FCC TEST REPORT

FCC ID	: A5MWD770-B
Applicant	: Lenovo (Beijing) Limited
Address	: No.6 Chuang Ye Road, Shangdi Information Industry Base, Haidian District, Beijing, China

Equipment Under Test (EUT) :

Product Name	: Lenovo Wireless Headset W770
Model No.	: WD770-B
Standards	: FCC CFR47 Part 15 Section 15.247:2009
Date of Test	: February 25 ~ February 28, 2012
Date of Issue	: February 29, 2012
Test Engineer	: Maikou.zhang / Engineer
Reviewed By	: Philo zhong / Manager

Test Result	**: PASS**

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions (9kHz to 25GHz)	15.205(a) 15.209 15.247(d)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 Client Information

Applicant	: Lenovo (Beijing) Limited
Address of Applicant	: No.6 Chuang Ye Road, Shangdi Information Industry Base, Haidian District, Beijing, China
Trade Mark	
Manufacturer	: Lenovo (Beijing) Limited
Address of Manufacturer	: No.6 Chuang Ye Road, Shangdi Information Industry Base, Haidian District, Beijing, China

4.2 General Description of E.U.T.

Product Name	: Lenovo Wireless Headset WD770
Model No.	: WD770-B
Remark	: The product maybe have different color.

4.3 Details of E.U.T.

Technical Data	: 5.0 VDC
Operation Frequency	: 2404MHz ~ 2476MHz
Antenna Gain	: 0 dBi

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

The customer requested FCC tests for a Lenovo Wireless Headset W770. The standards used were FCC CFR47 Part 15 Section 15.203, Section 15.207, Section 15.209 and Section 15.247.

4.6 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: IC7760A**

  Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, August 3, 2010.

- **FCC – Registration No.: 880581**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

4.7 Test Location

All the tests were performed at:
Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd.,Songgang Street, Baoan District, Shenzhen, China

5 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY45114943	W2008001	9k-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Trilog Broadband Antenne	SCHWARZBECK MESS-ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Broad-band Horn Antenna	SCHWARZBECK MESS-ELEKTROM / BBHA 9120D(1201)	667	W2008003	1-18GHz	Aug. 2, 2011	Aug. 1, 2012	f < 10 GHz : ±1dB 10GHz < f < 18 GHz : ±1.5dB
Broadband Preamplifier	SCHWARZBECK MESS-ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
Broad-band Horn Antenna	SCHWARZBECK MESS-ELEKTROM / BBHA 9170	399	W2008005	15-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1.5dB
Broadband Preamplifier	SCHWARZBECK MESS-ELEKTROM / BBV 9719	9719-254	W2008006	18-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
10m Coaxial Cable with N-male Connectors	SCHWARZBECK MESS-ELEKTROM / AK 9515 H	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
10m 50 Ohm Coaxial Cable	SCHWARZBECK MESS-ELEKTROM / AK 9513	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Positioning Controller	C&C LAB/ CC-C-IF	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Color Monitor	SUNSPO/ SP-14C	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
Test Receiver	ROHDE&SCHWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Two-Line V-Network	ROHDE&SCHWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug. 2, 2011	Aug. 1, 2012	±10%
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range : 9K-1GHz RF voltage : -60 dBm-+10dBm	Aug. 2, 2011	Aug. 1, 2012	Power_freq distinguish0.1Hz RFeletricity distinguish 0.1B
Active Loop Antenna	Beijing Dazhi / ZN30900A	-	-	-	Aug. 2, 2011	Aug. 1, 2012	±1dB
AC Power Supply	TONGYUN/ DTDGC-4	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
PC1	Lenovo	T2900D	-	-	Aug.2, 2011	Aug.1, 2012	±1dB
PC2	IBM	ThinkPad X31	-	-	Aug.2, 2011	Aug.1, 2012	±1dB
Display	ViewSonic	S27996-1W	-	-	Aug.2, 2011	Aug.1, 2012	±0.5dB
K/B	Dell	L100	-	-	Aug.2, 2011	Aug.1, 2012	±0.5dB
Mouse	Acer	M-UVACR1	-	-	Aug.2, 2011	Aug.1, 2012	±0.5dB

