

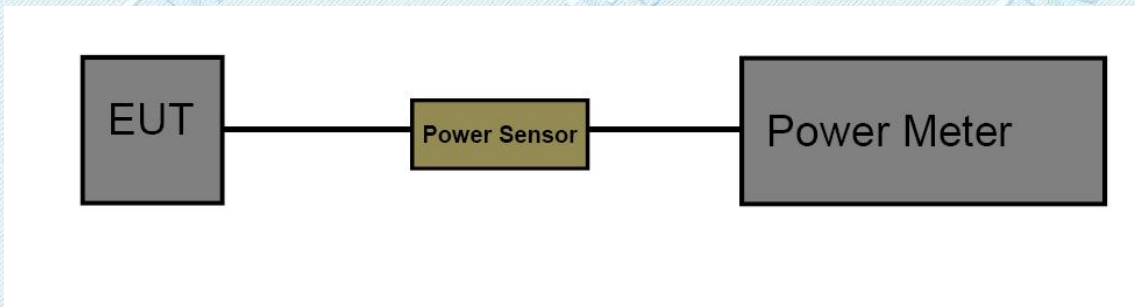
3.4. Conducted Output Power Test

Limit

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

FCC Part 15 Subpart E(15.407)		
Test Item	Limit	Frequency Range(MHz)
Conducted Output Power	Fixed: 1 Watt (30dBm) Mobile and Portable: 250mW (24dBm)	5150~5250
	250mW (24dBm)	5250~5350
	250mW (24dBm)	5470~5725
	1 Watt (30dBm)	5725~5850

Test Configuration



Test Procedure

1. The EUT was tested according to according to section 3 of KDB 789033 D02 General UNII Test Procedures New Rules V02r01.
2. The maximum conducted output power may be measured using a broadband AVG RF power meter.
3. Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor.
4. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
5. Record the measurement data.

Test Mode

Please refer to the clause 2.2.

Test Result

Band	Test Mode	Channel	Output Power (dBm)	Limit(dBm)	Result
U-NII-3	802.11a	CH _L	5.90	30	Pass
		CH _M	7.01		
		CH _H	8.00		
	802.11n(HT20)	CH _L	-1.79	30	Pass
		CH _M	-0.58		
		CH _H	-0.26		
	802.11n(HT40)	CH _L	-6.59	30	Pass
		CH _H	-4.65		

Remark: The EUT provides one antennas for transmitting and receiving.
Gain=1.5dBi< 6dBi
So P_{out}=P_{limit}

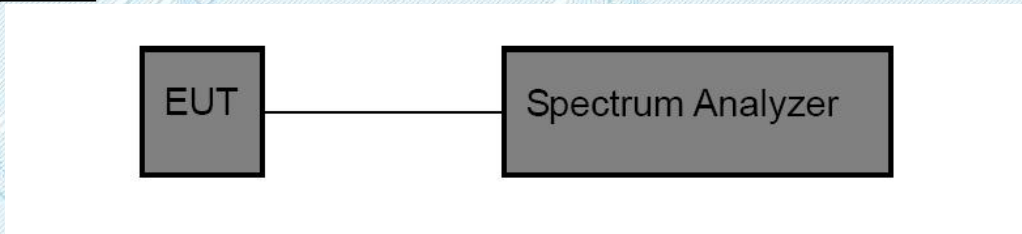
3.5. Maximum Power Spectral Density Test

Limit

FCC CFR Title 47 Part 15 Subpart E Section 15.407(a):

FCC Part 15 Subpart E(15.407)		
Test Item	Limit	Frequency Range(MHz)
Power Spectral Density	Other than Mobile and Portable : 17dBm/MHz Mobile and Portable : 11dBm/MHz	5150~5250
	11dBm/MHz	5250~5350
	11dBm/MHz	5470~5725
	30dBm/500kHz	5725~5850

Test Configuration



Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement is according to KDB 789033 D02 General UNII Test Procedures New Rules V02r01.

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Set analyser centre frequency to transmitting frequency.
- (3) Set the span to encompass the entire emissions bandwidth (EBW)(alternatively, the entire 99% OBW) of the signal.
- (4) Set the RBW to: 300kHz
- (5) Set the VBW to: ≥3RBW
- (6) Detector: RMS
- (7) Trace: Max Hold
- (7) Sweep time: auto
- (8) Trace average at least 100 traces in power averaging.
- (9) User the peak marker function to determine the maximum amplitude level within the RBW. Apply correction to the result if different RBW is used.

Note :

- 1. For UNII-3, according to KDB publication 789033 D02 General UNII Test Procedures New Rules v02, section II.F.5., it is acceptable to set RBW at 1MHz and VBW at 3MHz if the spectrum analyzer does not have 500kHz RBW.
- 2. The value measured with RBW=1MHz is to be added with 10log(500kHz/MHz) which is -3dB. For example, if the measured value is +10dBm using RBW=1MHz (that is +10dBm/MHz), then the converted value will be +7dBm/500kHz.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

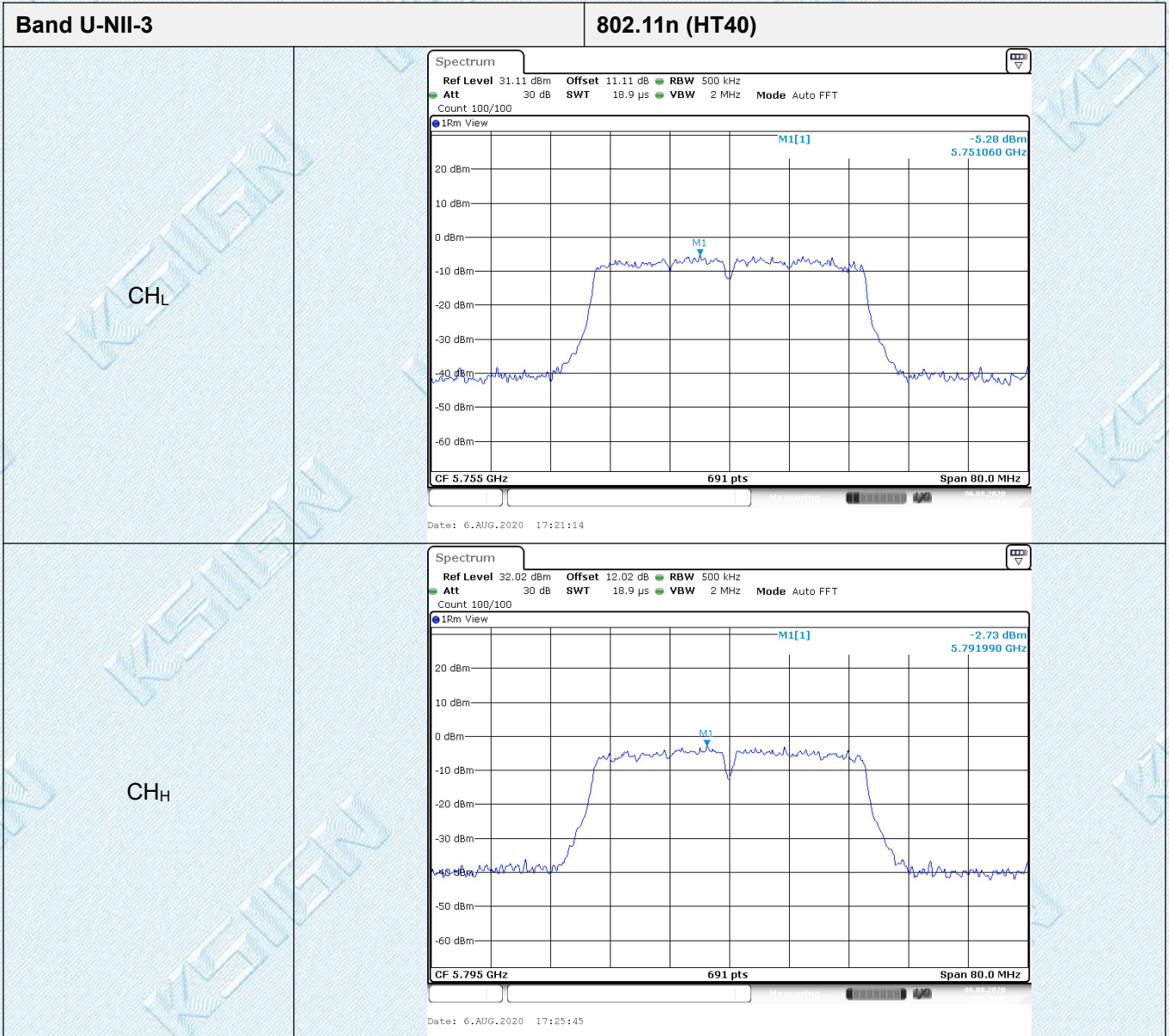
Please refer to the clause 2.2.

