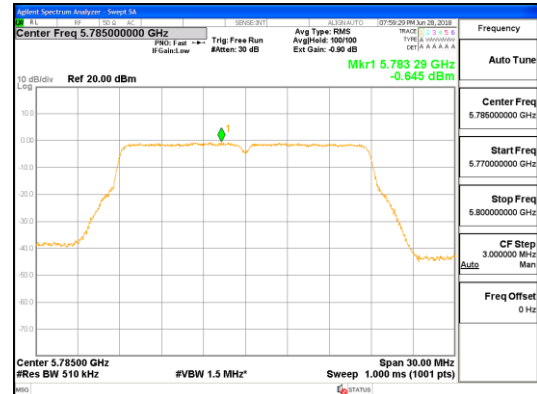
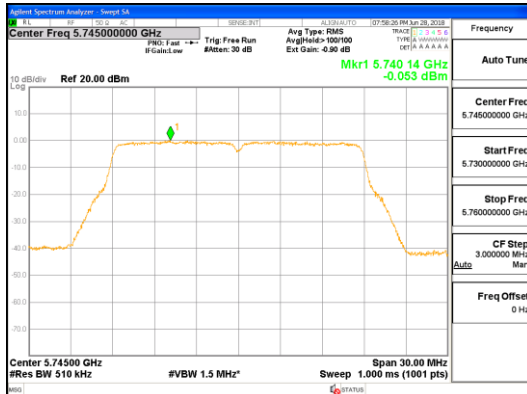


802.11n(HT20)_UNII 3 Band

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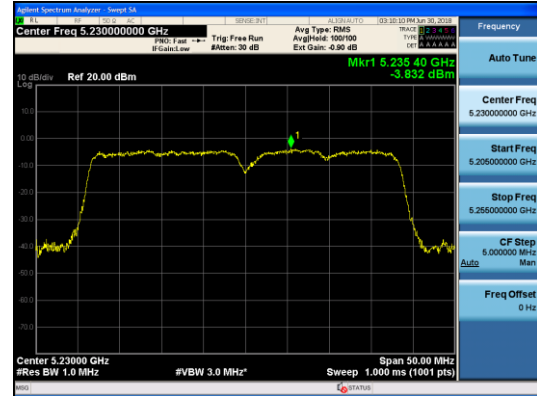
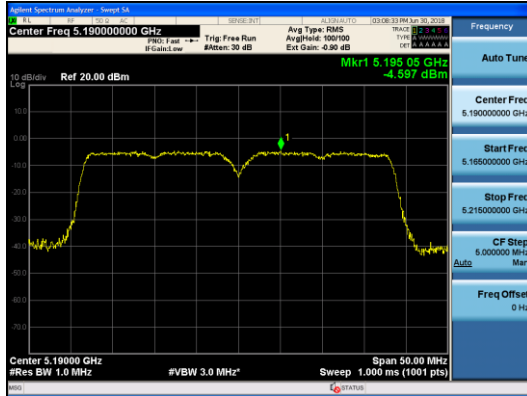


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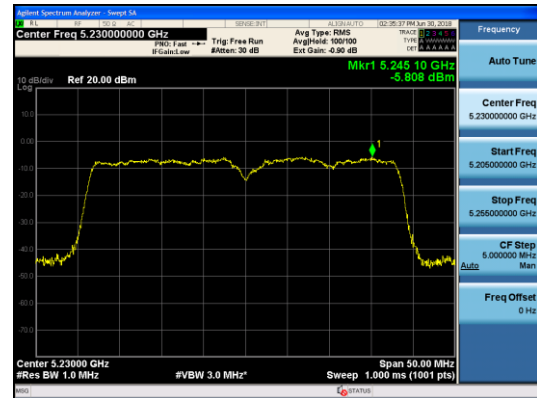
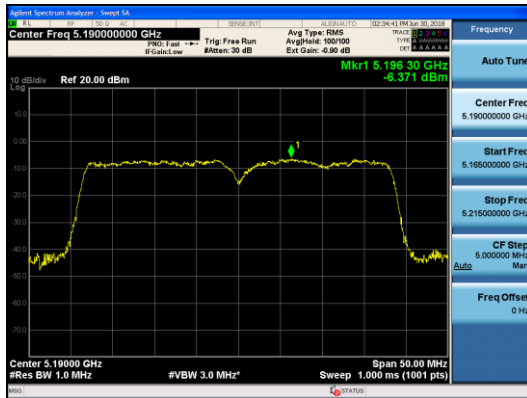


802.11n(HT40)_UNII 1 Band

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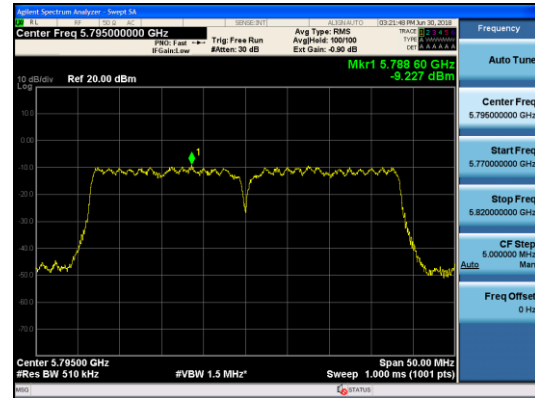
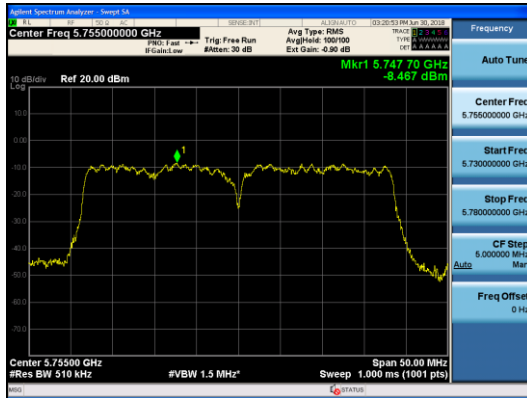


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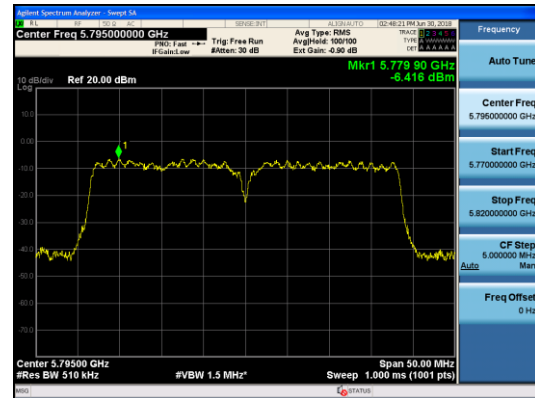
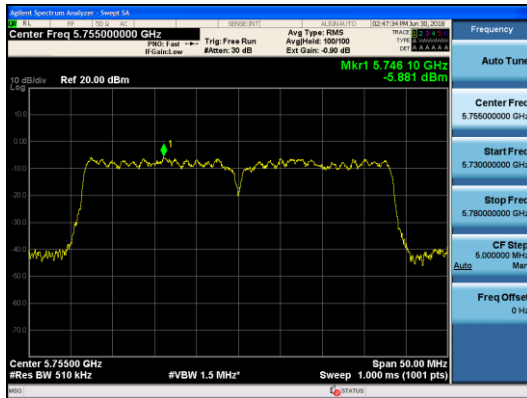


802.11n(HT40)_UNII 3 Band

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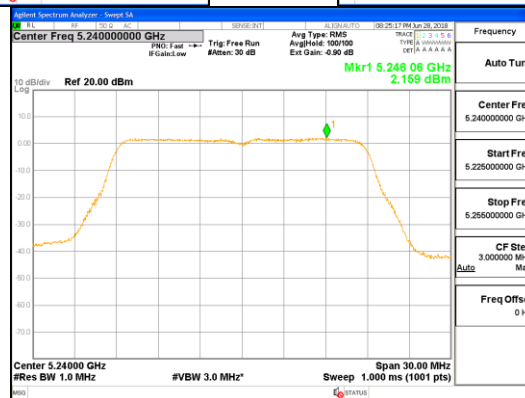
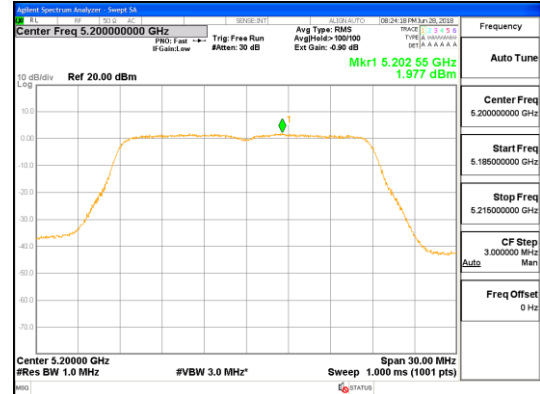
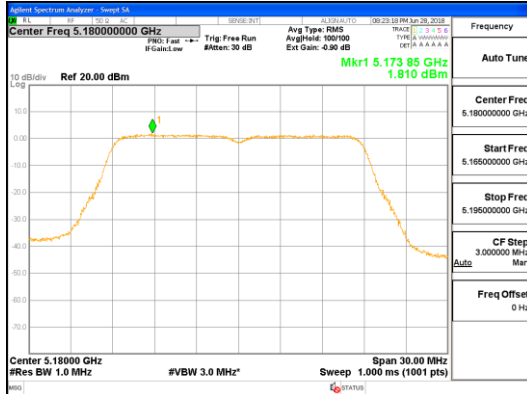


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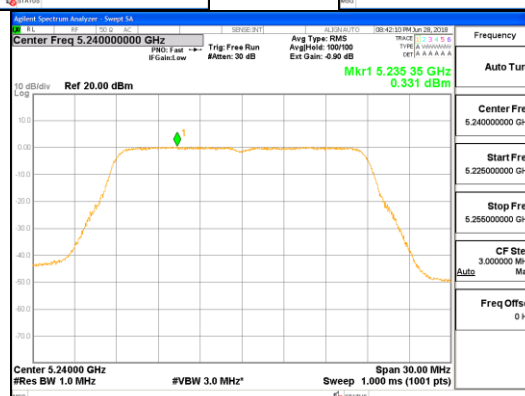
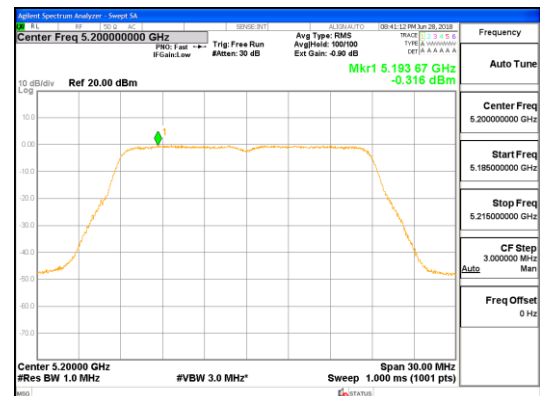
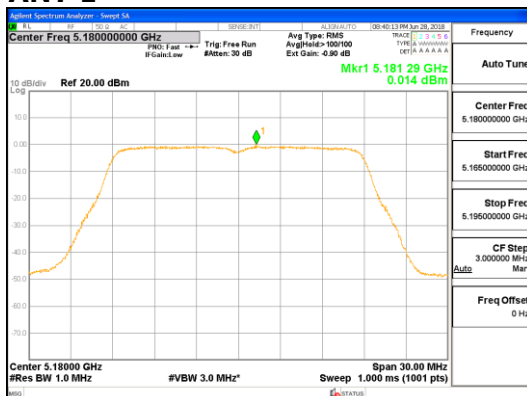


802.11ac(VHT20)_UNII 1 Band

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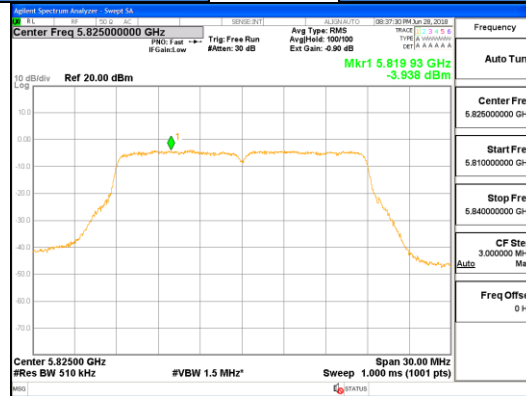
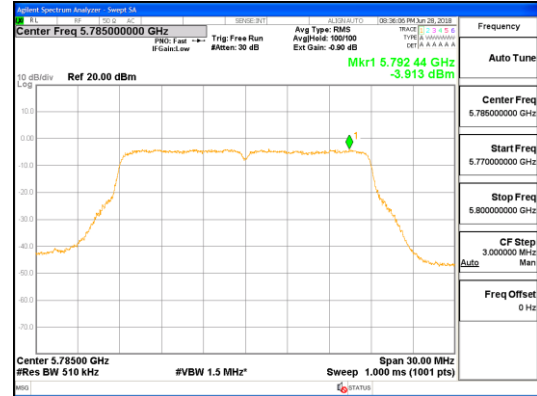
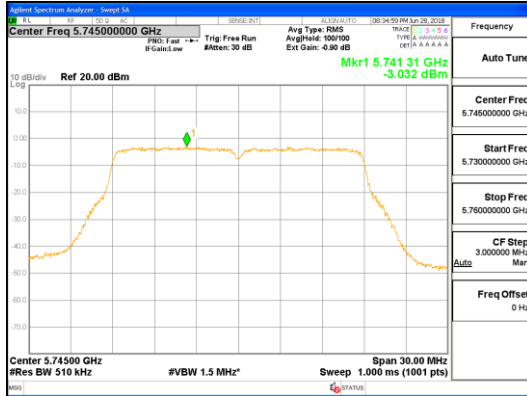


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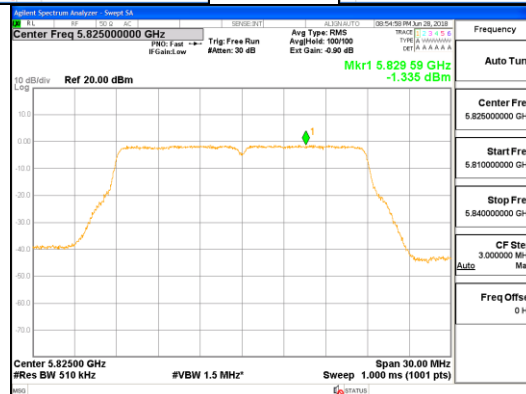
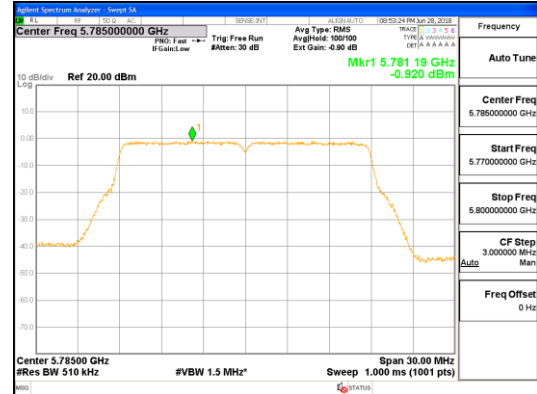
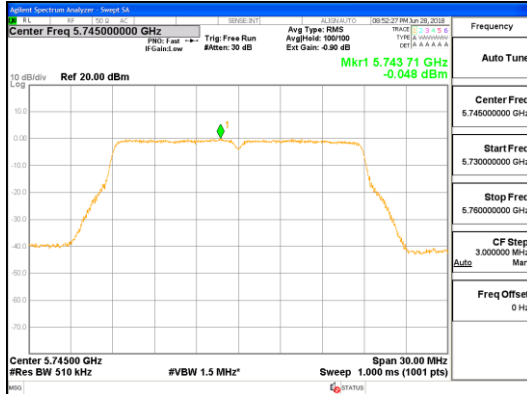