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz 56 dBμV between 0.5MHz & 5MHz 60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1012 mbar

EUT Operation:

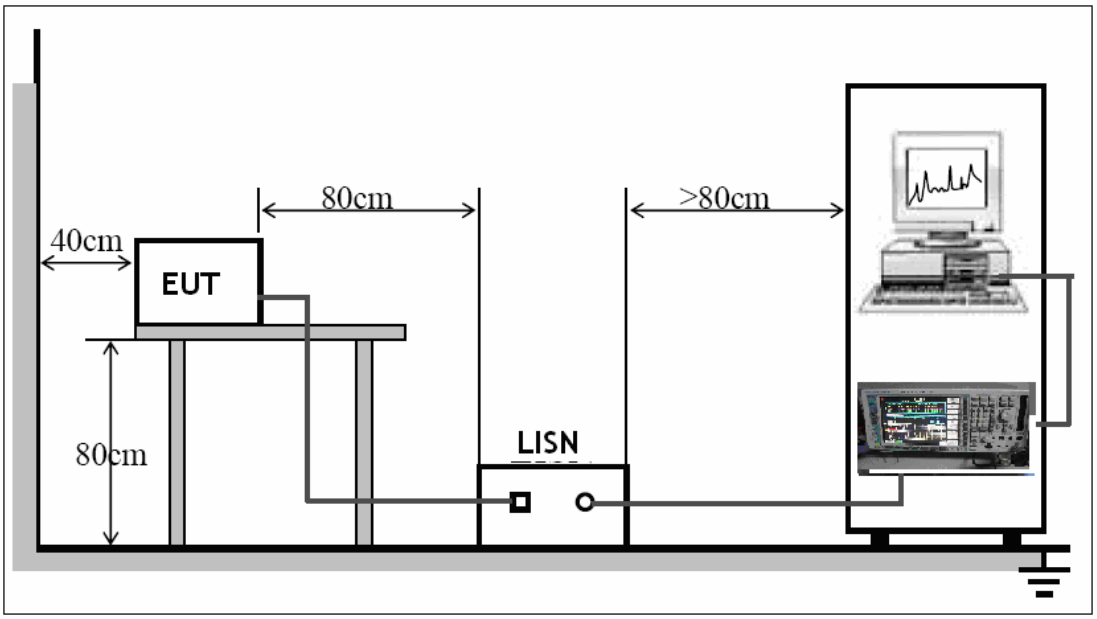
The EUT was tested in Normal Link mode.

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part 15.207 limits.