Test Result

Band	Test Mode	Channel	Power Spectral Density (dBm/MHz)	Limit(dBm/kHz)	Result
U-NII-3	802.11a	CH _L	1.55	30/500	Pass
		CH _M	2.77		
		CH _H	4.94		
	802.11n(HT20)	CH _L	-3.65	30/500	Pass
		CH _M	-1.94		
		CH _H	-1.45		
	802.11n(HT40)	CH _L	-5.28	30/500	Pass
		CH _H	-2.73		





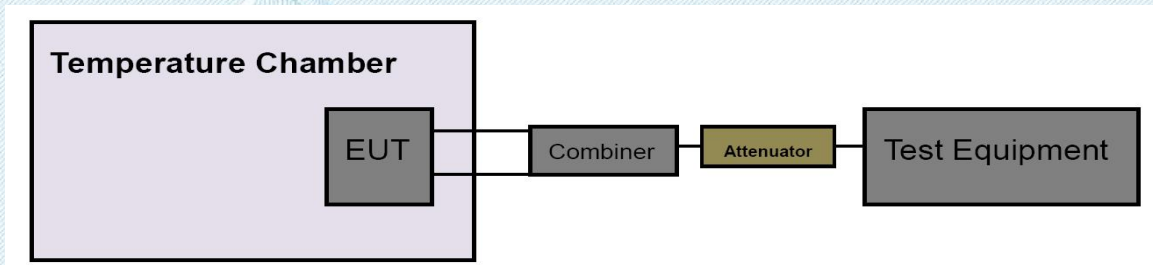


3.6. Frequency Stability Measurement

Limit

FCC Part 15 Subpart C(15.407)		
Test Item	Limit	Frequency Range(MHz)
Peak Excursion Measurement	Specified in the user's manual, the transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification)	5150~5250
		5250~5350
		5470~5725
		5725~5850

Test Configuration



Test Procedure

The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above.

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Set analyser centre frequency to transmitting frequency.
- (3) Set the span to encompass the entire emissions bandwidth (EBW) of the signal.
- (4) Set the RBW to: 10 kHz, VBW=10 kHz with peak detector and maxhold settings.
- (5) The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
- (6) Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.
- (7) Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.
- (8) Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

NOTE: The EUT was set to continuously transmitting in continuously un-modulation transmitting mode.

Test Mode

Please refer to the clause 2.2.

Test Result

Pre-scan 802.11a/n(HT20/HT40)modulation, and found the 802.11a modulation 5745MHz which it is worse case, so only show the test data for worse case.

Band U-NII-3	
801.11a	5745 MHz
Voltage vs. Frequency Stability	
Voltage (V)	Measurement Frequency (MHz)
7.40	5745.001
6.66	5745.000
8.14	5744.997
Max. Deviation (MHz)	0.001
Max. Deviation (ppm)	0.1741
Limit (ppm)	20
Result	Pass
Temperature vs. Frequency Stability	
Temperature (°C)	Measurement Frequency (MHz)
-30	5745.002
-20	5745.002
-10	5745.002
0	5745.001
10	5744.997
20	5744.996
30	5744.996
40	5744.997
50	5745.001
Max. Deviation (MHz)	0.002
Max. Deviation (ppm)	0.3481
Limit (ppm)	20
Result	Pass

3.7. Band Edge Emissions(Radiated)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.407(b):
Limits of unwanted emission out of the restricted bands

Frequency (MHz)	EIRP Limits (dBm)	Equivalent Field Strength at 3m (dBuV/m)
5150~5250	-27	68.2
5250~5350	-27	68.2
5470~5725	-27	68.2
5725~5850	-27(Note 2)	68.2
	10(Note 2)	105.2
	15.6(Note 2)	110.8
	27(Note 2)	122.2

NOTE:

1, The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

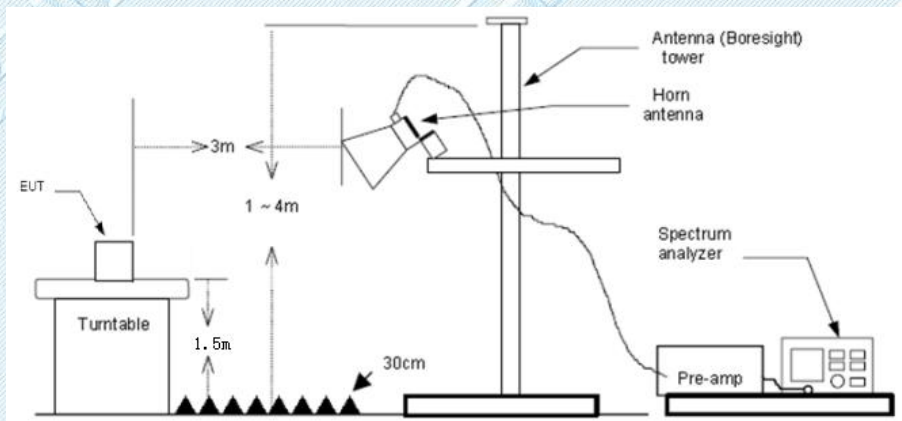
$$E = \frac{1000000\sqrt{30P}}{3} \text{ uV/m, where P is the eirp (Watts)}$$

2, According to FCC 16-24, 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 25MHz 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 27dBm/MHz at the band edge.

* Increase/Decreases with the linearity of the frequency.

For emission above 1GHz and in restricted band, according to FCC KDB 789033 D02 General UNII Test Procedure, all emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit. $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters.

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
 RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
 RBW=1MHz, VBW=10Hz RMS detector for Average value.

Test Mode

Please refer to the clause 2.2.