802.11ac(VHT20)_UNII 3 Band

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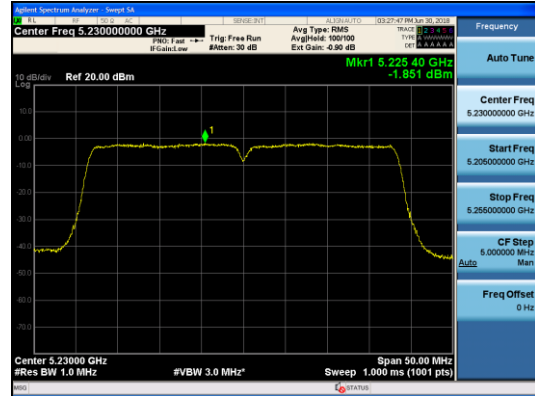
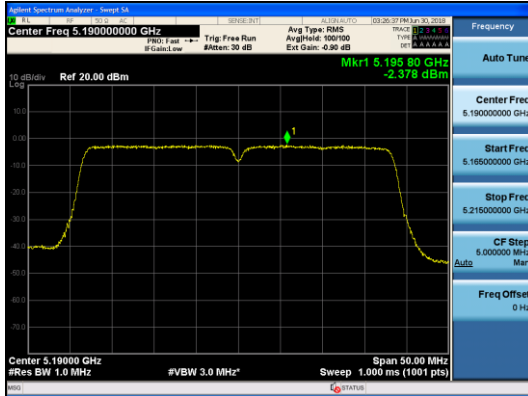


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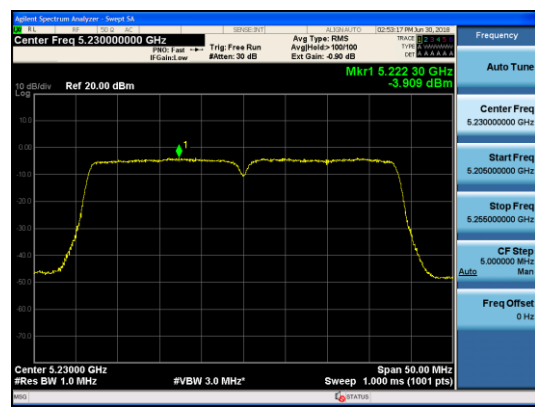
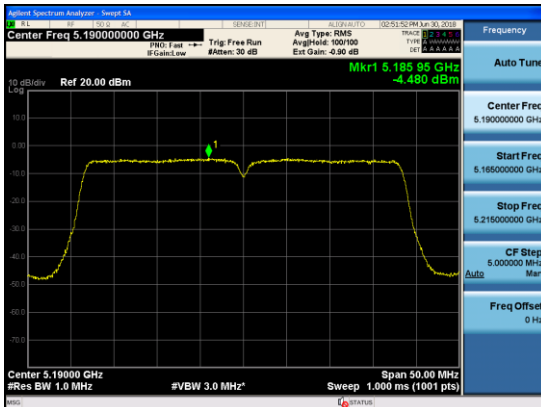


802.11ac(VHT40)_UNII 1 Band

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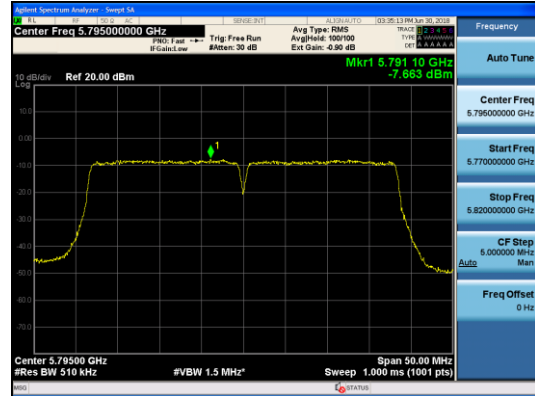
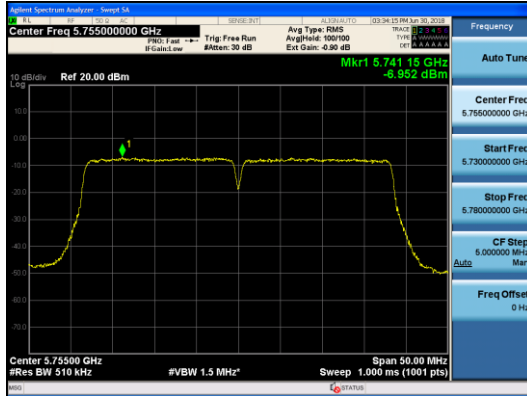


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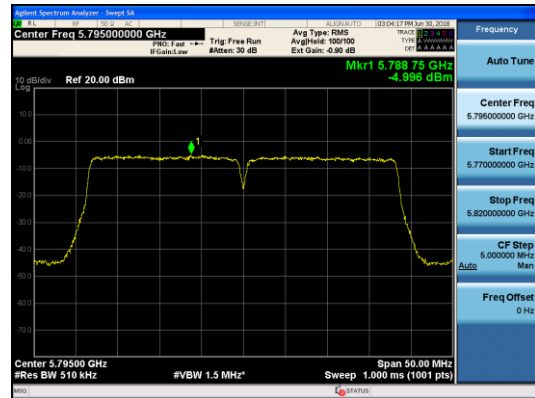
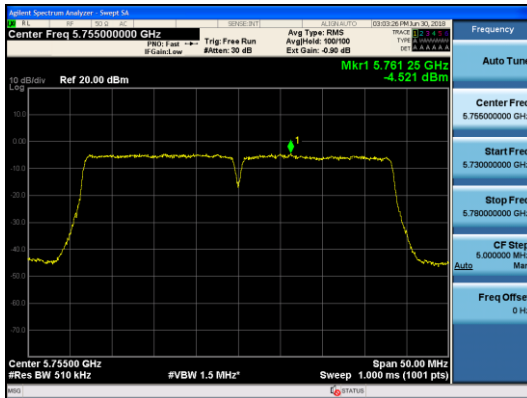


802.11ac(VHT40)_UNII 3 Band

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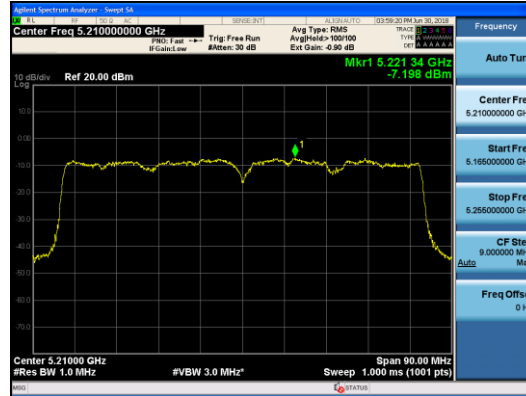


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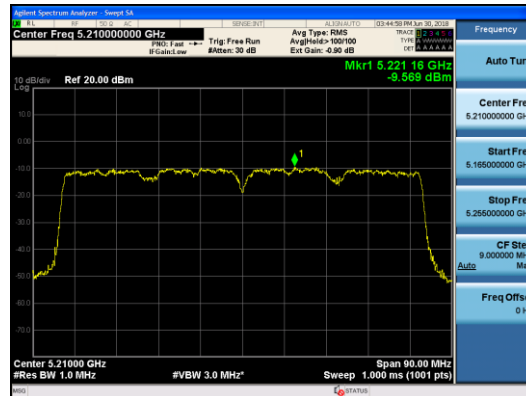


802.11ac(VHT80)_UNII 1 Band

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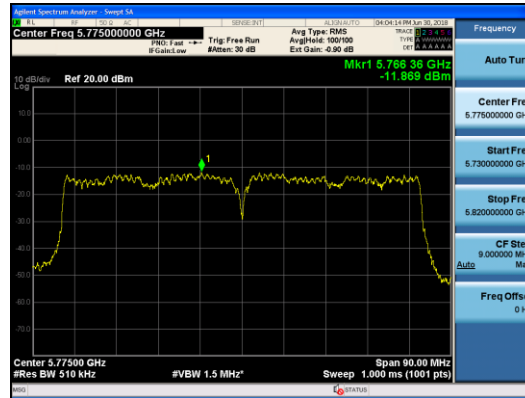


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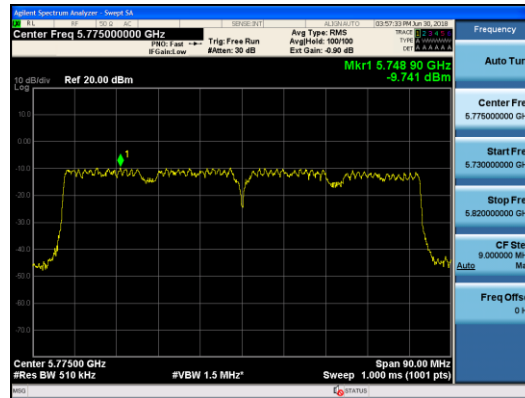


802.11ac(VHT80)_UNII 3 Band

ANT 0



ANT 1



4.5 Frequency Stability

Test Procedures

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 0 °C and +45 °C (Declaration by the Manufacturer). The temperature was incremented by 10 °C 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.

Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual.

Frequency Error (kHz)						
Frequency [MHz]	Temperature					
	0 °C	10 °C	20 °C	30 °C	40 °C	45 °C
5 180	46.911	33.365	4.517	0.670	-18.243	-22.666
5 200	58.587	42.683	20.428	5.447	-9.082	-11.246
5 240	54.622	43.717	24.648	6.021	-5.479	-11.802
5 745	57.166	39.921	21.863	-4.723	-17.566	-23.022
5 785	55.855	43.998	20.727	0.295	-17.290	-19.990
5 825	72.180	47.378	28.036	11.050	-3.620	-14.299

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.

This modular transmitter have its own power supply regulation.

4.6 Unwanted Emissions

Test Location

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

Test Procedures

- 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 range 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 ~ 40 GHz

- a) RBW = 1 MHz for $f \geq 1$ GHz, 120 kHz for $f < 1$ GHz, 9 kHz for $f < 30$ MHz
- b) VBW $\geq$ RBW
- c) Sweep time = auto

Limit

- 1) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement 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

- 2) 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 e.i.r.p. of -27 dBm/MHz.
- 3) 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.

- ※ $E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] - 20\log(d) + 104.77$
 $E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ m
 e.i.r.p. -27 dBm => **68.2 dBuV/m**
 e.i.r.p. 10 dBm => **105.2 dBuV/m**
 e.i.r.p. 15.6 dBm => **110.8 dBuV/m**
 e.i.r.p. 27 dBm => **122.2 dBuV/m**

4) The provisions of §15.205 apply to intentional radiators operating under this section.

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:

Table 1. Restricted Frequency Bands*

MHz	MHz	MHz	MHz	MHz	GHz
0.09-0.11	8.37626-8.38675	73-74.6	399.9-410	2690-2900	10.6-12.7
¹ 0.495-0.505	8.41425-8.41475	74.8-75.2	608-614	3260-3267	13.25-13.4
2.1735-2.1905	12.29-12.293	108-121.94	960-1240	3332-3339	14.47-14.5
4.125-4.128	12.51975-12.52025	123-138	1300-1427	3345.8-3358	15.35-16.2
4.17725-4.17775	12.57675-12.57725	149.9-150.05	1435-1626.5	3600-4400	17.7-21.4
4.20725-4.20775	13.36-13.41	156.52475-156.52525	1645.5-1646.5	4500-5150	22.01-23.12
6.215-6.218	16.42-16.423	156.7-156.9	1660-1710	5350-5460	23.6-24
6.26775-6.26825	16.69475-16.69525	162.0125-167.17	1718.8-1722.2	7250-7750	31.2-31.8
6.31175-6.31225	16.80425-16.80475	167.72-173.2	2200-2300	8025-8500	36.43-36.5
8.291-8.294	25.5-25.67	240-285	2310-2390	9000-9200	² Above 38.6
8.362-8.366	37.5-38.25	322-335.4	2483.5-2500	9300-9500	

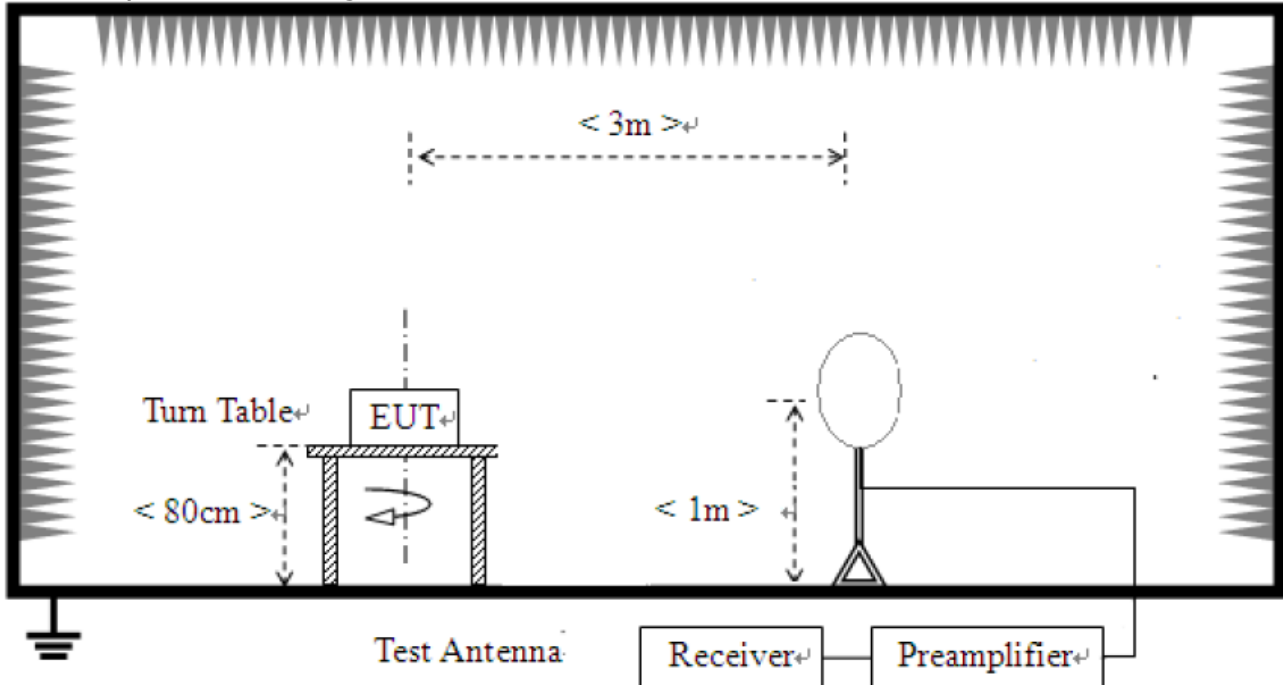
¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

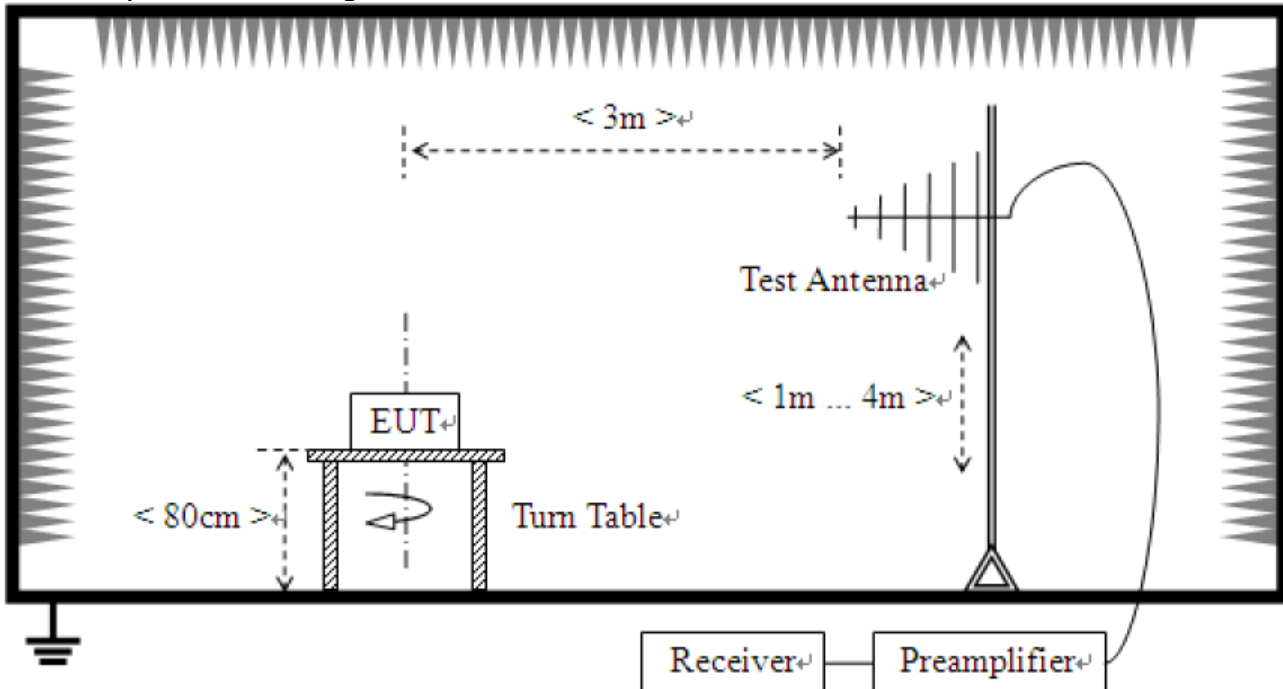
15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using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