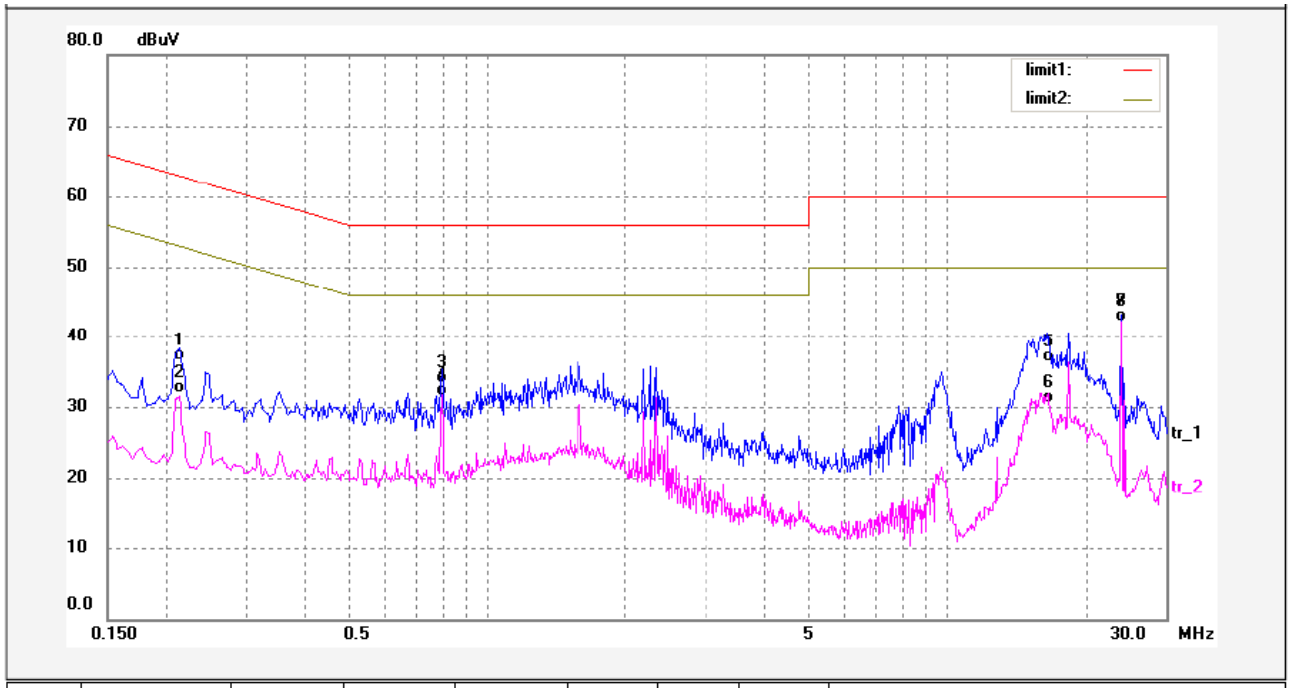
The EUT was placed on the test table in shielding room

6.3 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

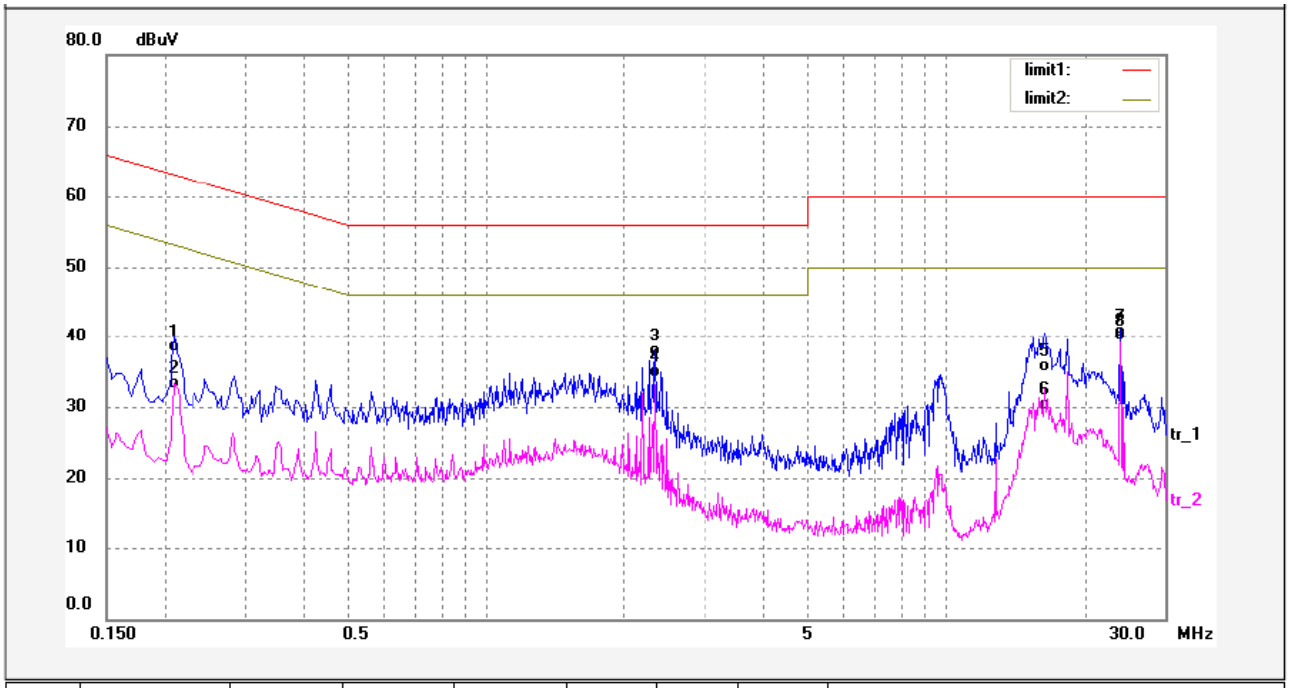
The EUT was tested in normal link mode.