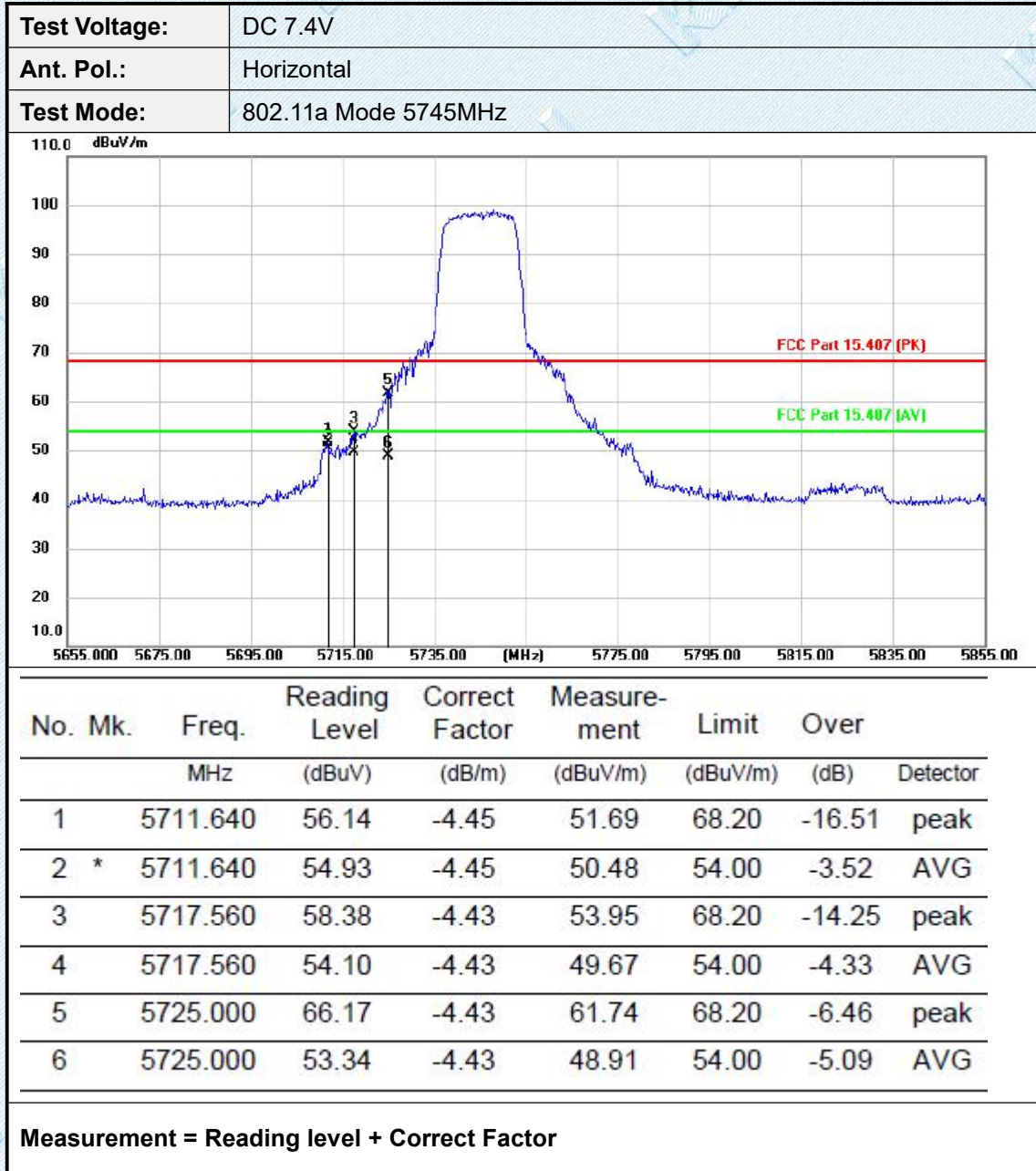
Test Results

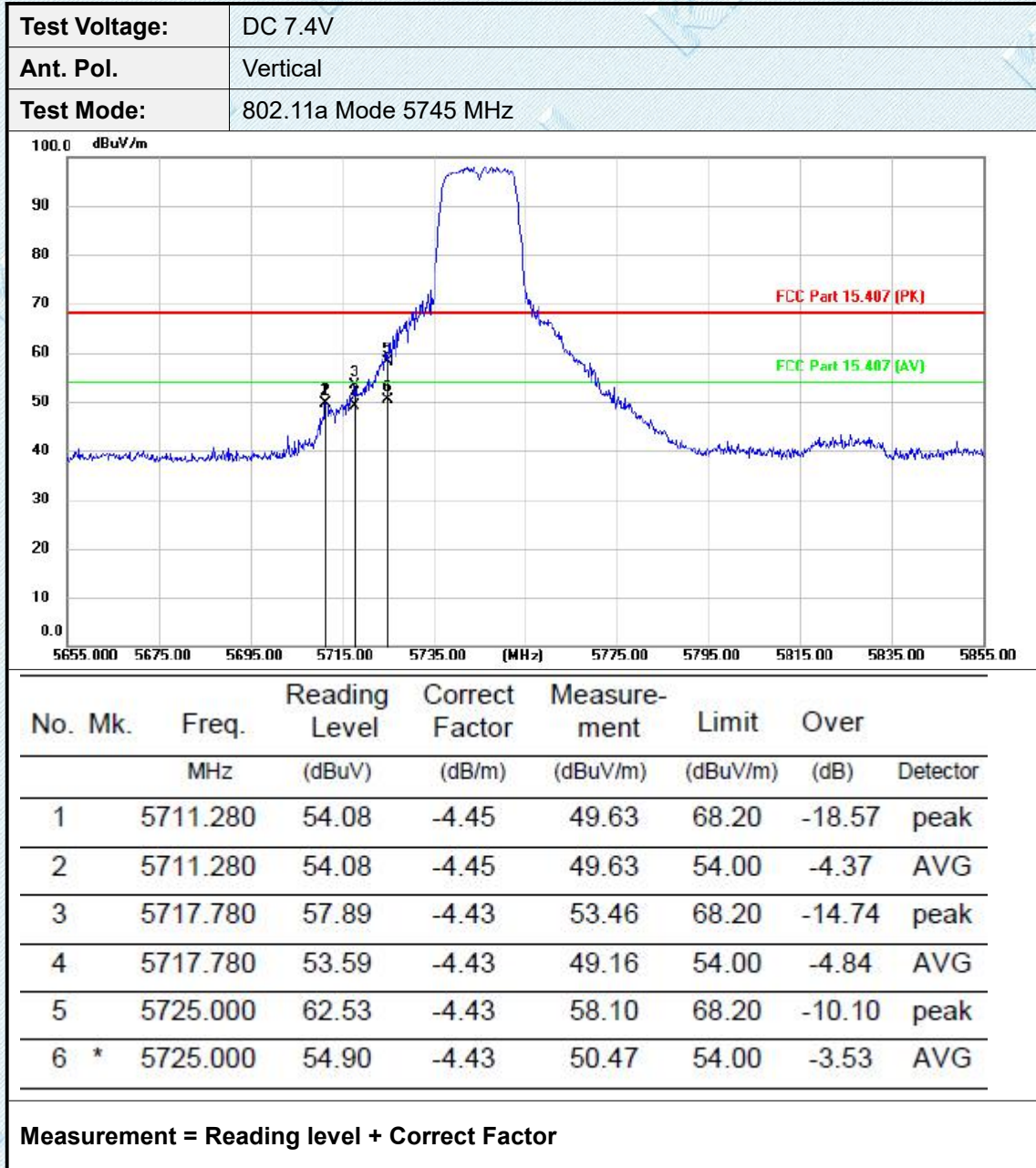
Note:

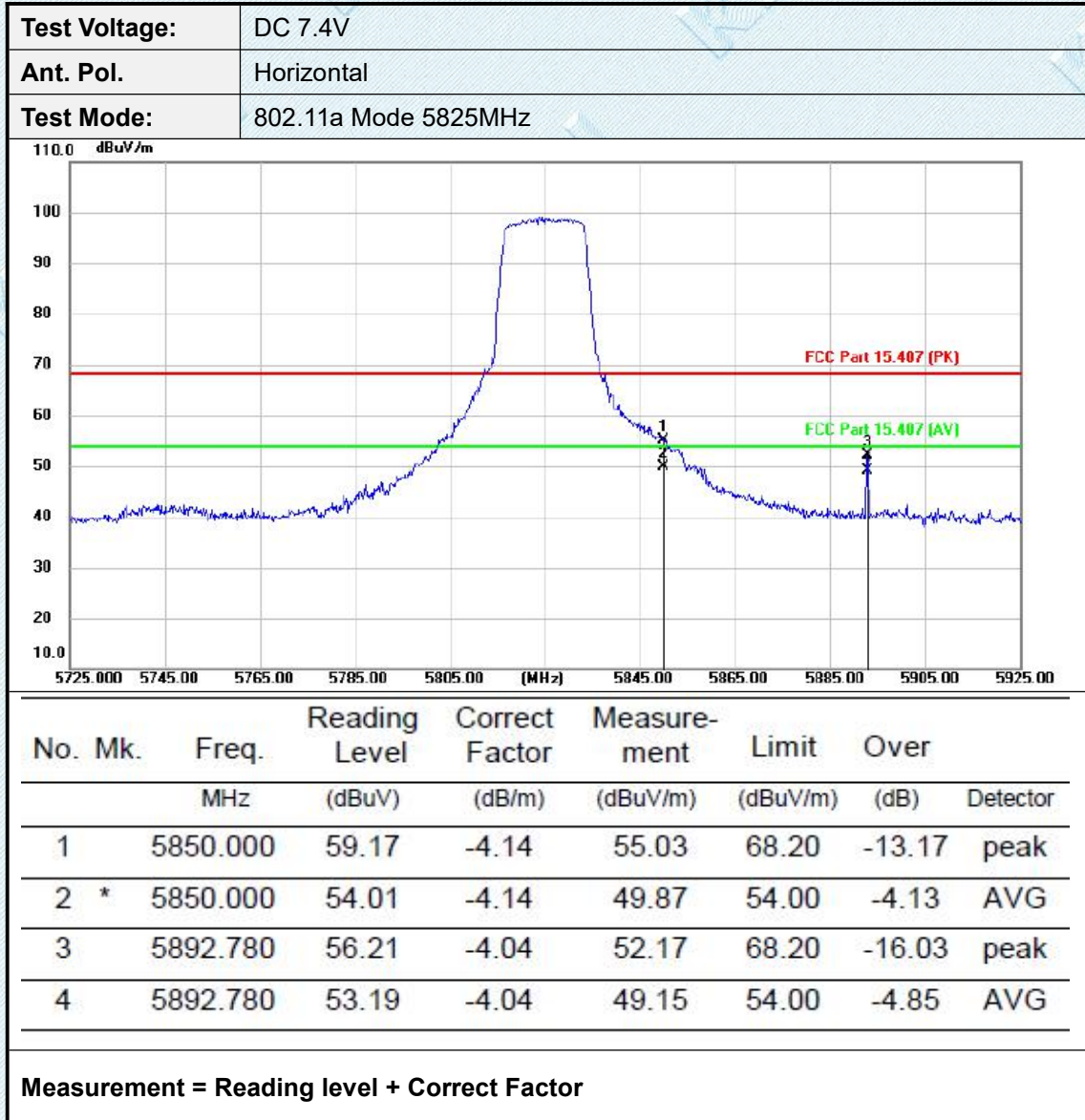
1.Measurement = Reading level + Correct Factor

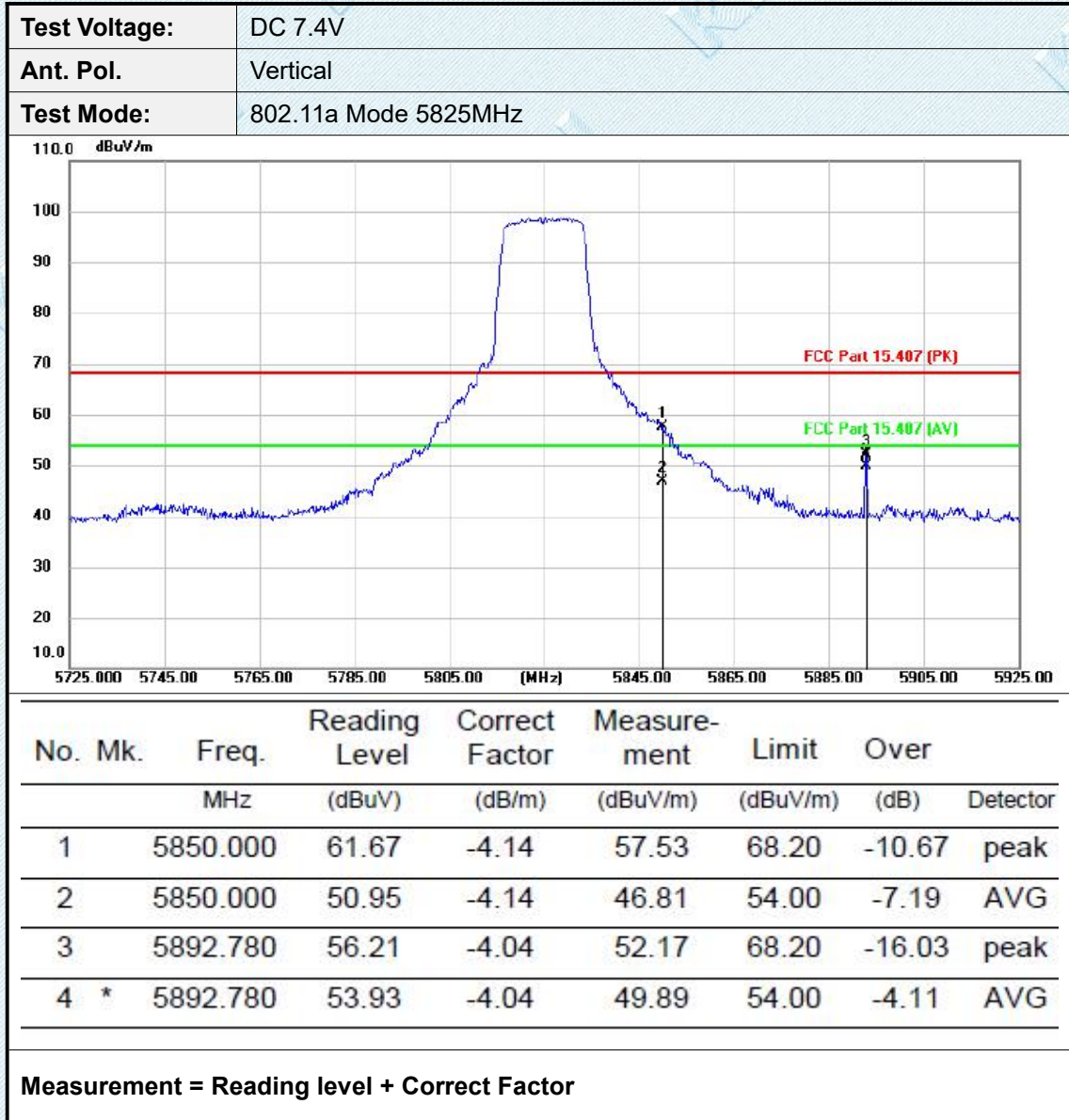
Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

2.Pre-scan 802.11a/n(HT20/HT40) modulation, and found the 802.11a modulation which it is worse case for above 1GHz, so only show the test data for worse case.