Test Setup:

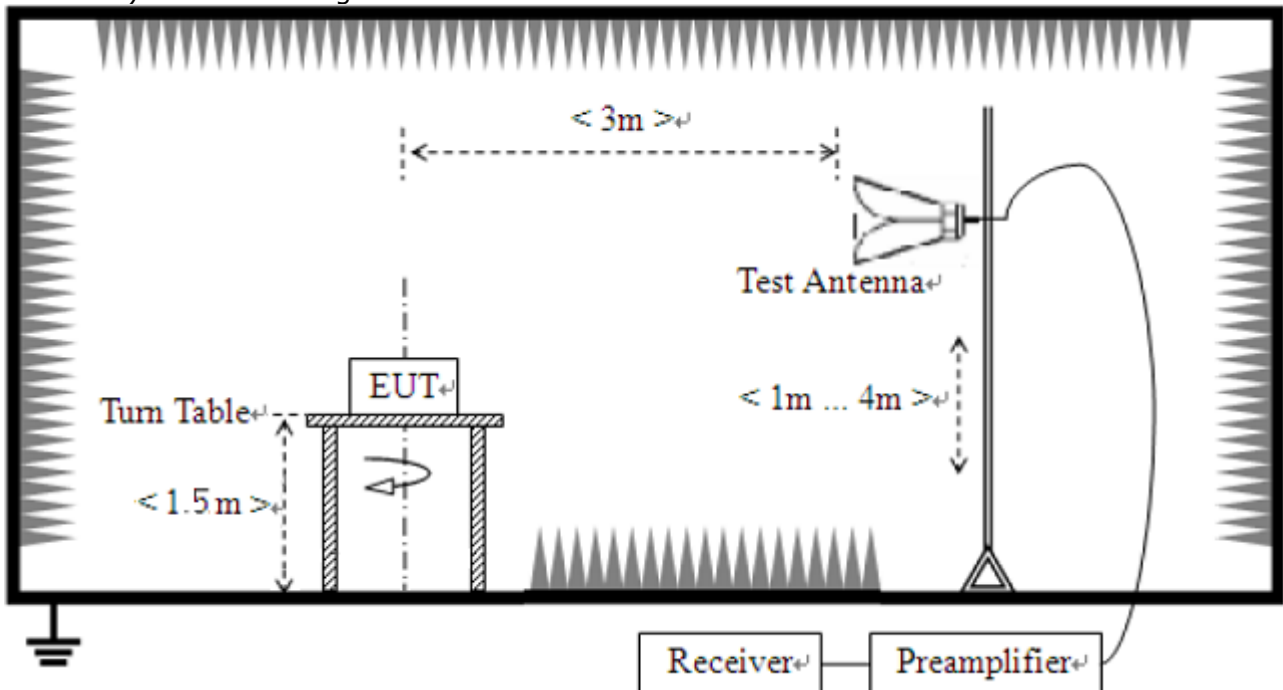
- 1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



Test Results

1) 9 kHz to 30 MHz

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)

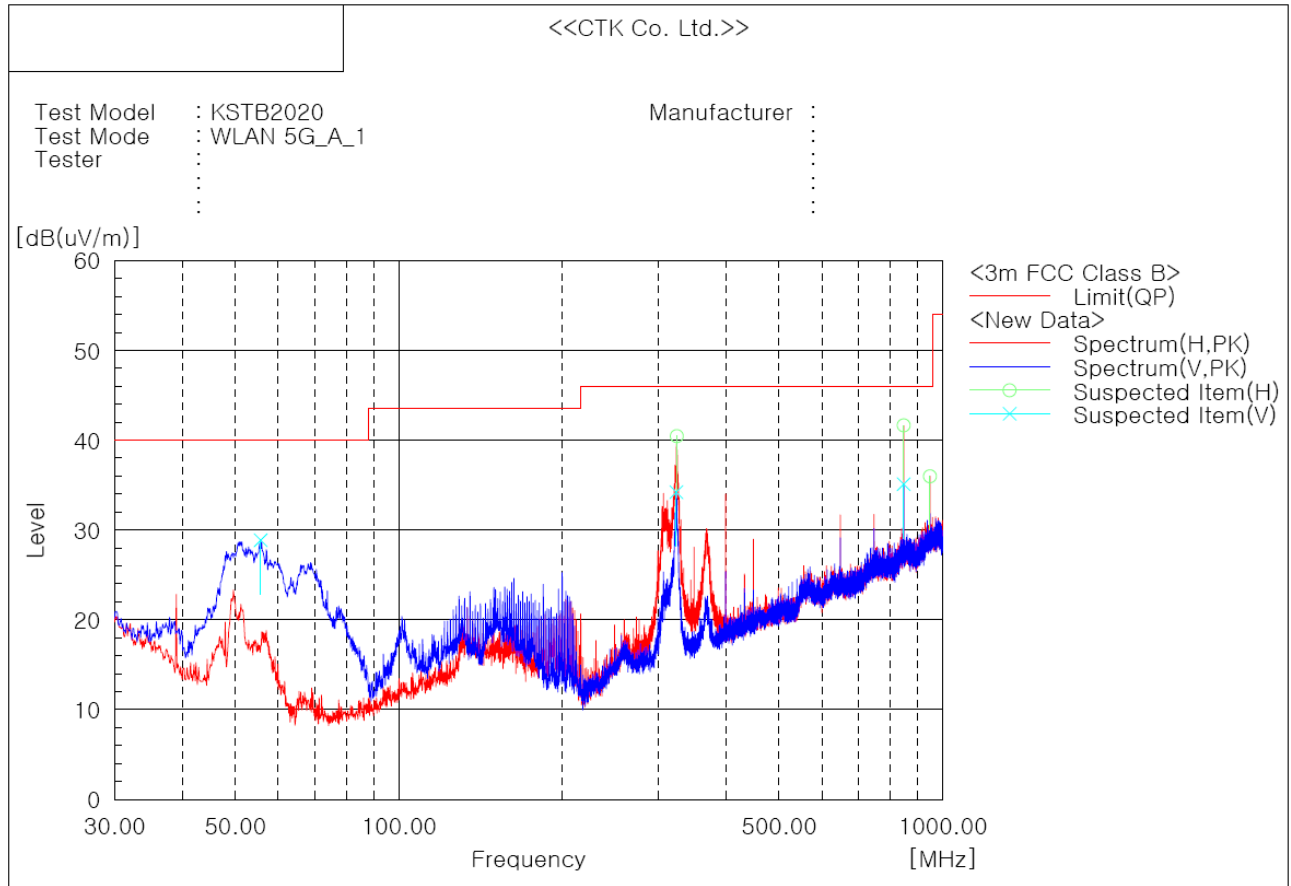
2) 30 MHz to 1 GHz

Test mode : 802.11a, UNII 1 band, ANT 0, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency (P)	Reading	c.f	Result PK	Limit QP	Margin QP	Height	Angle
	[MHz]	[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	55.705	V 46.9	-18.0	28.9	40.0	11.1	100.0	321.0
2	323.546	V 42.5	-8.3	34.2	46.0	11.8	100.0	216.0
3	324.274	H 48.7	-8.3	40.4	46.0	5.6	101.0	224.0
4	847.468	H 37.6	4.0	41.6	46.0	4.4	101.0	303.0
5	847.468	V 31.1	4.0	35.1	46.0	10.9	100.0	0.0
6	947.135	H 29.5	6.5	36.0	46.0	10.0	101.0	92.0

Remark :

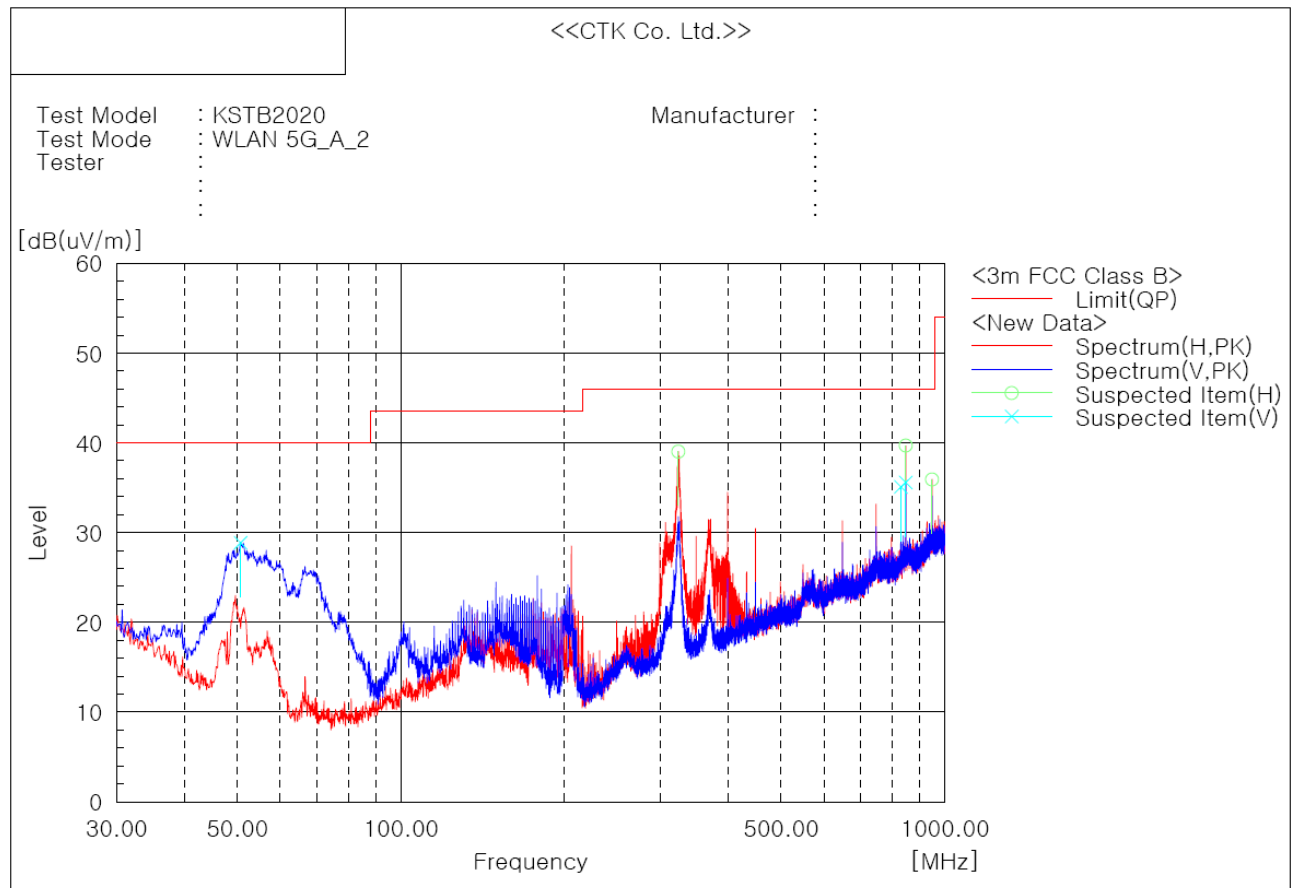
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11a, UNII 1 band, ANT 1, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	50.734	V	44.9	-16.0	28.9	40.0	11.1	101.0	321.0
2	323.668	H	47.3	-8.3	39.0	46.0	7.0	100.0	223.0
3	830.493	V	31.8	3.3	35.1	46.0	10.9	101.0	295.0
4	847.468	H	35.7	4.0	39.7	46.0	6.3	100.0	302.0
5	847.468	V	31.6	4.0	35.6	46.0	10.4	200.0	328.0
6	947.135	H	29.4	6.5	35.9	46.0	10.1	100.0	38.0

Remark :

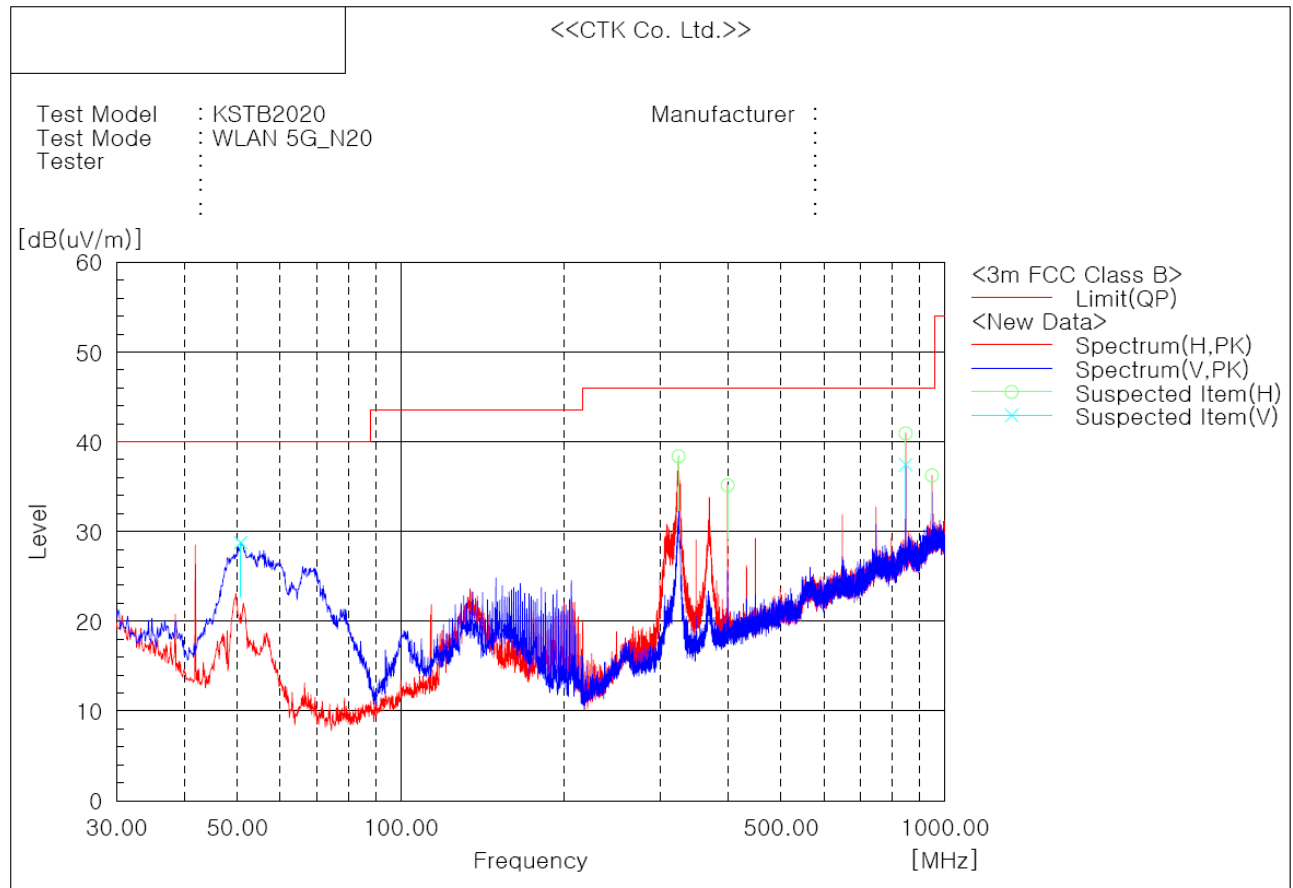
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11n(HT20), UNII 1 band, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	50.734	V	44.8	-16.0	28.8	40.0	11.2	101.0	242.0
2	323.910	H	46.7	-8.3	38.4	46.0	7.6	101.0	171.0
3	398.721	H	40.6	-5.4	35.2	46.0	10.8	101.0	66.0
4	847.468	H	36.9	4.0	40.9	46.0	5.1	101.0	303.0
5	847.468	V	33.4	4.0	37.4	46.0	8.6	200.0	0.0
6	947.135	H	29.7	6.5	36.2	46.0	9.8	101.0	92.0

Remark :