Live line:



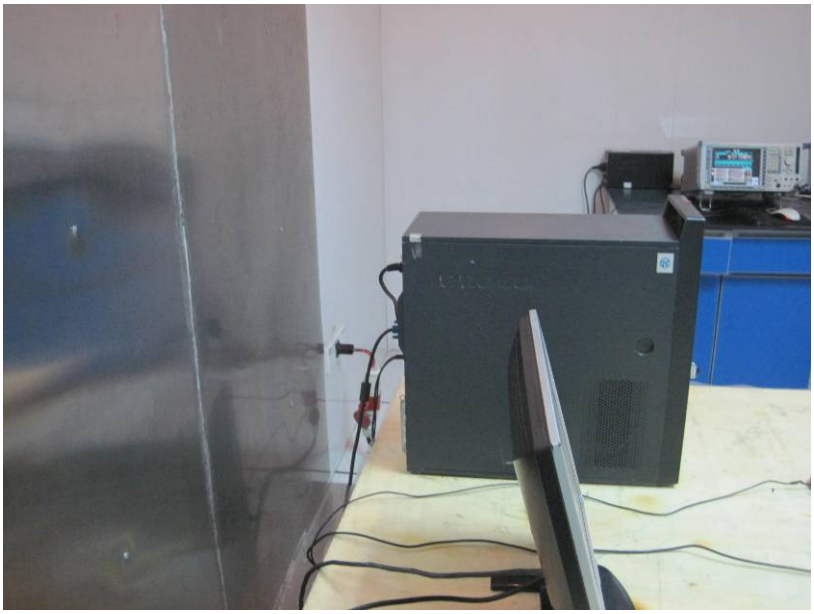
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2140	25.79	10.66	36.45	63.04	-26.59	QP	
2	0.2140	21.17	10.66	31.83	53.04	-21.21	AVG	
3	0.7980	21.22	12.17	33.39	56.00	-22.61	QP	
4	0.7980	19.26	12.17	31.43	46.00	-14.57	AVG	
5	16.3860	24.01	12.29	36.30	60.00	-23.70	QP	
6	16.3860	18.20	12.29	30.49	50.00	-19.51	AVG	
7	24.0740	29.61	12.48	42.09	60.00	-17.91	QP	
8	24.0740	29.56	12.48	42.04	50.00	-7.96	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2100	27.14	10.66	37.80	63.20	-25.40	QP	
2	0.2100	21.82	10.66	32.48	53.20	-20.72	AVG	
3	2.3380	24.93	12.26	37.19	56.00	-18.81	QP	
4	2.3380	21.86	12.26	34.12	46.00	-11.88	AVG	
5	16.4619	22.49	12.32	34.81	60.00	-25.19	QP	
6	16.4619	17.13	12.32	29.45	50.00	-20.55	AVG	
7	24.0740	27.52	12.48	40.00	60.00	-20.00	QP	
8	24.0740	26.85	12.48	39.33	50.00	-10.67	AVG	

6.4 Photograph – Conducted Emission Test Setup



7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: Based on DA 00-705

Test Result: PASS

Frequency Range: 9kHz to 25GHz

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Test mode: The EUT was tested in continuously Transmit mode.