3.8. Radiated Spurious Emissions

Limit

FCC CFR Title 47 Part 15 Subpart E Section 15.407(b):

Radiated Emission Limits (9 kHz~1000 MHz)

Frequency (MHz)	Field Strength (microvolt/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

Radiated Emission Limit (Above 1000MHz)

Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)= 20log Emission Level (uV/m)

Limits of unwanted emission out of the restricted bands

Frequency (MHz)	EIRP Limits (dBm)	Equivalent Field Strength at 3m (dBuV/m)
5150~5250	-27	68.2
5250~5350	-27	68.2
5470~5725	-27	68.2
5725~5850	-27(Note 2)	68.2
	10(Note 2)	105.2
	15.6(Note 2)	110.8
	27(Note 2)	122.2

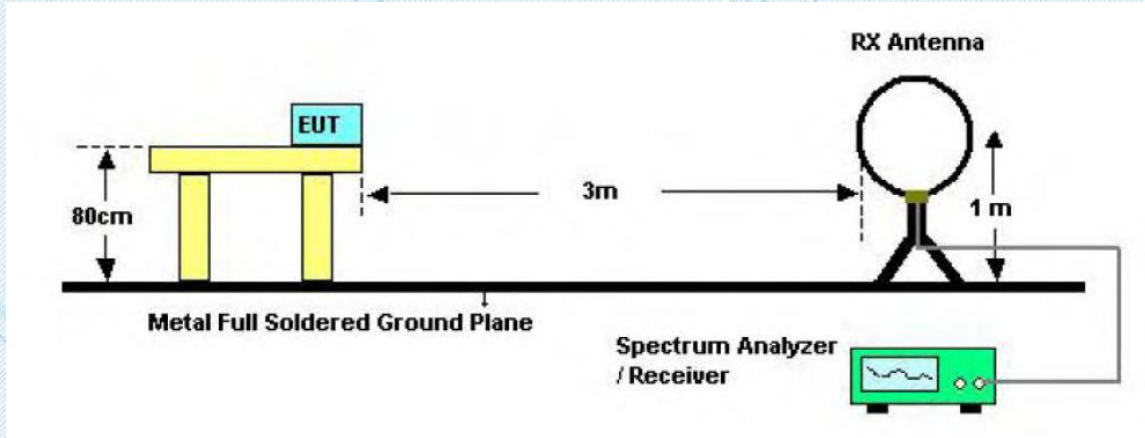
NOTE:

1, The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

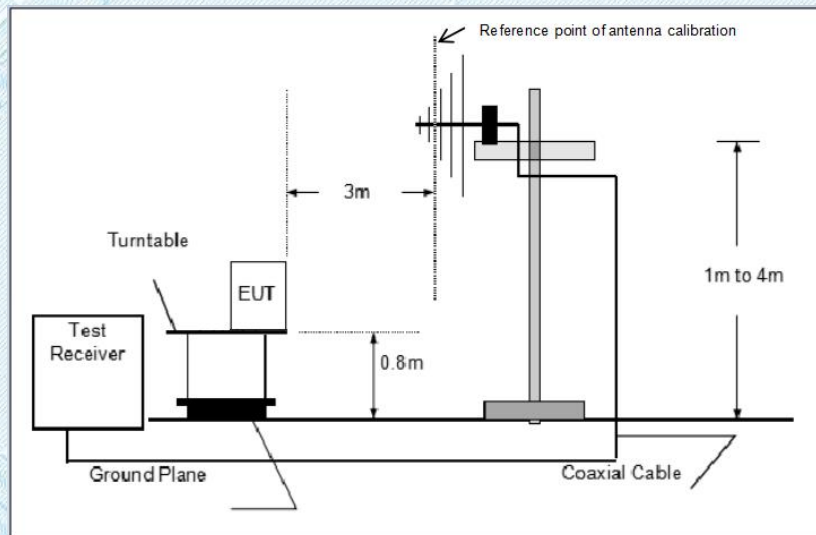
$$E = \frac{1000000 \sqrt{30P}}{3} \text{ uV/m, where P is the eirp (Watts)}$$

2, According to FCC 16-24, 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 25MHz 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 27dBm/MHz at the band edge.

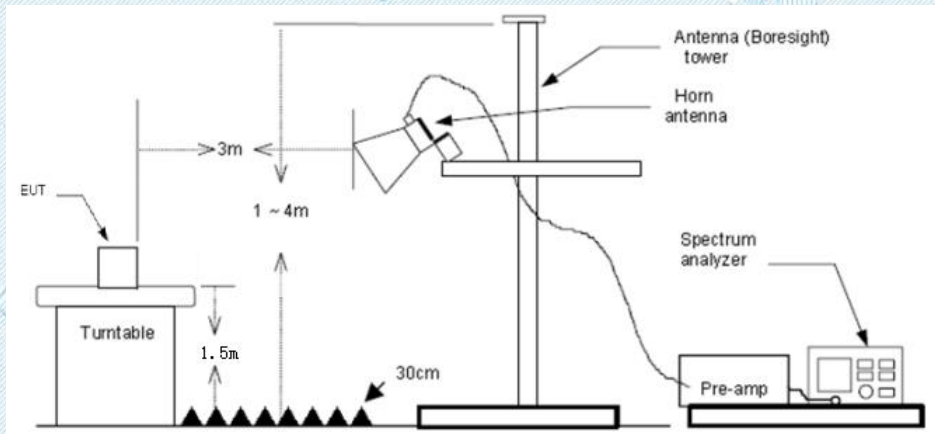
Test Configuration



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) From 1 GHz to 10th harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW=10Hz RMS detector for Average value.

Test Mode

Please refer to the clause 2.2.

Test Result

9 KHz~30 MHz and 18GHz~40GHz

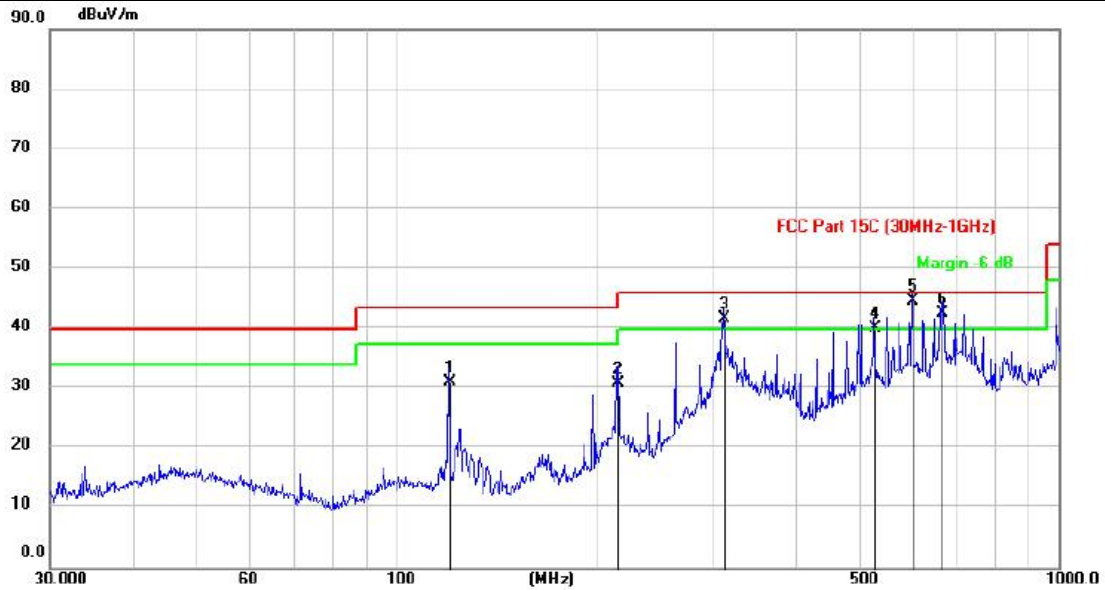
From 9 KHz~30 MHz and 18GHz~40GHz: Conclusion: PASS

Note:

- 1) Measurement = Reading level + Correct Factor
Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor
- 2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
- 3) The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4) The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
- 5) Pre-scan 802.11a/n(HT20/HT40) modulation, and found the 802.11a modulation 5745MHz which it is worse case for 30MHz-1GHz , so only show the test data for worse case.
- 6) Pre-scan 802.11a/n(HT20/HT40) modulation, and found the 802.11a modulation which it is worse case for above 1GHz, so only show the test data for worse case.