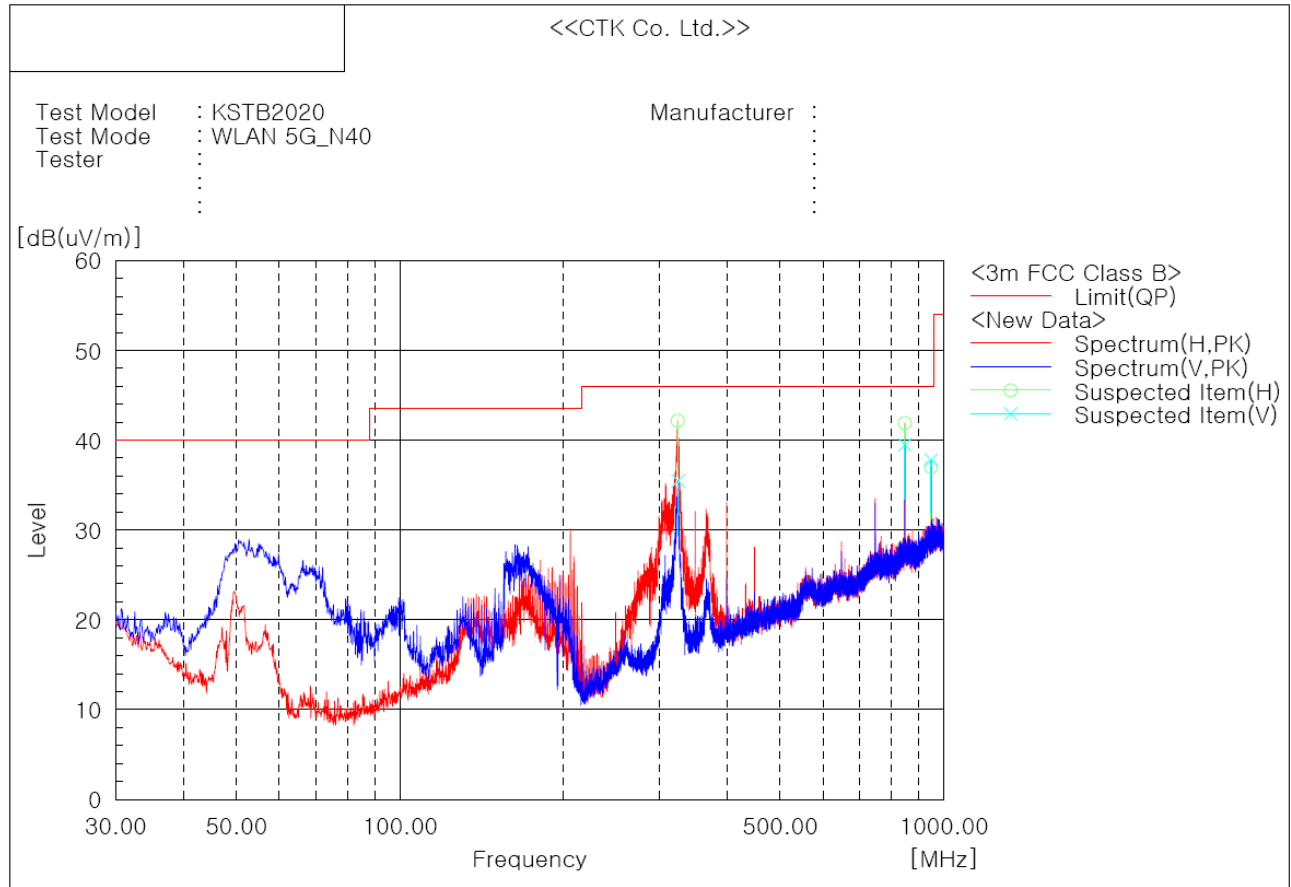
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11n(HT40), UNII 1 band, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	323.910	H	50.5	-8.3	42.2	46.0	3.8	101.0	249.0
2	324.638	V	43.8	-8.3	35.5	46.0	10.5	100.0	138.0
3	847.468	H	37.9	4.0	41.9	46.0	4.1	101.0	91.0
4	847.468	V	35.5	4.0	39.5	46.0	6.5	200.0	0.0
5	947.135	V	31.3	6.5	37.8	46.0	8.2	100.0	295.0
6	947.135	H	30.5	6.5	37.0	46.0	9.0	101.0	328.0

Remark :

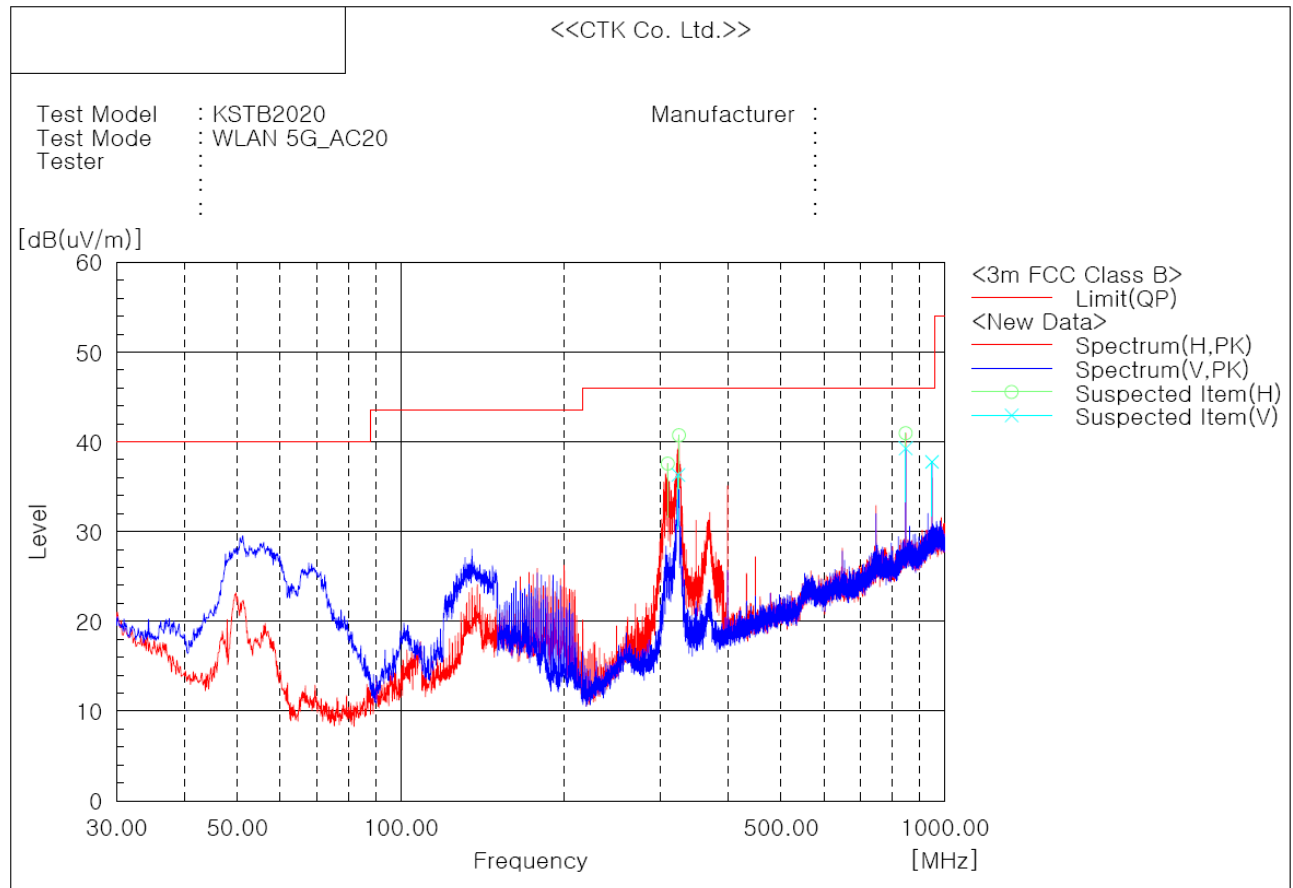
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11ac(VHT20), UNII 1 band, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	309.481	H	46.4	-8.8	37.6	46.0	8.4	101.0	144.0
2	323.546	V	44.6	-8.3	36.3	46.0	9.7	101.0	243.0
3	324.516	H	49.0	-8.3	40.7	46.0	5.3	101.0	223.0
4	847.468	H	37.0	4.0	41.0	46.0	5.0	101.0	91.0
5	847.468	V	35.3	4.0	39.3	46.0	6.7	200.0	0.0
6	947.135	V	31.3	6.5	37.8	46.0	8.2	101.0	295.0

Remark :

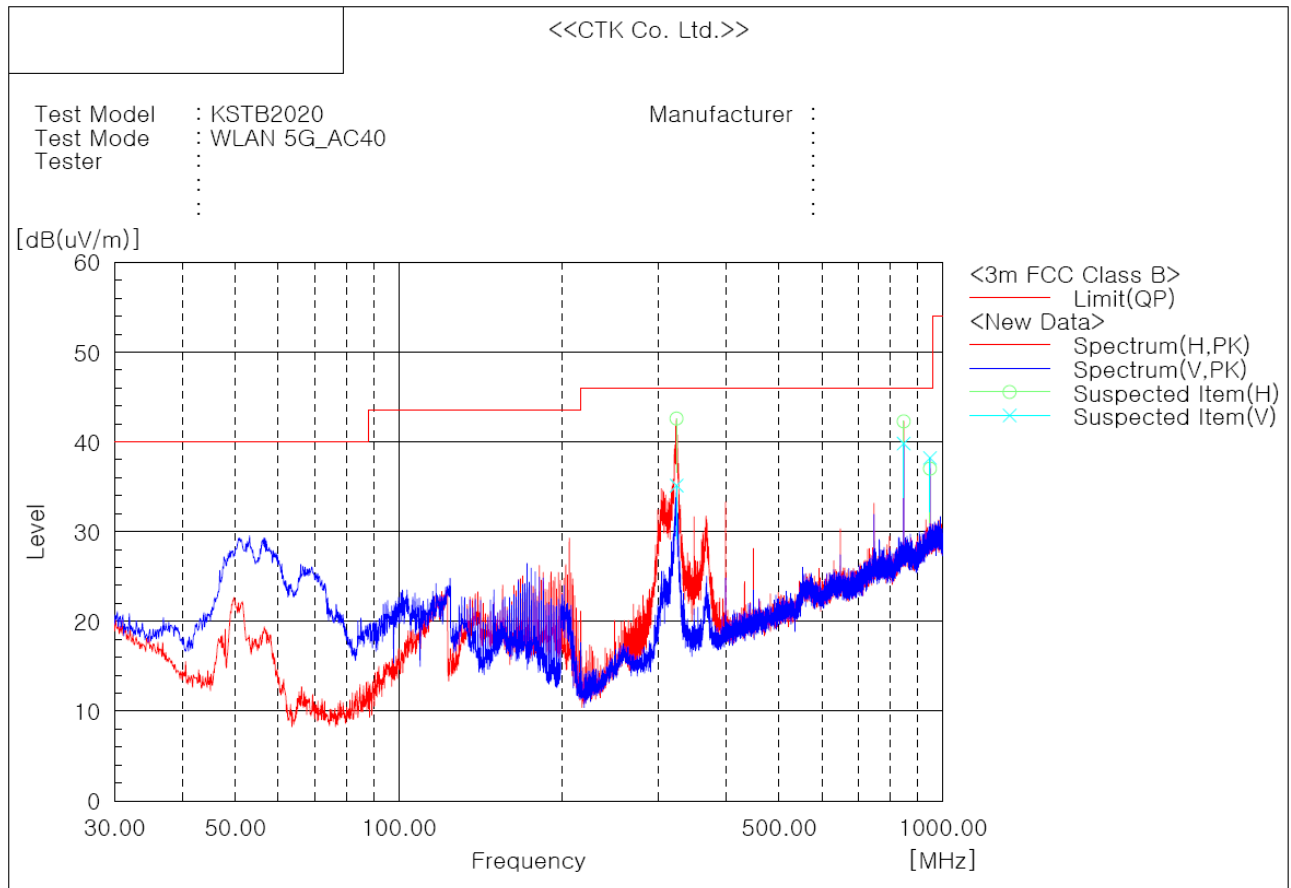
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11ac(VHT40), UNII 1 band, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	323.910	H	50.9	-8.3	42.6	46.0	3.4	100.0	223.0
2	324.031	V	43.4	-8.3	35.1	46.0	10.9	100.0	216.0
3	847.468	H	38.3	4.0	42.3	46.0	3.7	100.0	92.0
4	847.468	V	35.8	4.0	39.8	46.0	6.2	200.0	39.0
5	947.135	V	31.7	6.5	38.2	46.0	7.8	100.0	295.0
6	947.135	H	30.5	6.5	37.0	46.0	9.0	100.0	328.0

Remark :

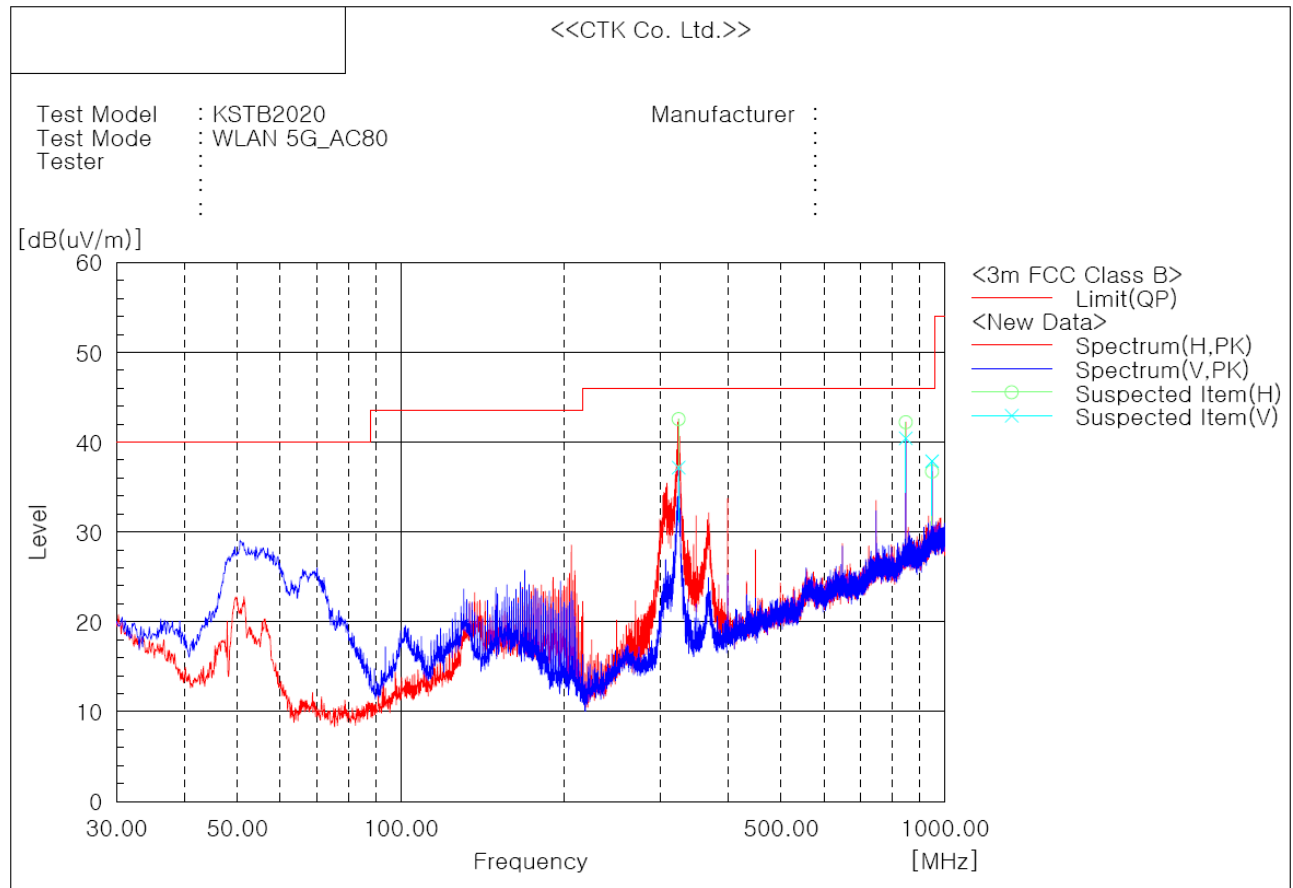
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11ac(VHT80), UNII 1 band, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	324.031	H	50.9	-8.3	42.6	46.0	3.4	100.0	250.0
2	324.031	V	45.5	-8.3	37.2	46.0	8.8	101.0	190.0
3	847.468	H	38.2	4.0	42.2	46.0	3.8	100.0	92.0
4	847.468	V	36.4	4.0	40.4	46.0	5.6	201.0	39.0
5	947.135	V	31.4	6.5	37.9	46.0	8.1	101.0	295.0
6	947.135	H	30.2	6.5	36.7	46.0	9.3	100.0	92.0