7.1 EUT Operation :

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1012 mbar

7.2 Measurement Uncertainty

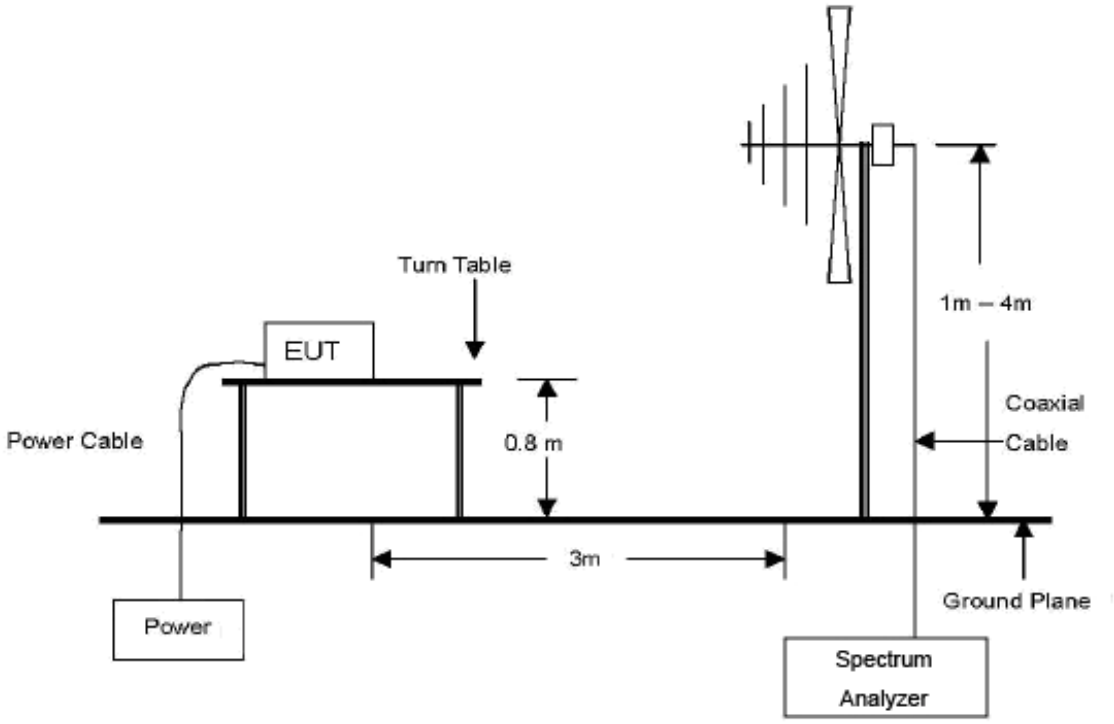
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is ±5.03dB.