30MHz-1GHz

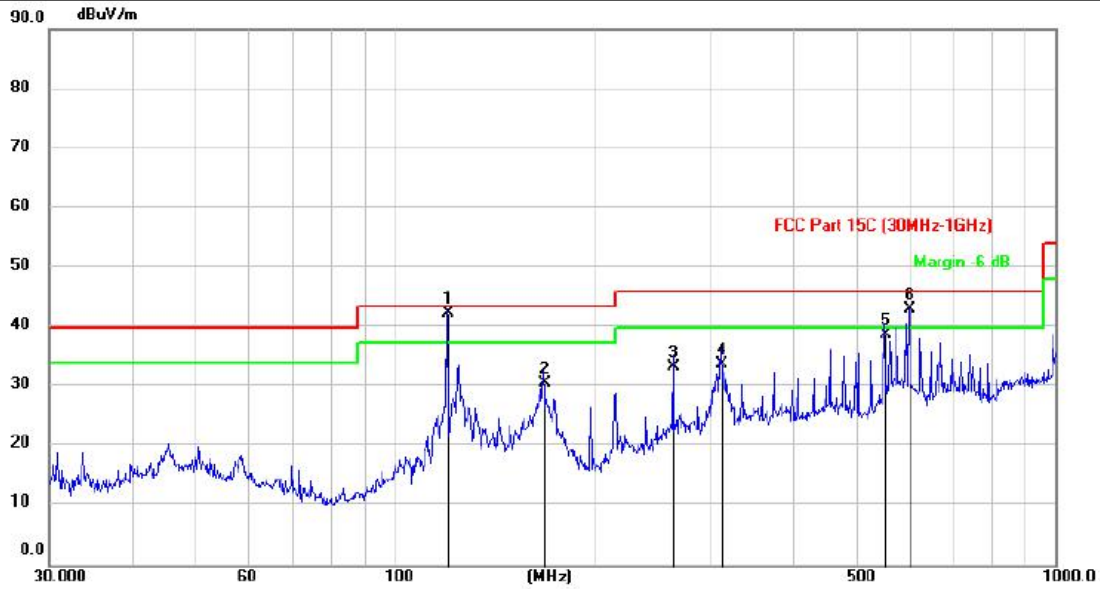
Test Voltage:	DC 7.4V
Ant. Pol.	Horizontal
Test Mode:	TX 802.11a Mode 5745MHz (U-NII-3)
Remark:	Only worse case is reported



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		119.9817	44.55	-13.48	31.07	43.50	-12.43	QP
2		216.0236	42.36	-11.38	30.98	46.00	-15.02	QP
3		312.0700	50.00	-8.24	41.76	46.00	-4.24	QP
4		528.0606	43.21	-3.15	40.06	46.00	-5.94	QP
5		599.9921	45.49	-0.73	44.76	46.00	-1.24	QP
6		665.8035	43.64	-1.02	42.62	46.00	-3.38	QP

Measurement = Reading Level+ Correct Factor

Test Voltage:	DC 7.4V
Ant. Pol.	Vertical
Test Mode:	TX 802.11a Mode 5745MHz (U-NII-3)
Remark:	Only worse case is reported

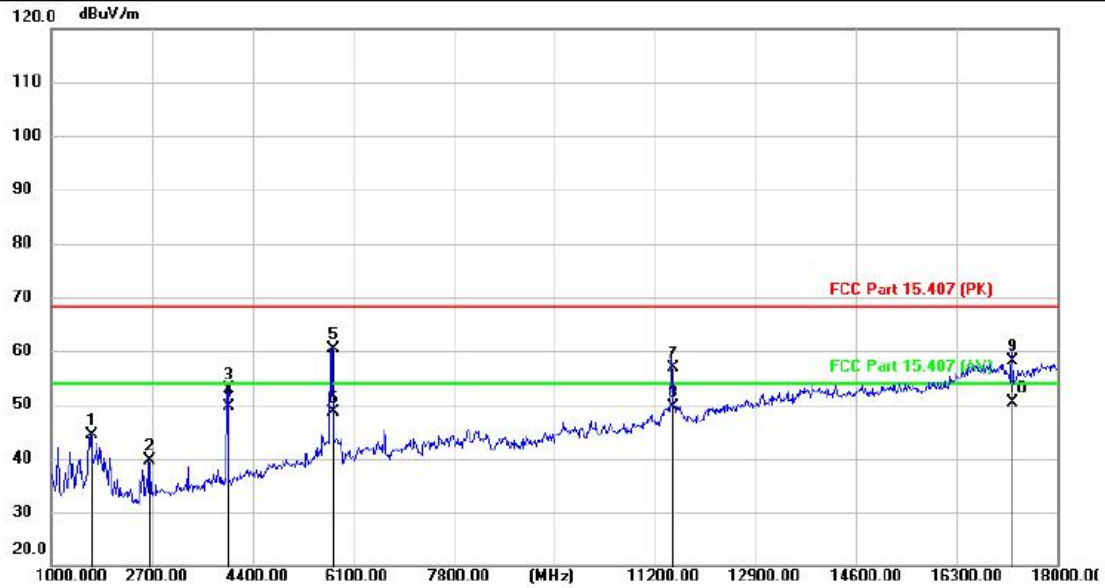


No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		119.9986	55.79	-13.48	42.31	43.50	-1.19	QP
2		168.0005	45.59	-14.84	30.75	43.50	-12.75	QP
3		264.0040	42.94	-9.60	33.34	46.00	-12.66	QP
4		312.0700	42.20	-8.24	33.96	46.00	-12.04	QP
5		552.1082	41.18	-2.39	38.79	46.00	-7.21	QP
6		599.9521	43.81	-0.73	43.08	46.00	-2.92	QP