Remark :

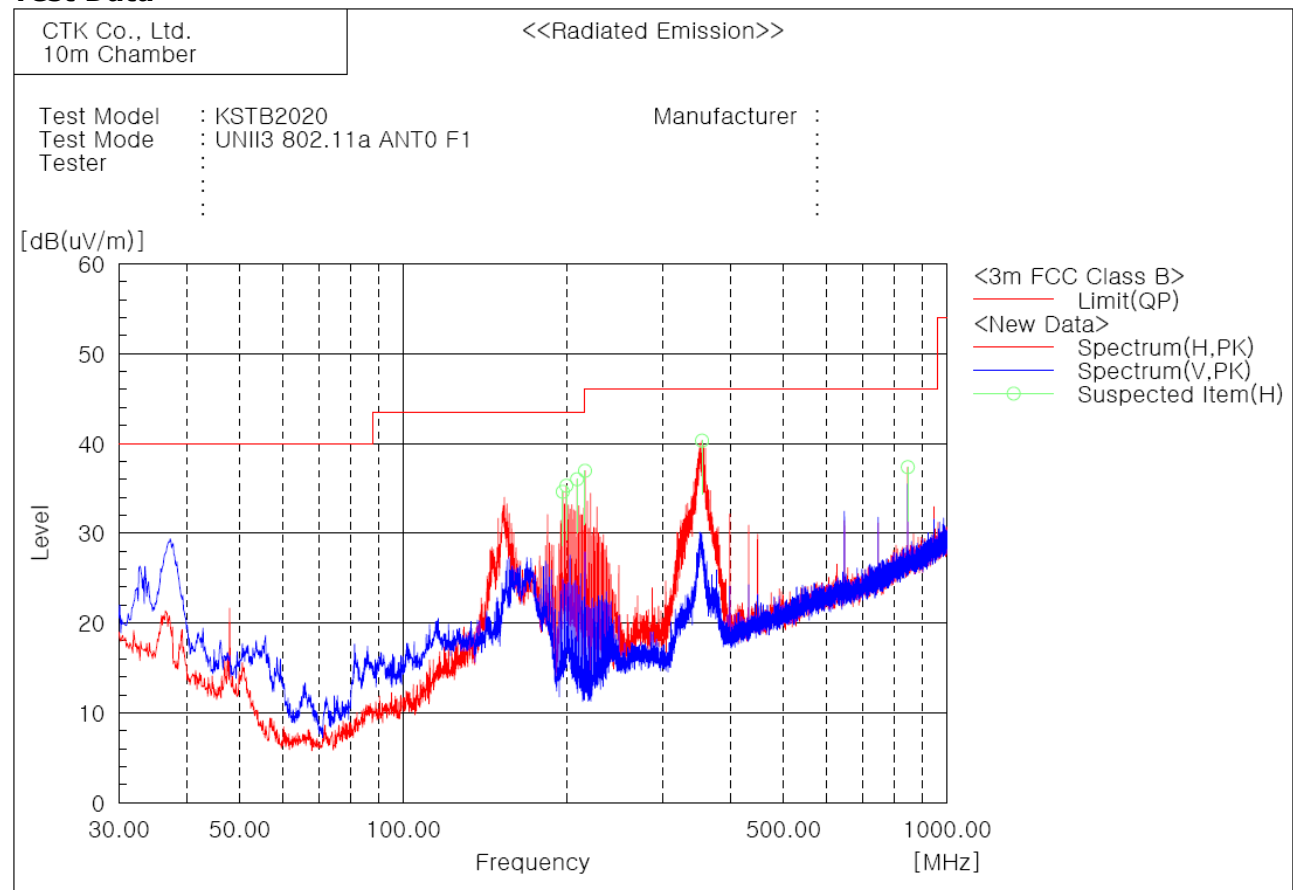
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11a, UNII 3 band, ANT 0, low channel(Worst case)

The requirements are:

☒ Complies

Test Data



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	196.598	H	48.4	-13.8	34.6	43.5	8.9	101.0	197.0
2	199.629	H	49.2	-13.9	35.3	43.5	8.2	201.0	321.0
3	208.844	H	49.5	-13.5	36.0	43.5	7.5	101.0	39.0
4	215.998	H	50.1	-13.1	37.0	43.5	6.5	101.0	39.0
5	354.586	H	47.1	-6.8	40.3	46.0	5.7	101.0	39.0
6	847.468	H	33.7	3.7	37.4	46.0	8.6	101.0	65.0

Remark :

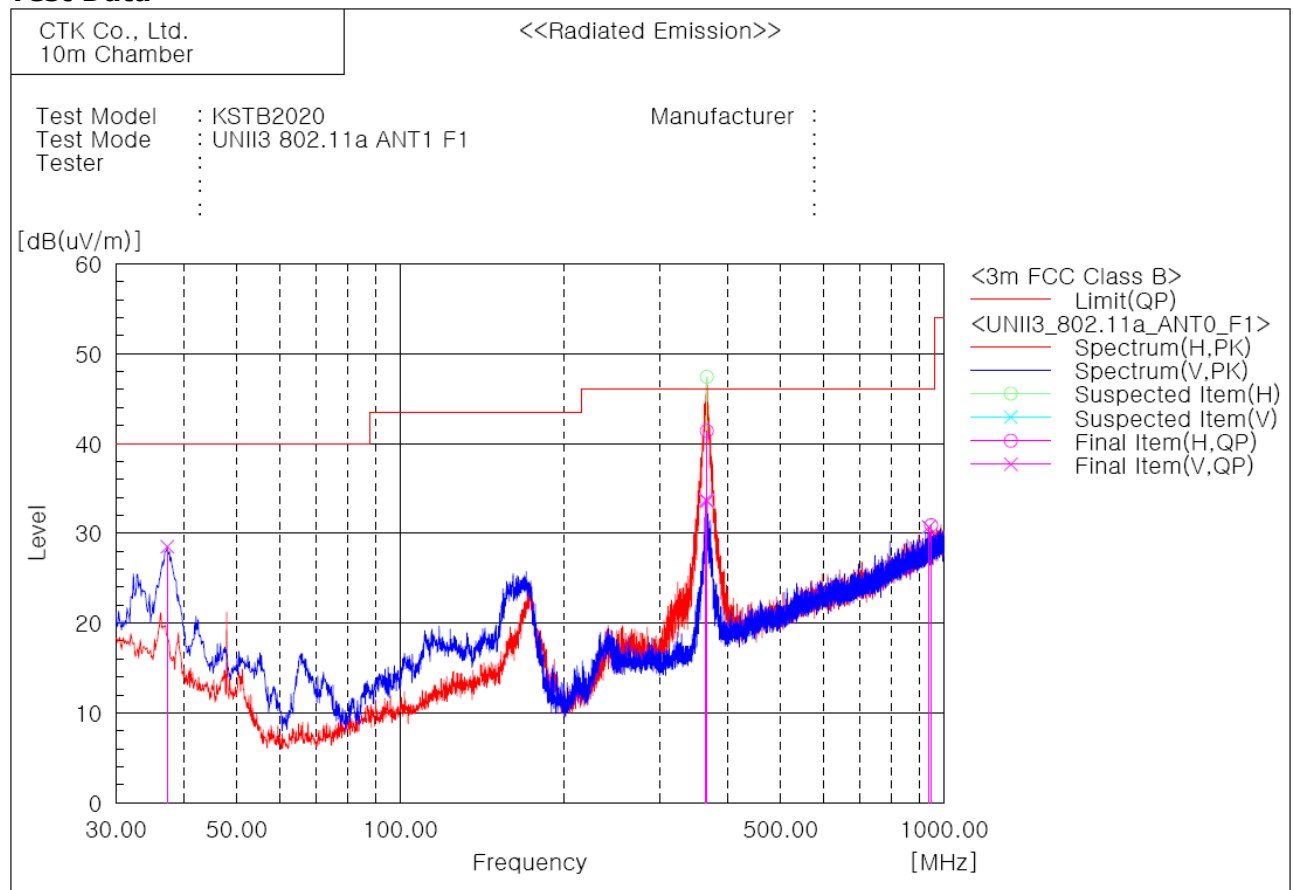
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor +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

Test mode : 802.11a, UNII 3 band, ANT 1, low channel(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	37.275	V	38.6	-10.1	28.5	40.0	11.5	101.0	294.0
2	365.014	V	40.0	-6.3	33.7	46.0	12.3	300.0	110.0
3	366.348	H	47.6	-6.2	41.4	46.0	4.6	101.0	39.0
4	366.590	V	39.8	-6.2	33.6	46.0	12.4	300.0	242.0
5	937.799	V	24.7	6.0	30.7	46.0	15.3	200.0	359.0
6	947.135	H	24.7	6.2	30.9	46.0	15.1	101.0	65.0

Remark :

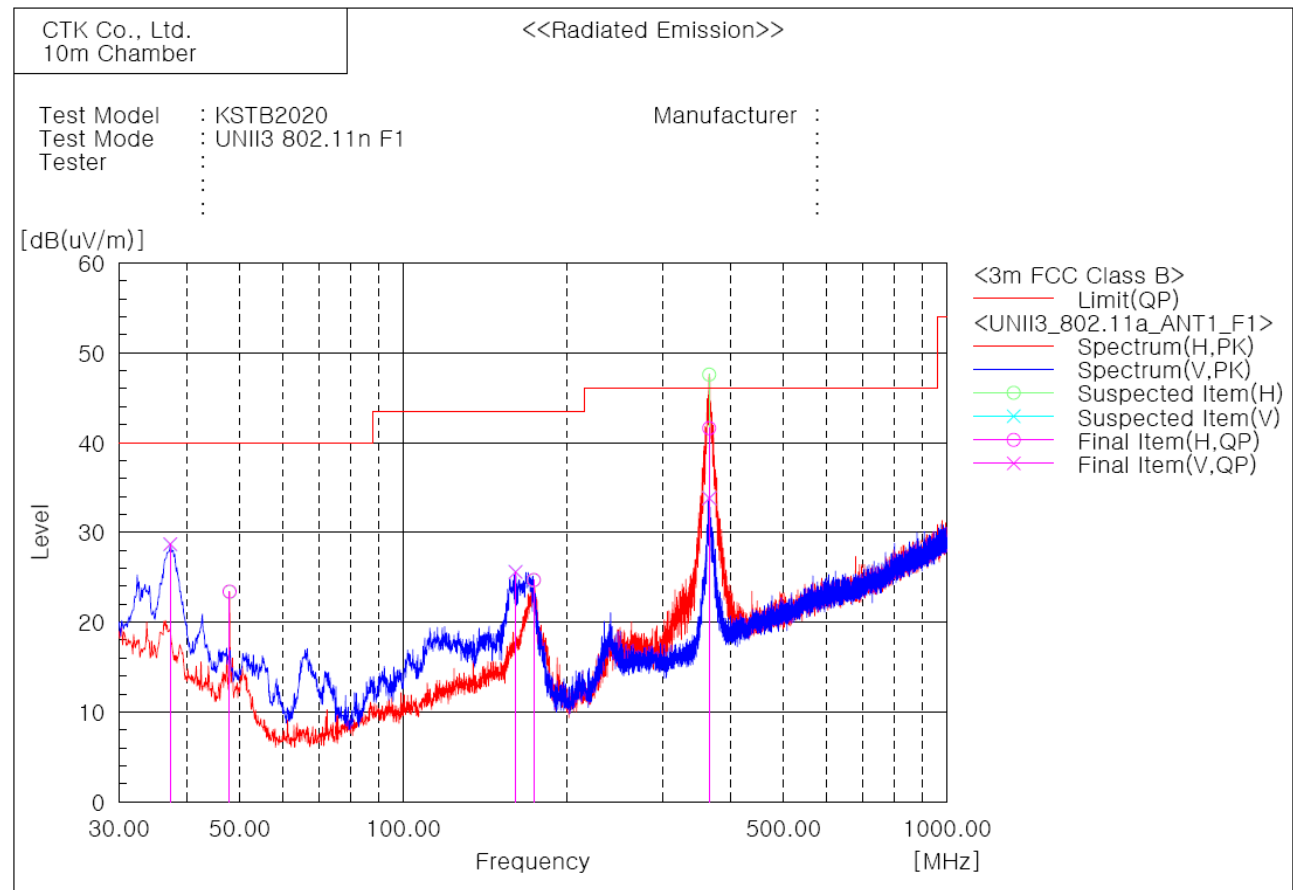
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. It is the peak(PK) value except for the No.3 data.

Test mode : 802.11n(HT20), UNII 3 band, low channel(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	37.275	V	38.8	-10.1	28.7	40.0	11.3	101.0	329.0
2	47.945	H	37.9	-14.5	23.4	40.0	16.6	101.0	321.0
3	160.950	V	38.7	-13.1	25.6	43.5	17.9	101.0	303.0
4	173.924	H	38.6	-13.9	24.7	43.5	18.8	200.0	0.0
5	365.499	H	47.9	-6.3	41.6	46.0	4.4	101.0	1.0
6	365.620	V	40.1	-6.3	33.8	46.0	12.2	300.0	92.0

Remark :

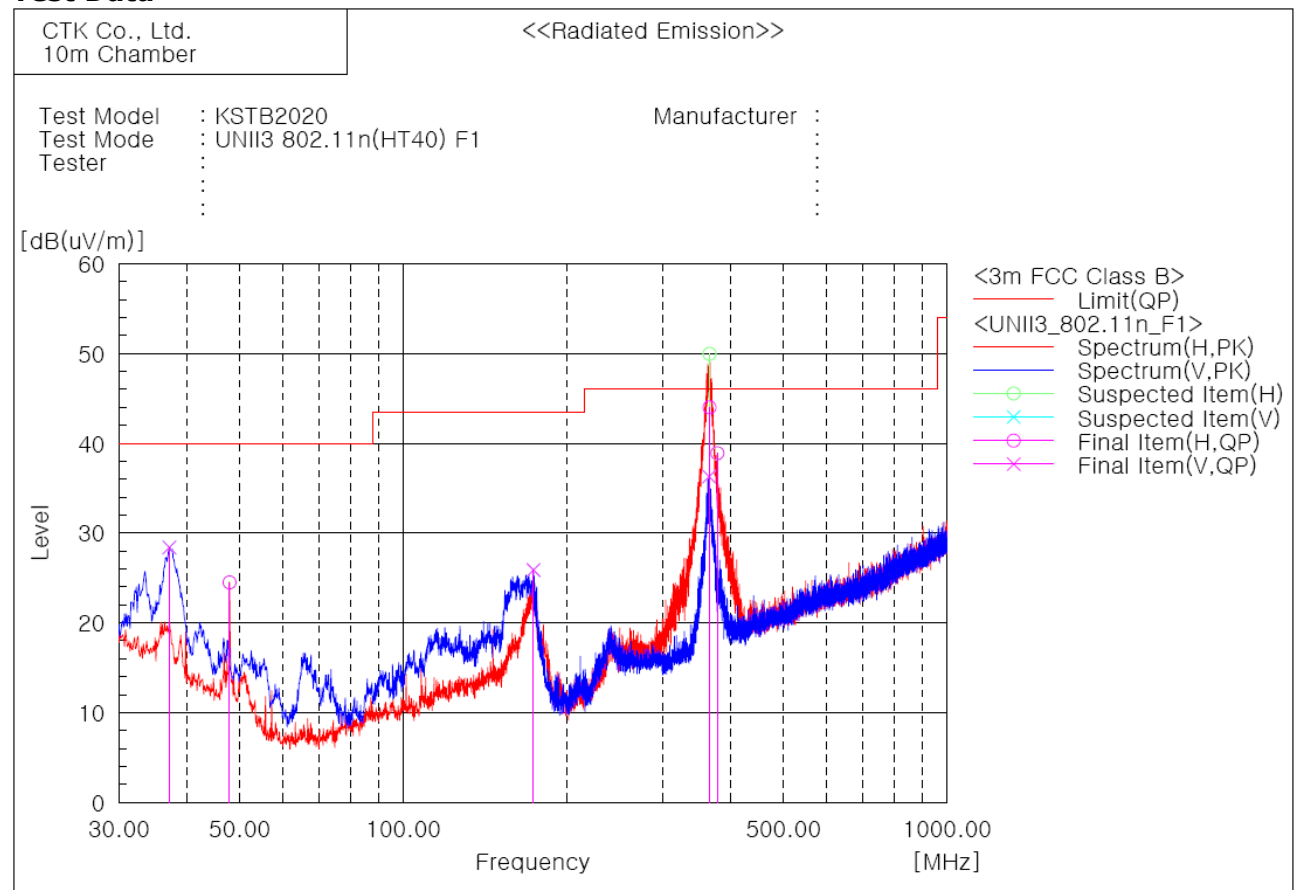
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. It is the peak(PK) value except for the No.5 data.