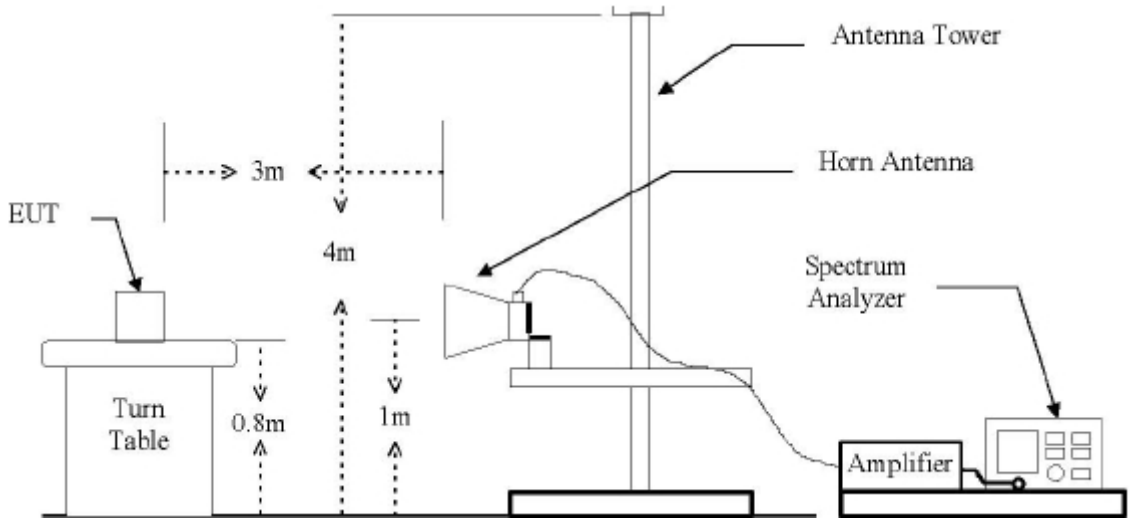
7.3 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4:2003.

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 25 GHz Emissions.



7.4 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested 9kHz to 25000MHz.

9kHz ~ 30MHz

Start Frequency	9kHz
Stop Frequency	30MHz
Sweep Speed	Auto
IF Bandwidth	10KHz
Video Bandwidth	10KHz
Resolution Bandwidth	10KHz

30MHz ~ 1GHz

Start Frequency	30 MHz
Stop Frequency	1000MHz
Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth	100KHz
Quasi-Peak Adapter Bandwidth	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	100KHz

Above 1GHz

Start Frequency	1000 MHz
Stop Frequency	25000MHz
Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth	1MHz
Quasi-Peak Adapter Bandwidth	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	1MHz

7.5 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X(normal uses) axis positioning. And all the modes was tested in the report.Only the worst case is shown in the report.

7.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

7.7 Summary of Test Results

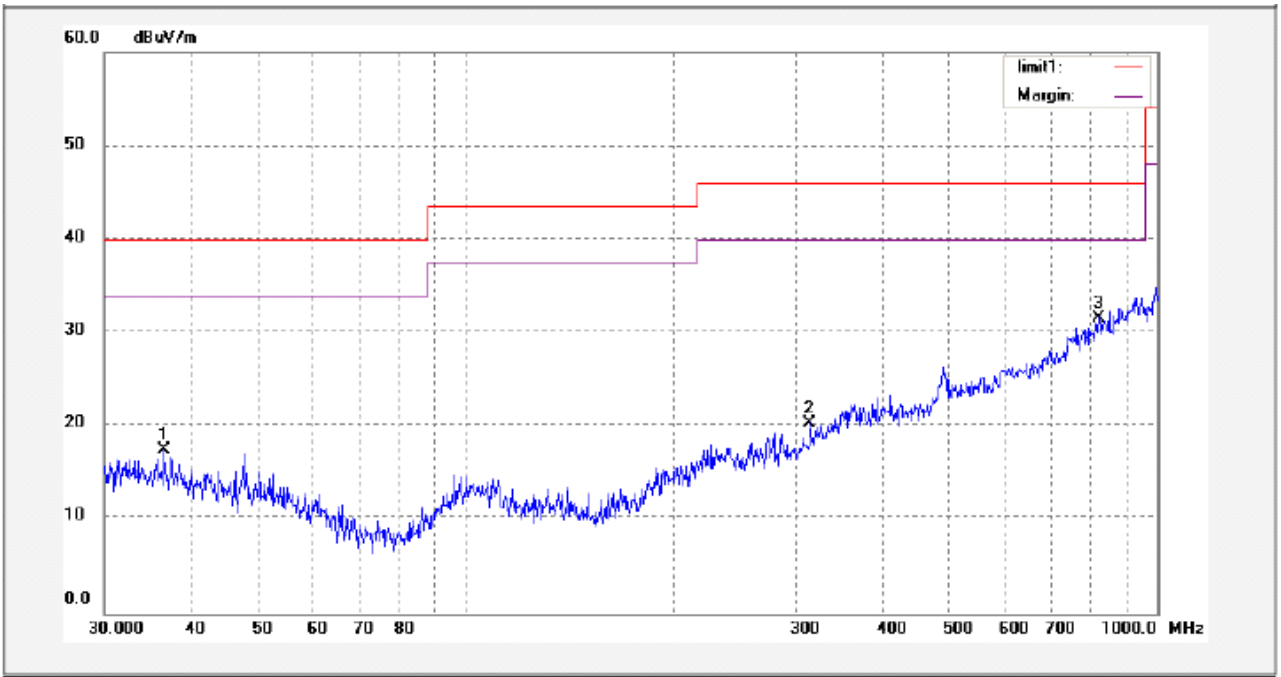
According to the data in this section, the EUT complied with the FCC CFR47 Part 15 Section 15.209 & 15.247 standards.