Measurement = Reading Level+ Correct Factor

Adobe 1GHz

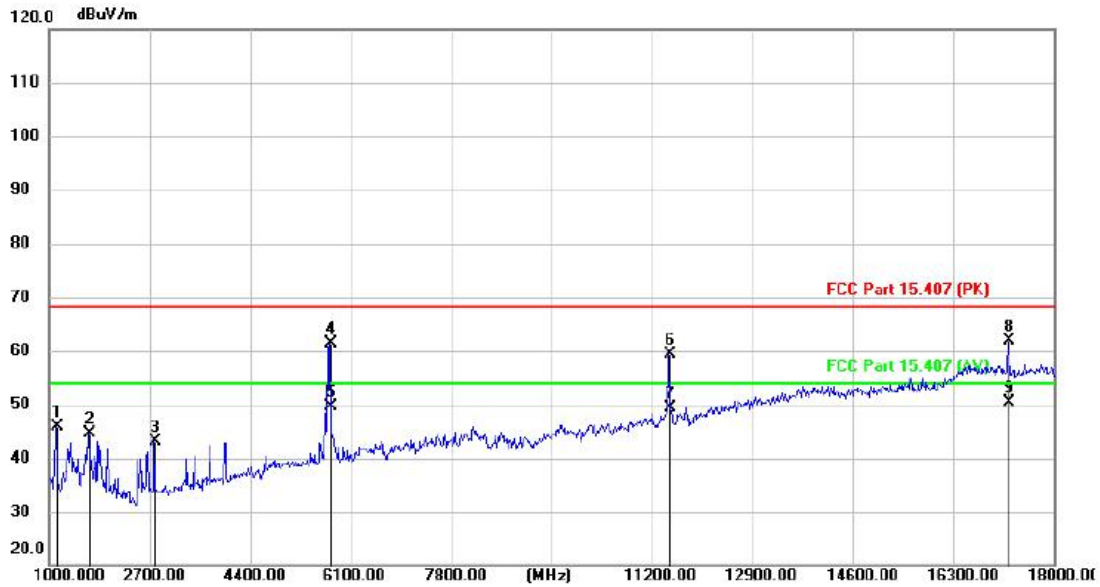
Test Voltage:	DC 7.4V
Ant. Pol.	Horizontal
Test Mode:	TX 802.11a Mode 5745MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		1666.400	55.94	-11.48	44.46	68.20	-23.74	peak
2		2659.200	50.47	-10.79	39.68	68.20	-28.52	peak
3		3976.700	61.33	-8.49	52.84	68.20	-15.36	peak
4		3976.700	58.16	-8.49	49.67	54.00	-4.33	AVG
5		5751.500	64.65	-4.36	60.29	68.20	-7.91	peak
6		5751.500	52.97	-4.36	48.61	54.00	-5.39	AVG
7		11492.400	50.05	6.84	56.89	68.20	-11.31	peak
8		11492.400	42.88	6.84	49.72	54.00	-4.28	AVG
9		17228.200	45.00	13.19	58.19	68.20	-10.01	peak
10	*	17228.200	37.18	13.19	50.37	54.00	-3.63	AVG

Measurement = Reading level + Correct Factor

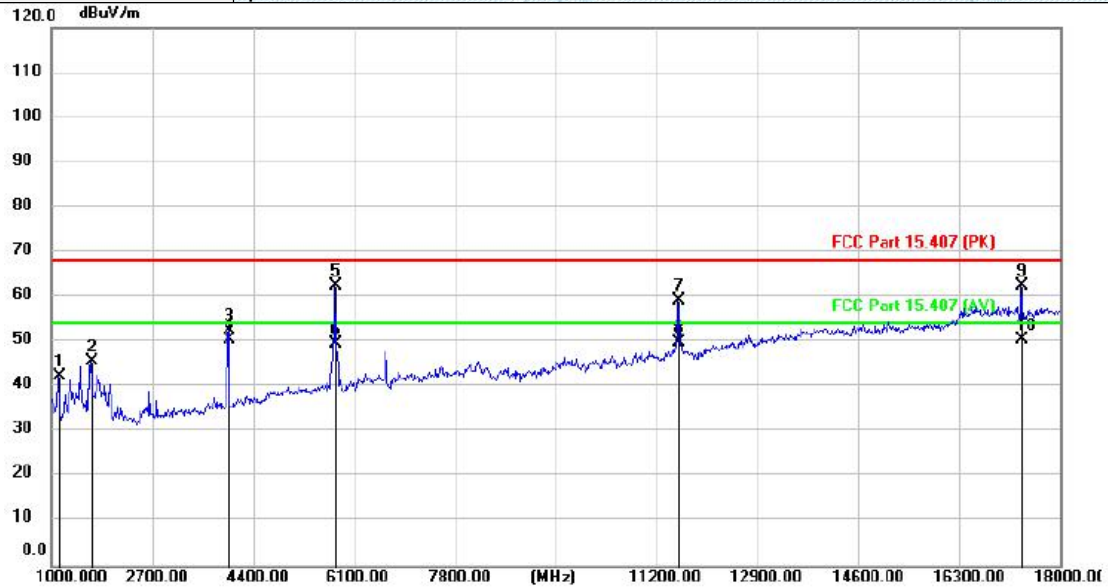
Test Voltage:	DC 7.4V
Ant. Pol.	Vertical
Test Mode:	TX 802.11a Mode 5745MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		1125.800	57.97	-12.19	45.78	68.20	-22.42	peak
2		1666.400	56.16	-11.48	44.68	68.20	-23.52	peak
3		2798.600	53.91	-10.71	43.20	68.20	-25.00	peak
4		5746.400	65.81	-4.38	61.43	68.20	-6.77	peak
5		5746.400	54.09	-4.38	49.71	54.00	-4.29	AVG
6		11490.700	52.46	6.84	59.30	68.20	-8.90	peak
7		11490.700	42.48	6.84	49.32	54.00	-4.68	AVG
8		17226.500	48.77	13.19	61.96	68.20	-6.24	peak
9	*	17226.500	37.29	13.19	50.48	54.00	-3.52	AVG

Measurement = Reading level + Correct Factor

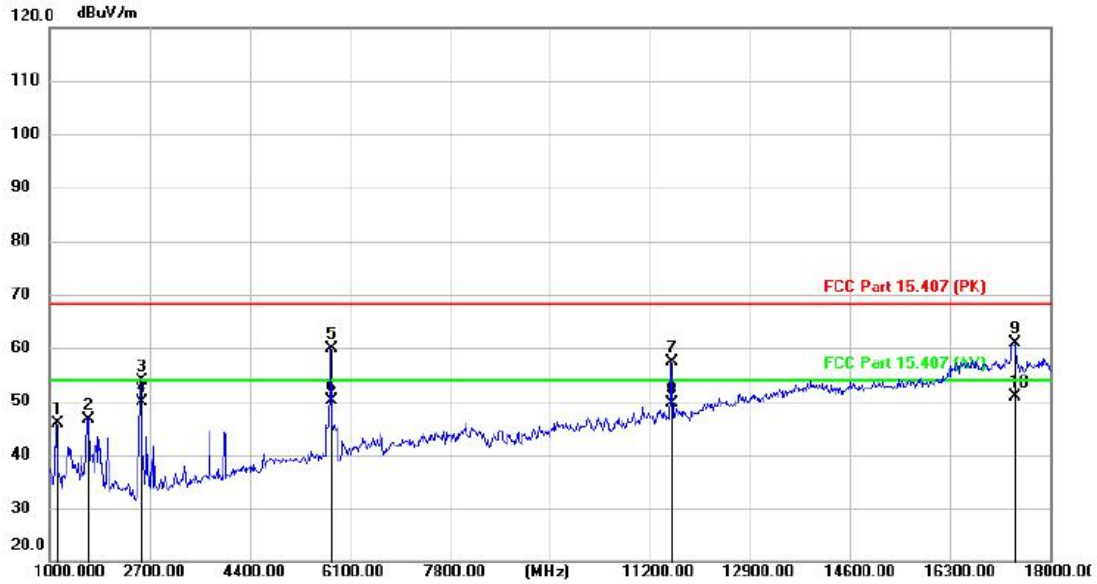
Test Voltage:	DC 7.4V
Ant. Pol.	Horizontal
Test Mode:	TX 802.11a Mode 5785MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		1124.100	54.59	-12.19	42.40	68.20	-25.80	peak
2		1671.500	57.26	-11.47	45.79	68.20	-22.41	peak
3		3995.400	61.07	-8.44	52.63	68.20	-15.57	peak
4	*	3995.400	59.13	-8.44	50.69	54.00	-3.31	AVG
5		5783.800	66.73	-4.29	62.44	68.20	-5.76	peak
6		5783.800	53.96	-4.29	49.67	54.00	-4.33	AVG
7		11567.200	52.16	7.00	59.16	68.20	-9.04	peak
8		11567.200	43.10	7.00	50.10	54.00	-3.90	AVG
9		17350.600	49.31	13.29	62.60	68.20	-5.60	peak
10		17350.600	37.19	13.29	50.48	54.00	-3.52	AVG