Test mode : 802.11n(HT40), UNII 3 band, low channel(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	37.154	V	38.5	-10.1	28.4	40.0	11.6	101.0	0.0
2	47.945	H	39.0	-14.5	24.5	40.0	15.5	101.0	294.0
3	173.560	V	39.8	-13.9	25.9	43.5	17.6	101.0	303.0
4	365.135	V	42.6	-6.3	36.3	46.0	9.7	300.0	92.0
5	365.984	H	50.3	-6.3	44.0	46.0	2.0	101.0	1.0
6	378.473	H	44.6	-5.7	38.9	46.0	7.1	101.0	31.0

Remark :

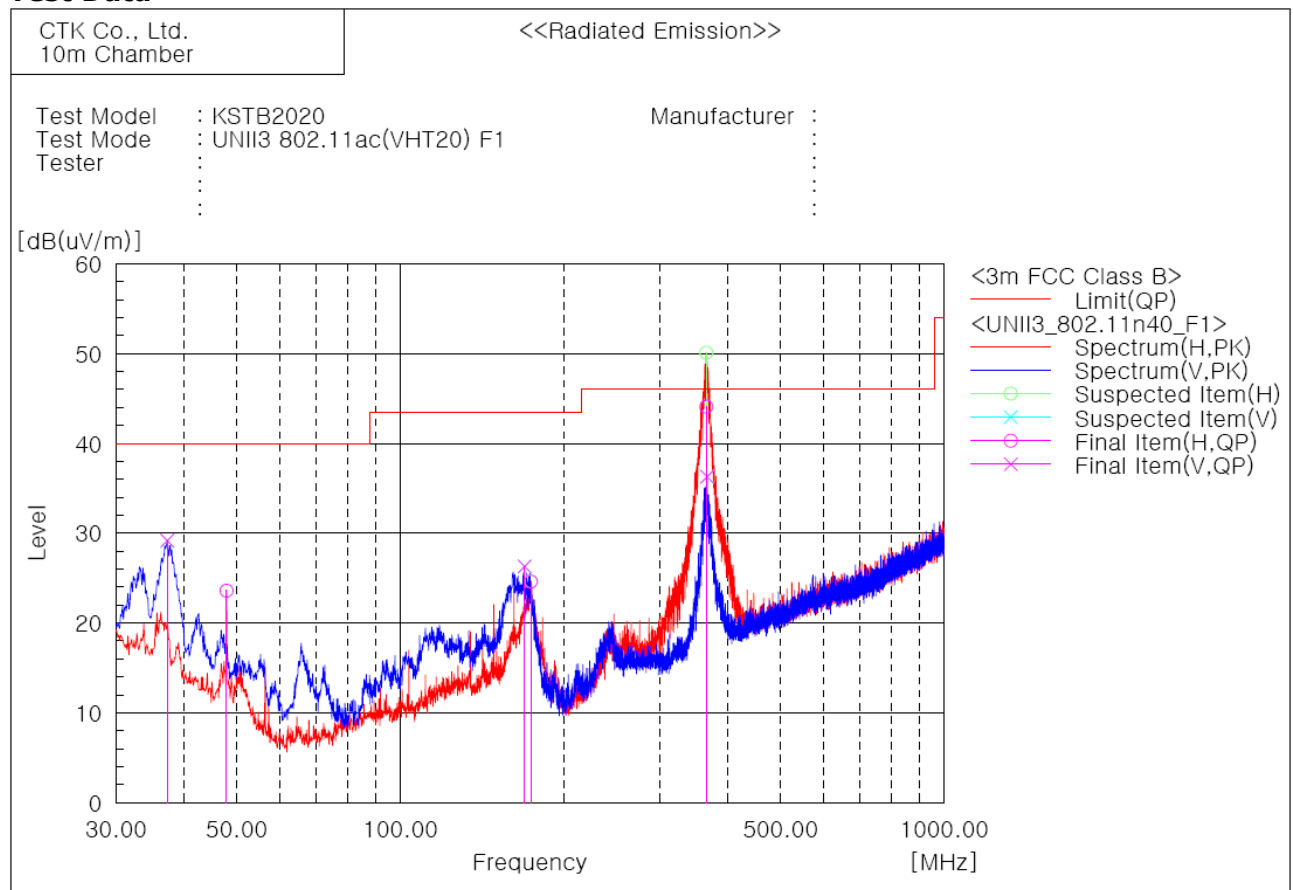
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. It is the peak(PK) value except for the No.5 data.

Test mode : 802.11ac(VHT20), UNII 3 band, low channel(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	37.275	V	39.3	-10.1	29.2	40.0	10.8	101.0	276.0
2	47.945	H	38.1	-14.5	23.6	40.0	16.4	101.0	189.0
3	169.316	V	39.8	-13.5	26.3	43.5	17.2	101.0	359.0
4	173.924	H	38.5	-13.9	24.6	43.5	18.9	300.0	0.0
5	365.499	H	50.4	-6.3	44.1	46.0	1.9	101.0	321.0
6	366.711	V	42.5	-6.2	36.3	46.0	9.7	301.0	145.0

Remark :

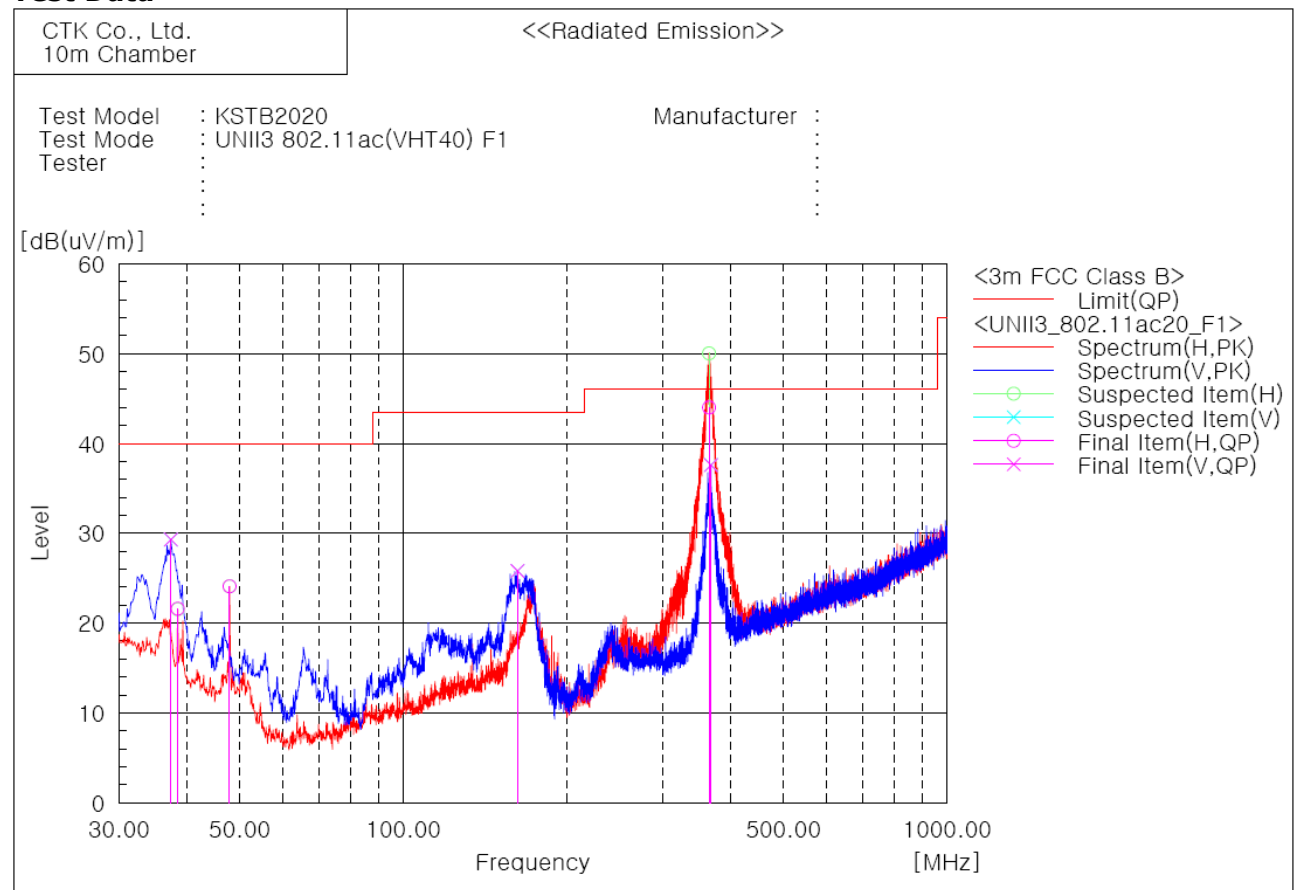
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. It is the peak(PK) value except for the No.5 data.

Test mode : 802.11ac(VHT40), UNII 3 band, low channel(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	37.396	V	39.5	-10.2	29.3	40.0	10.7	101.0	328.0
2	38.488	H	32.3	-10.7	21.6	40.0	18.4	101.0	321.0
3	47.945	H	38.6	-14.5	24.1	40.0	15.9	101.0	216.0
4	162.284	V	38.9	-13.1	25.8	43.5	17.7	101.0	302.0
5	365.256	H	50.3	-6.3	44.0	46.0	2.0	101.0	321.0
6	368.166	V	43.7	-6.1	37.6	46.0	8.4	300.0	118.0

Remark :

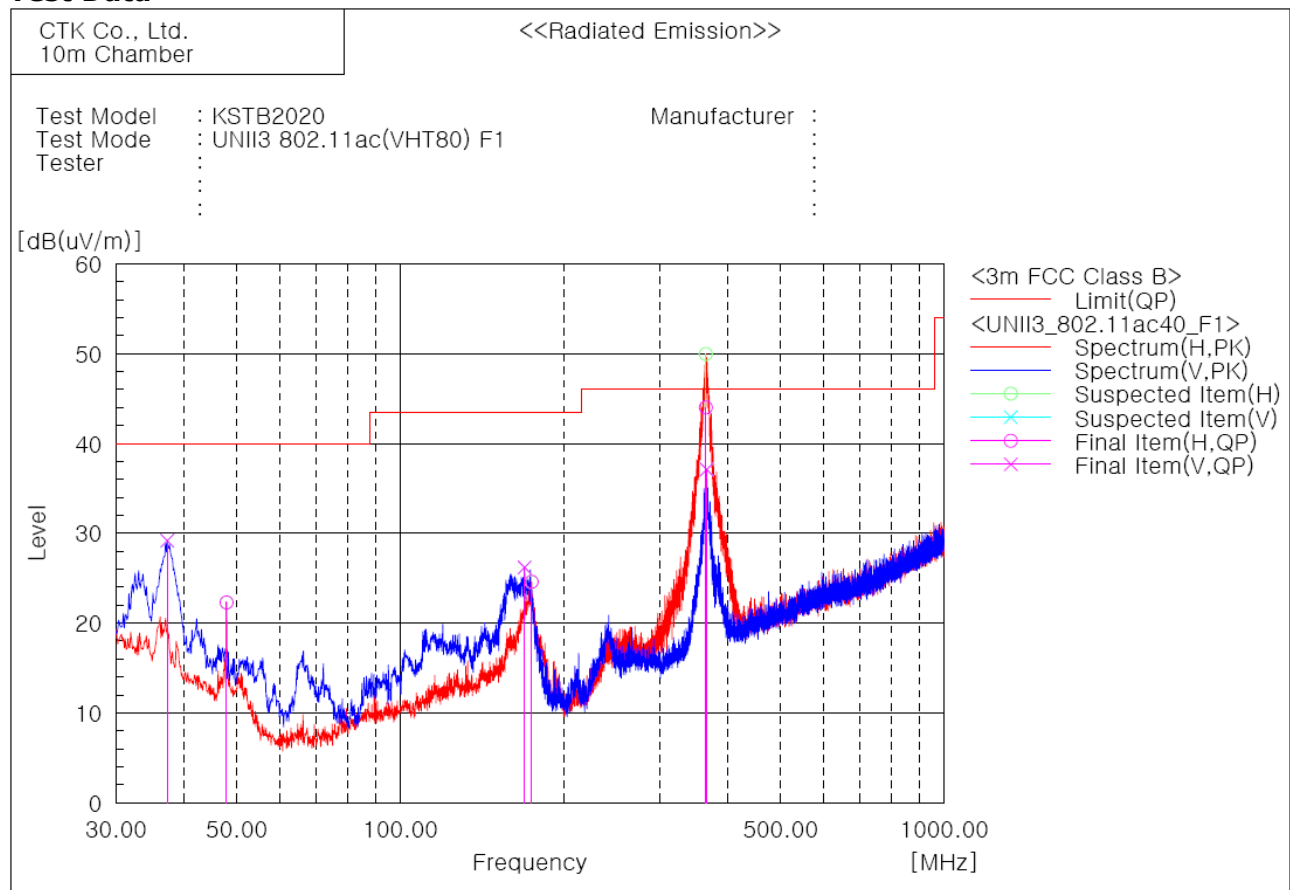
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
2. Result = Reading + c.f(Correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. It is the peak(PK) value except for the No.5 data.

Test mode : 802.11ac(VHT80), UNII 3 band, low channel(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	37.275	V	39.3	-10.1	29.2	40.0	10.8	101.0	39.0
2	47.945	H	36.8	-14.5	22.3	40.0	17.7	101.0	268.0
3	169.316	V	39.7	-13.5	26.2	43.5	17.3	101.0	359.0
4	174.530	H	38.5	-13.9	24.6	43.5	18.9	300.0	1.0
5	364.771	H	50.3	-6.3	44.0	46.0	2.0	101.0	0.0
6	366.105	V	43.4	-6.3	37.1	46.0	8.9	300.0	118.0

Remark :

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(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. It is the peak(PK) value except for the No.5 data.

3) above 1 GHz

Test mode : 802.11a, UNII 1 band, ANT 0

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 149.7*	H	61.8	1.8	63.6	74	10.4	Peak
	5 149.3*	H	48.2	1.8	50.0	54	4.0	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11a, UNII 3 band, ANT 0

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 646.0	H	60.5	4.1	64.6	68.2	3.6	Peak
High	5 930.9	V	60.9	5.2	66.1	68.2	2.1	Peak
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11a, UNII 1 band, ANT 1

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 117.0*	H	59.8	1.7	61.5	74	12.5	Peak
	5 147.1*	V	47.7	1.8	49.5	54	4.5	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11a, UNII 3 band, ANT 1

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 567.8	V	60.3	3.8	64.1	68.2	4.1	Peak
High	5 943.9	V	60.9	5.3	66.2	68.2	2.0	Peak
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Remarks

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

Test mode : 802.11n(HT20), UNII 1 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 130.7*	V	59.8	1.7	61.5	74	12.5	Peak
	5 130.9*	V	47.6	1.7	49.3	54	4.7	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11n(HT20), UNII 3 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 599.2	H	60.1	3.9	64.0	68.2	4.2	Peak
High	5 930.9	H	60.5	5.2	65.7	68.2	2.5	Peak
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11n(HT40), UNII 1 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 149.0*	H	70.5	1.8	72.3	74	1.7	Peak
	5 148.0*	H	49.4	1.8	51.2	54	2.8	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11n(HT40), UNII 3 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 563.6	V	60.1	3.8	63.9	68.2	4.3	Peak
High	5 943.2	H	60.7	5.3	66.0	68.2	2.2	Peak

Remarks

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

Test mode : 802.11ac(VHT20), UNII 1 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 149.2*	H	62.5	1.8	64.3	74	9.7	Peak
	5 149.5*	H	48.2	1.8	50.0	54	4.0	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11ac(VHT20), UNII 3 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 609.0	V	59.9	4.0	63.9	68.2	4.3	Peak
High	5 935.2	V	60.3	5.3	65.6	68.2	2.6	Peak
Middle	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11ac(VHT40), UNII 1 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 149.3*	H	64.0	1.8	65.8	74	8.2	Peak
	5 149.8*	H	49.6	1.8	51.4	54	2.6	Average
High	The emissions above 1 GHz were 20 dB lower than the limit.							