Test mode: continuously recevie mode

Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

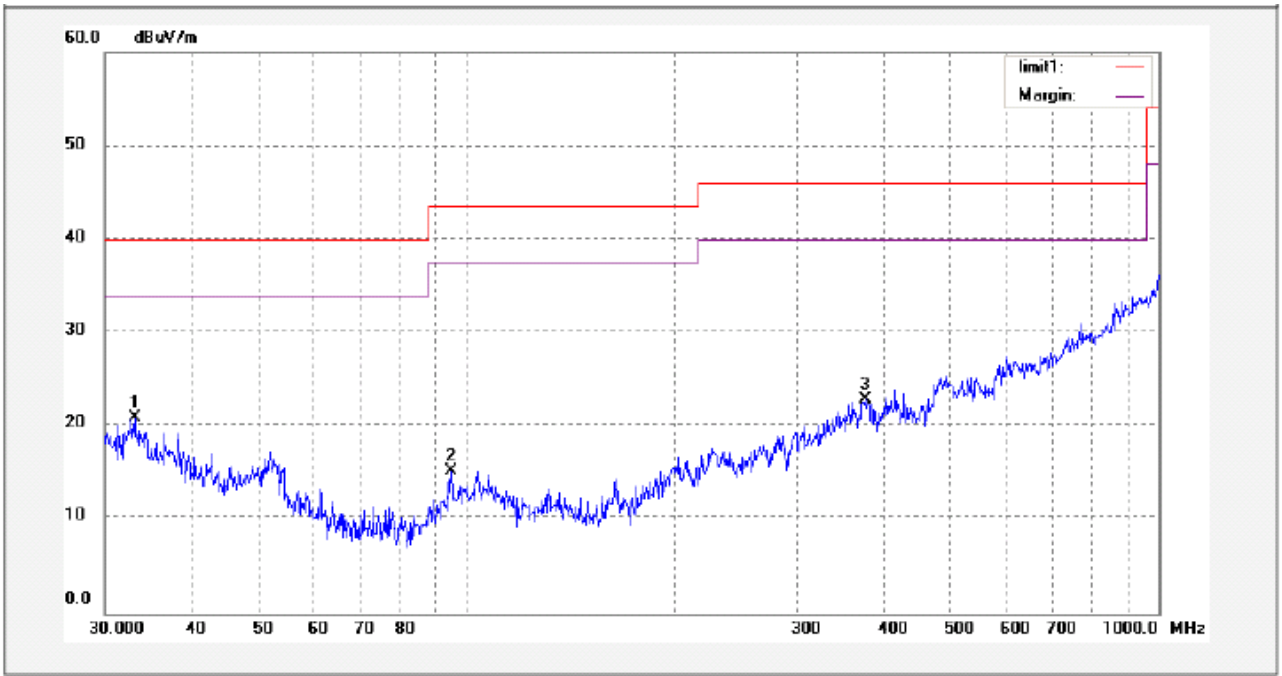
Test Frequency : 30MHz ~ 1000MHz

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	36.654	2.01	16.42	18.43	40.00	-21.57	peak	
2	318.73	3.00	18.40	21.40	46.00	-24.60	peak	
3	824.34	1.17	29.48	30.65	46.00	-15.35	peak	