Measurement = Reading level + Correct Factor

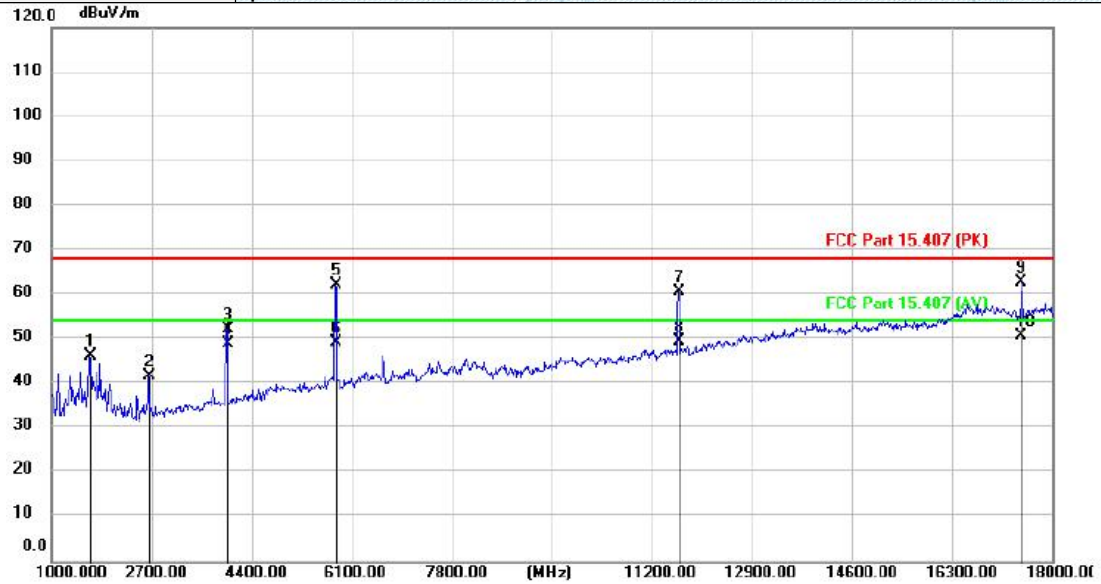
Test Voltage:	DC 7.4V
Ant. Pol.	Vertical
Test Mode:	TX 802.11a Mode 5785MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		1125.800	58.05	-12.19	45.86	68.20	-22.34	peak
2		1661.300	58.24	-11.49	46.75	68.20	-21.45	peak
3		2552.100	64.63	-10.85	53.78	68.20	-14.42	peak
4		2552.100	60.68	-10.85	49.83	54.00	-4.17	AVG
5		5783.800	64.12	-4.29	59.83	68.20	-8.37	peak
6		5783.800	54.46	-4.29	50.17	54.00	-3.83	AVG
7		11570.600	50.44	7.00	57.44	68.20	-10.76	peak
8		11570.600	42.67	7.00	49.67	54.00	-4.33	AVG
9		17393.100	47.53	13.32	60.85	68.20	-7.35	peak
10	*	17393.100	37.62	13.32	50.94	54.00	-3.06	AVG

Measurement = Reading level + Correct Factor

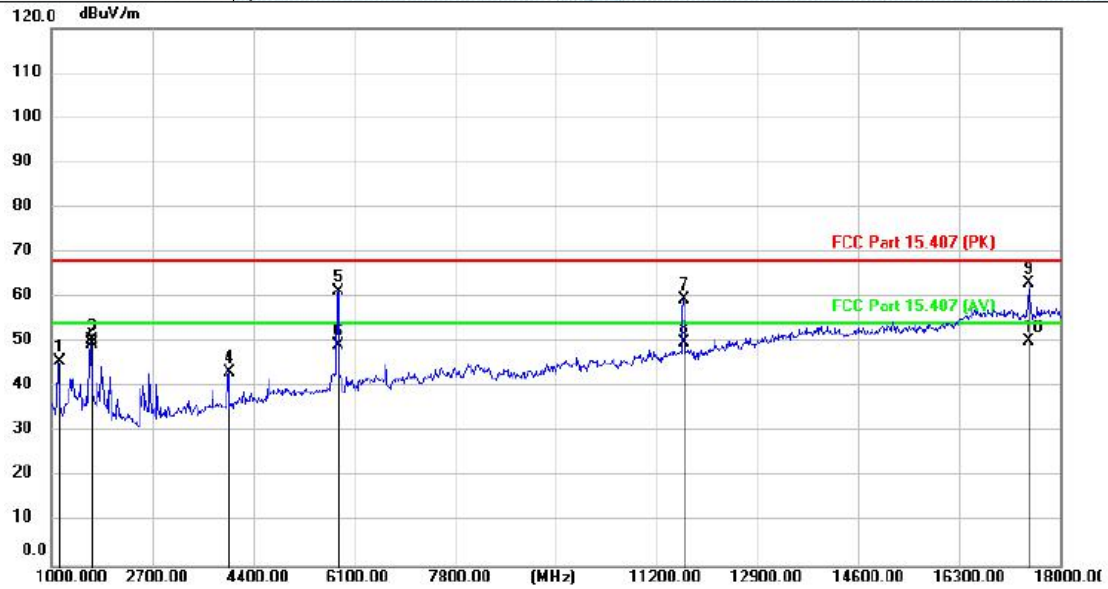
Test Voltage:	DC 7.4V
Ant. Pol.	Horizontal
Test Mode:	TX 802.11a Mode 5825MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No. Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1	1661.300	57.73	-11.49	46.24	68.20	-21.96	peak
2	2657.500	52.49	-10.78	41.71	68.20	-26.49	peak
3	3976.700	60.81	-8.49	52.32	68.20	-15.88	peak
4	3976.700	57.46	-8.49	48.97	54.00	-5.03	AVG
5	5819.500	66.54	-4.21	62.33	68.20	-5.87	peak
6	5819.500	53.54	-4.21	49.33	54.00	-4.67	AVG
7	11657.300	53.69	7.18	60.87	68.20	-7.33	peak
8	11657.300	42.50	7.18	49.68	54.00	-4.32	AVG
9	17473.000	49.38	13.39	62.77	68.20	-5.43	peak
10 *	17473.000	37.50	13.39	50.89	54.00	-3.11	AVG

Measurement = Reading level + Correct Factor

Test Voltage:	DC 7.4V
Ant. Pol.	Vertical
Test Mode:	TX 802.11a Mode 5825MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq. MHz	Reading Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	Detector
1		1125.800	57.86	-12.19	45.67	68.20	-22.53	peak
2		1664.700	61.14	-11.48	49.66	68.20	-18.54	peak
3	*	1664.700	62.15	-11.48	50.67	54.00	-3.33	AVG
4		3995.400	51.89	-8.44	43.45	68.20	-24.75	peak
5		5828.000	65.69	-4.19	61.50	68.20	-6.70	peak
6		5828.000	53.48	-4.19	49.29	54.00	-4.71	AVG
7		11652.200	52.32	7.17	59.49	68.20	-8.71	peak
8		11652.200	42.69	7.17	49.86	54.00	-4.14	AVG
9		17473.000	49.83	13.39	63.22	68.20	-4.98	peak
10		17473.000	37.00	13.39	50.39	54.00	-3.61	AVG

Measurement = Reading level + Correct Factor

4. EUT TEST PHOTOS

Reference to the document No.: Test Photos.

5. PHOTOGRAPHS OF EUT CONSTRUCTIONAL

Reference to the document No.: External Photos and Internal Photos.

*****THE END*****