Test mode : 802.11ac(VHT40), UNII 3 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 645.6	H	59.9	4.1	64.0	68.2	4.2	Peak
High	5 926.8	H	60.9	5.2	66.1	68.2	2.1	Peak

Remarks

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

Test mode : 802.11ac(VHT80), UNII 1 band

Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 131.9*	H	68.1	1.7	69.8	74	4.2	Peak
	5 144.9*	H	49.2	1.8	51.0	54	3.0	Average

Test mode : 802.11ac(VHT80), UNII 3 band

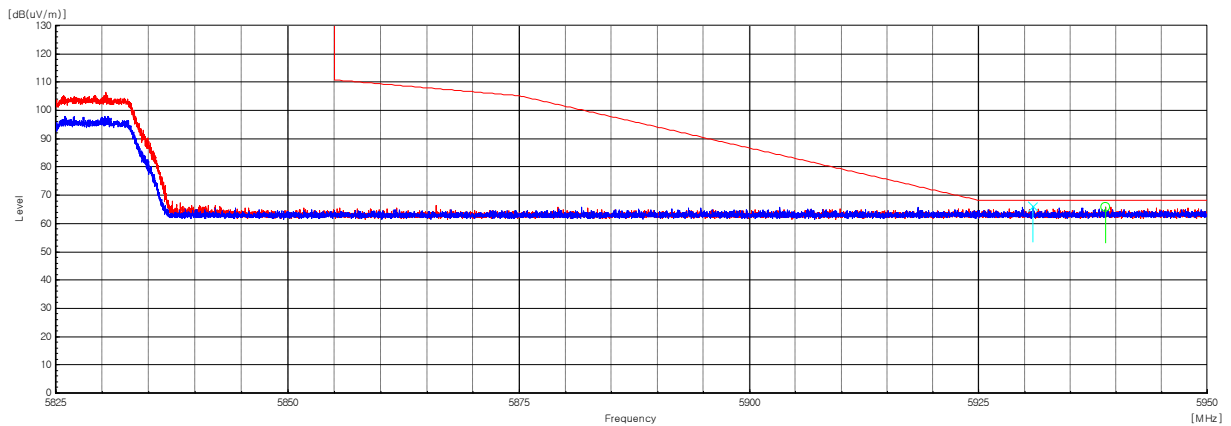
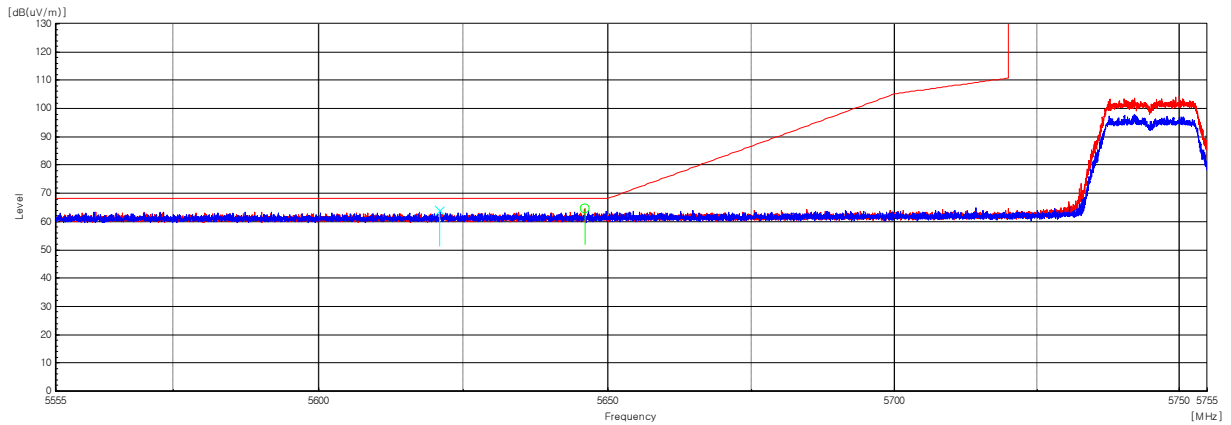
Channel	Frequency [MHz]	Ant. Pol. (V/H)	Reading [dBuV/m]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Low	5 569.9	H	60.3	3.8	64.1	68.2	4.1	Peak
	5 929.2	H	60.2	5.2	65.4	68.2	2.8	Peak

Remarks

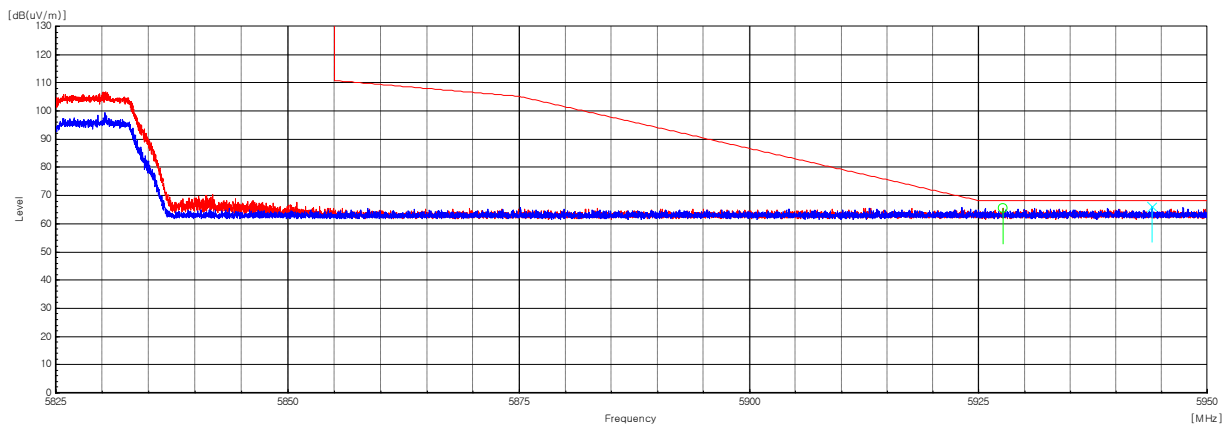
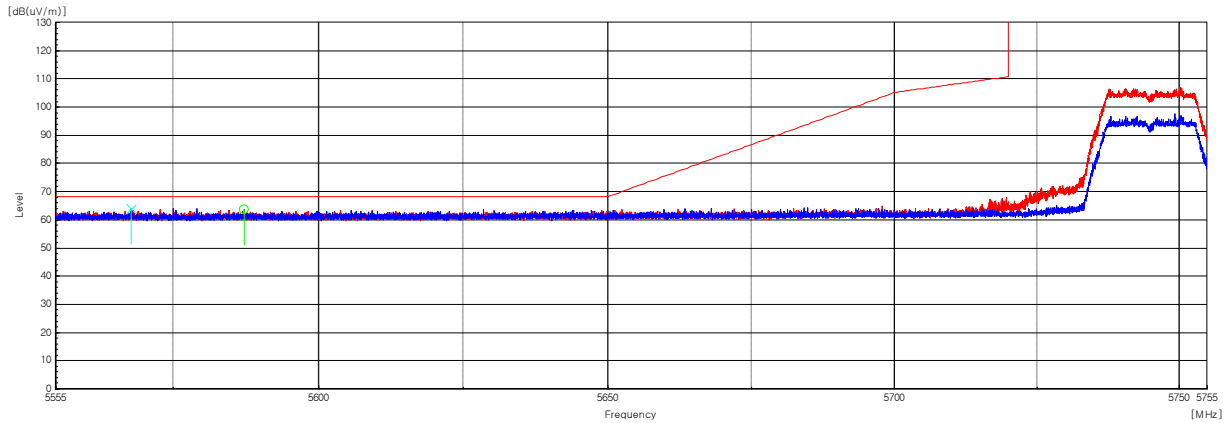
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.
 2. Result = Reading + c.f(Correction factor)
 3. Correction factor = Antenna factor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

Band emissions mask

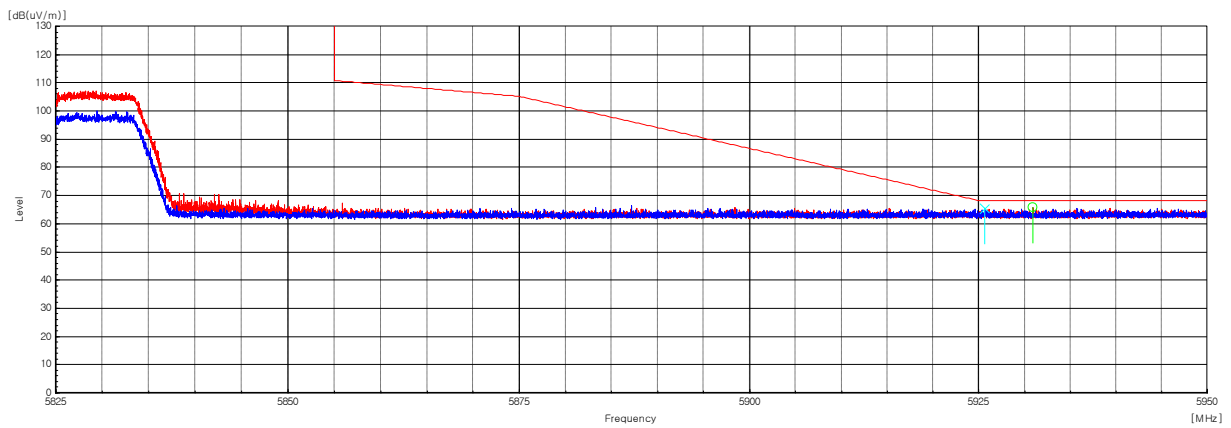
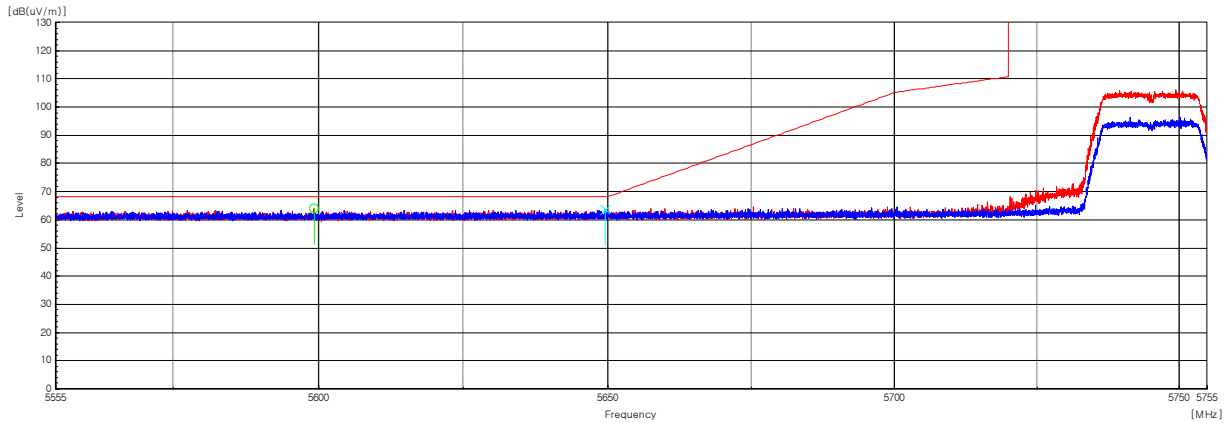
Test mode : 802.11a, UNII 3 band, ANT 0



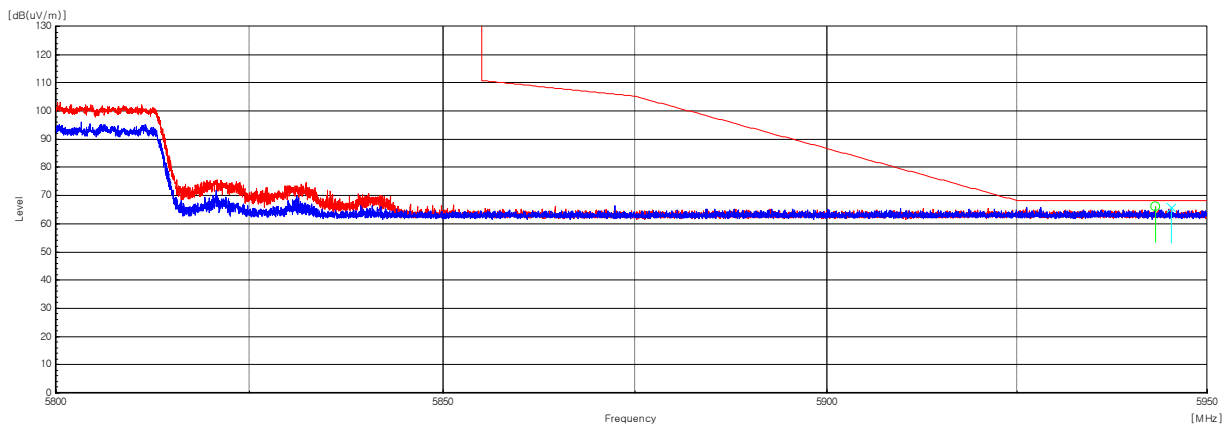
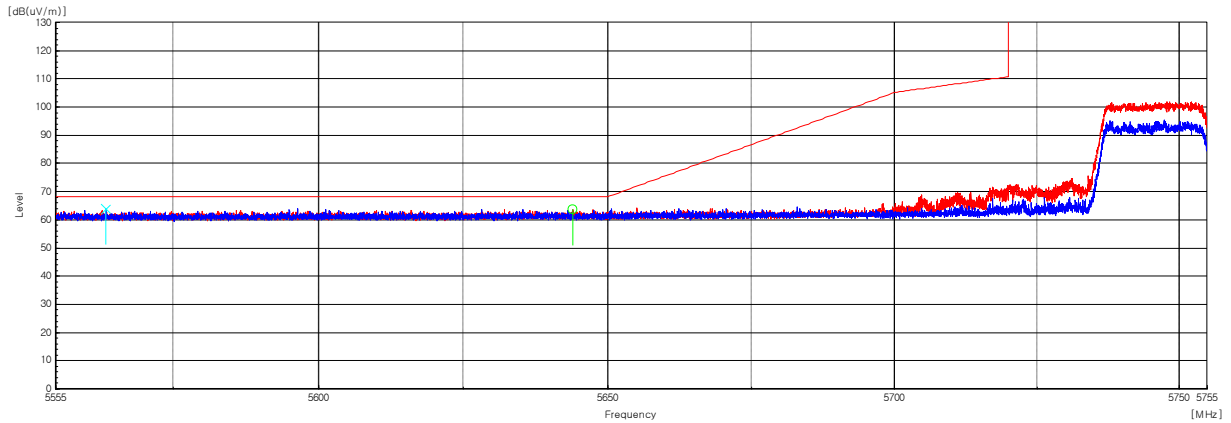
Test mode : 802.11a, UNII 3 band, ANT 1



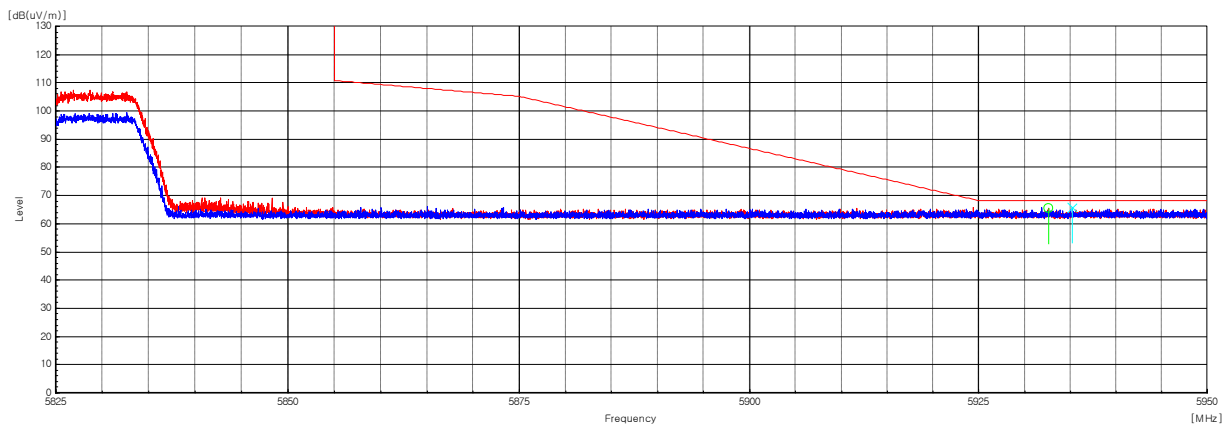
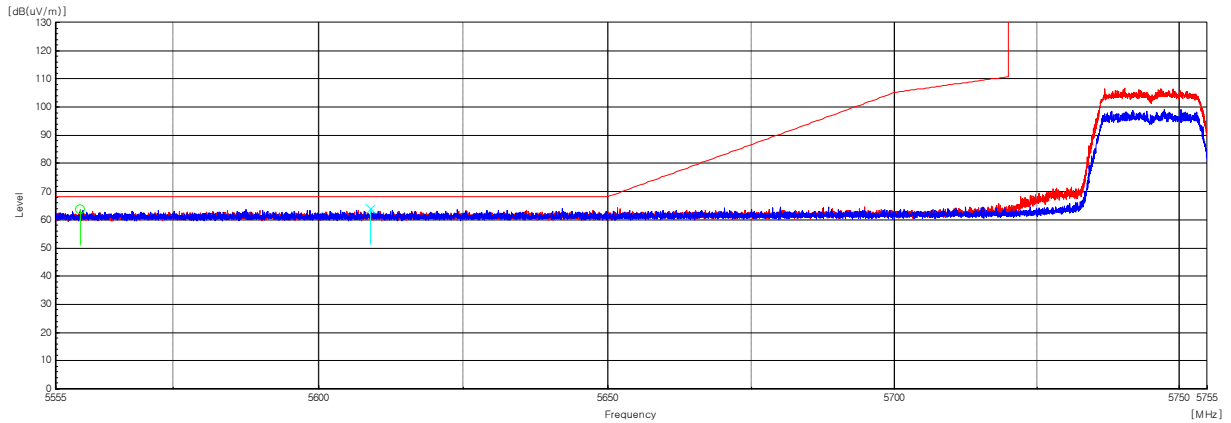
Test mode : 802.11n(HT20), UNII 3 band



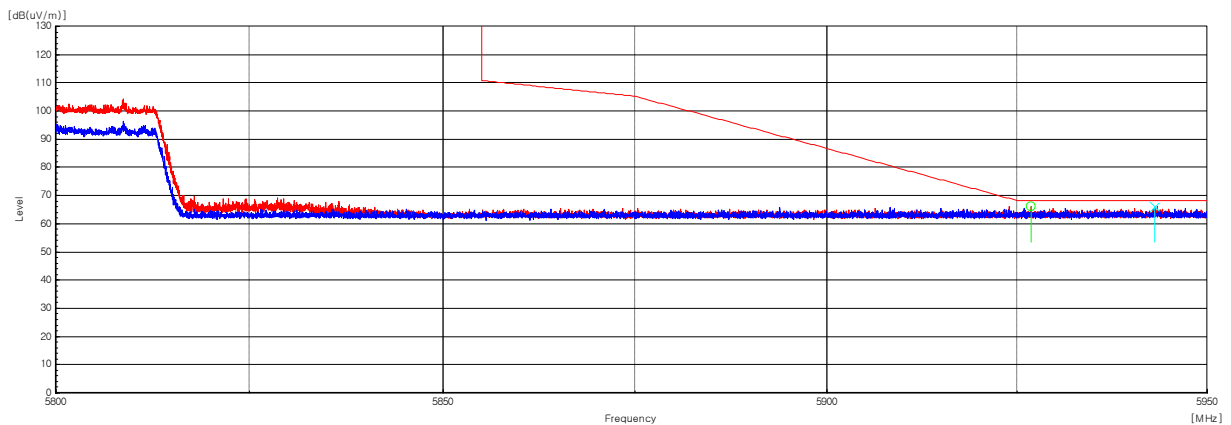
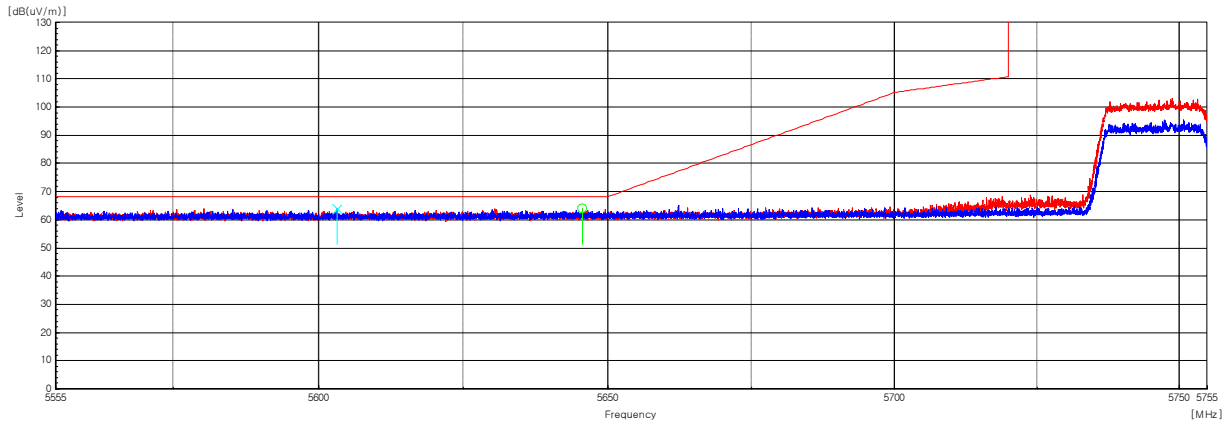
Test mode : 802.11n(HT40), UNII 3 band



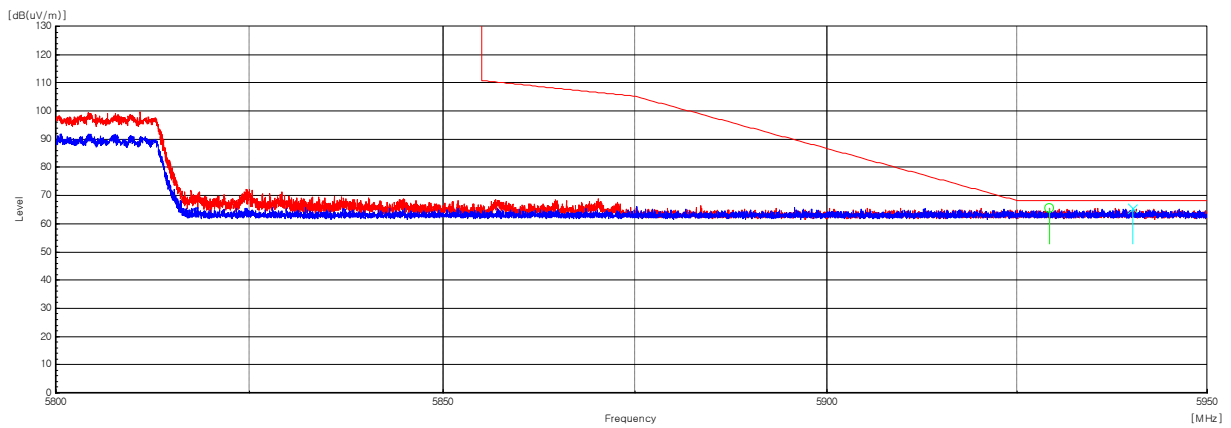
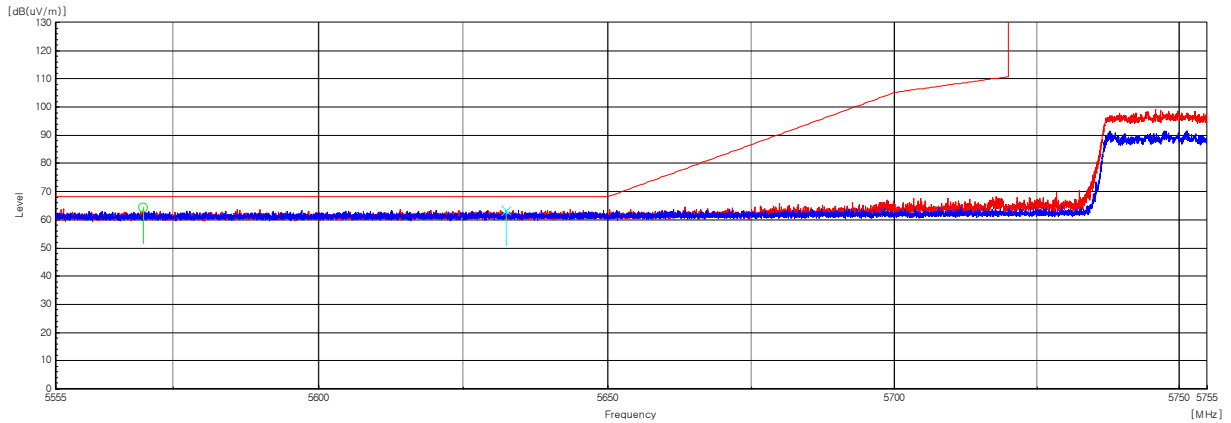
Test mode : 802.11ac(VHT20), UNII 3 band



Test mode : 802.11ac(VHT40), UNII 3 band



Test mode : 802.11ac(VHT80), UNII 3 band



4.7 AC Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average**
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* The level decreases linearly with the logarithm of the frequency.

** A linear average detector is required.

Test Results

The requirements are:

☒ Complies

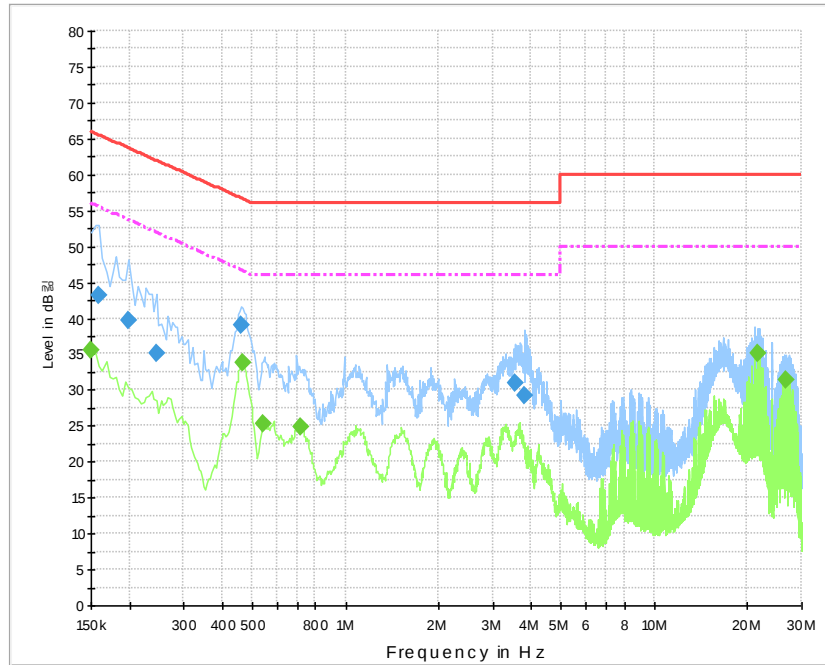
Test mode : 802.11a, UNII 1 band, ANT 0, low channel(Worst case)

Frequency [MHz]	Measured Data [dBuV]	Margin [dB]	Remark
0.465	33.8	12.8	Average

Test Data

[LINE]

Class B_L1



Final Result 1

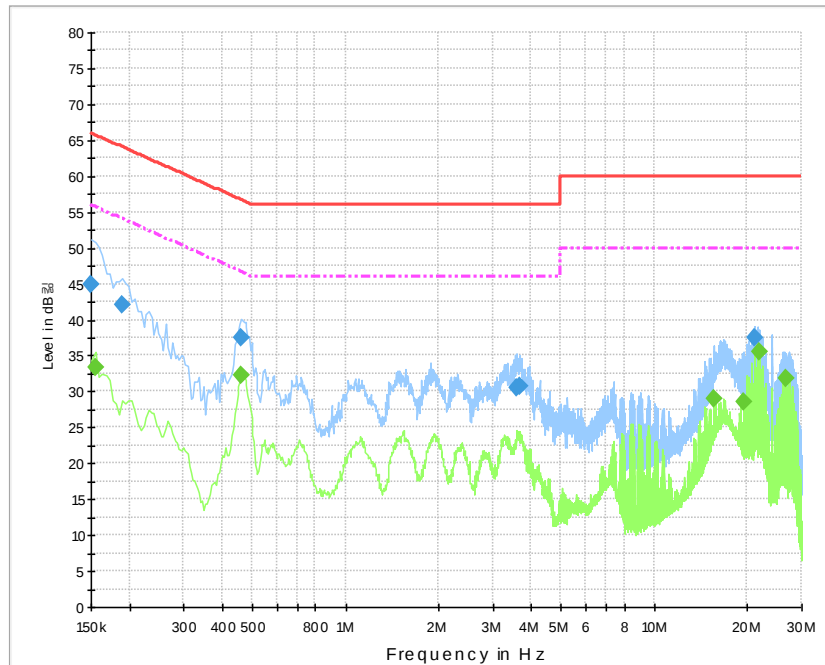
Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.159000	43.1	1000.0	9.000	On	L1	9.8	22.4	65.5
0.199500	39.7	1000.0	9.000	On	L1	9.9	23.9	63.6
0.244500	35.2	1000.0	9.000	On	L1	9.7	26.8	61.9
0.460500	38.9	1000.0	9.000	On	L1	9.9	17.7	56.7
3.534000	30.9	1000.0	9.000	On	L1	9.8	25.1	56.0
3.786000	29.3	1000.0	9.000	On	L1	9.8	26.7	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	35.6	1000.0	9.000	On	L1	9.8	20.4	56.0
0.465000	33.8	1000.0	9.000	On	L1	9.9	12.8	46.6
0.541500	25.4	1000.0	9.000	On	L1	9.9	20.6	46.0
0.717000	24.8	1000.0	9.000	On	L1	9.9	21.2	46.0
21.759000	35.1	1000.0	9.000	On	L1	10.0	14.9	50.0
26.799000	31.3	1000.0	9.000	On	L1	10.0	18.7	50.0

[NEUTRAL]

Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	45.0	1000.0	9.000	On	N	9.8	21.0	66.0
0.190500	42.0	1000.0	9.000	On	N	9.9	22.0	64.0
0.460500	37.5	1000.0	9.000	On	N	9.9	19.2	56.7
3.570000	30.4	1000.0	9.000	On	N	9.8	25.6	56.0
3.651000	30.8	1000.0	9.000	On	N	9.8	25.2	56.0
21.201000	37.5	1000.0	9.000	On	N	10.1	22.5	60.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.154500	33.4	1000.0	9.000	On	N	9.8	22.4	55.8
0.460500	32.2	1000.0	9.000	On	N	9.9	14.5	46.7
15.679500	28.9	1000.0	9.000	On	N	10.0	21.1	50.0
19.558500	28.6	1000.0	9.000	On	N	10.0	21.4	50.0
21.799500	35.4	1000.0	9.000	On	N	10.1	14.6	50.0
26.799000	31.8	1000.0	9.000	On	N	10.1	18.2	50.0

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY50510324	2018-01-26	2019-01-26
2	Signal Generator	Rohde & Schwarz	SMB100A	175528	2017-11-01	2018-11-01
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2017-10-25	2018-10-25
4	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-10	2020-05-10
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2018-05-02	2020-05-02
6	6dB Attenuator	R&S	DNF	272.4110.50-2	2017-10-25	2018-10-25
7	AMPLIFIER	SONOMA	310	291721	2018-02-02	2019-02-02
8	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2018-02-01	2019-02-01
9	LISN	Rohde & Schwarz	ENV216	101235	2018-01-31	2019-01-31
10	Preamplifier	Agilent	8449B	3008A02011	2017-11-30	2018-11-30
11	Horn Antenna	ETS-Lindgren	3116	00062504	2017-12-04	2019-12-04
12	Horn Antenna	ETS-Lindgren	3117	00154525	2017-09-14	2019-09-14
13	Band Reject Filter	Micro Tronics	BRM50716	G184	2018-01-26	2019-01-26
14	Dual-Tracking DC Power Supply	Topward Electric Instruments Co.,Ltd.	6303D	711196	2018-01-30	2019-01-30