Antenna polarization: Horizontal

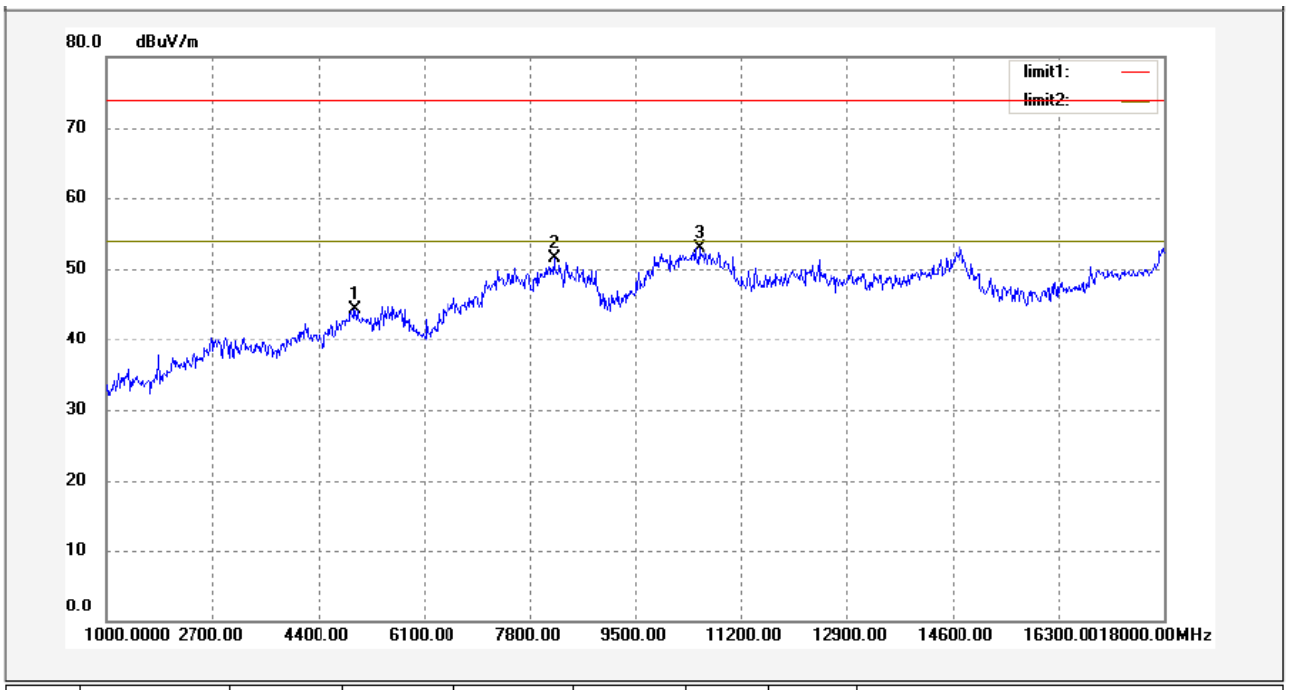


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	33.51	4.35	16.56	20.91	40.00	-19.09	peak	
2	94.97	2.10	13.15	15.25	43.50	-28.25	peak	
3	377.91	2.50	20.12	22.62	46.00	-23.38	peak	

Test Frequency: Above 1GHz radiation test data:

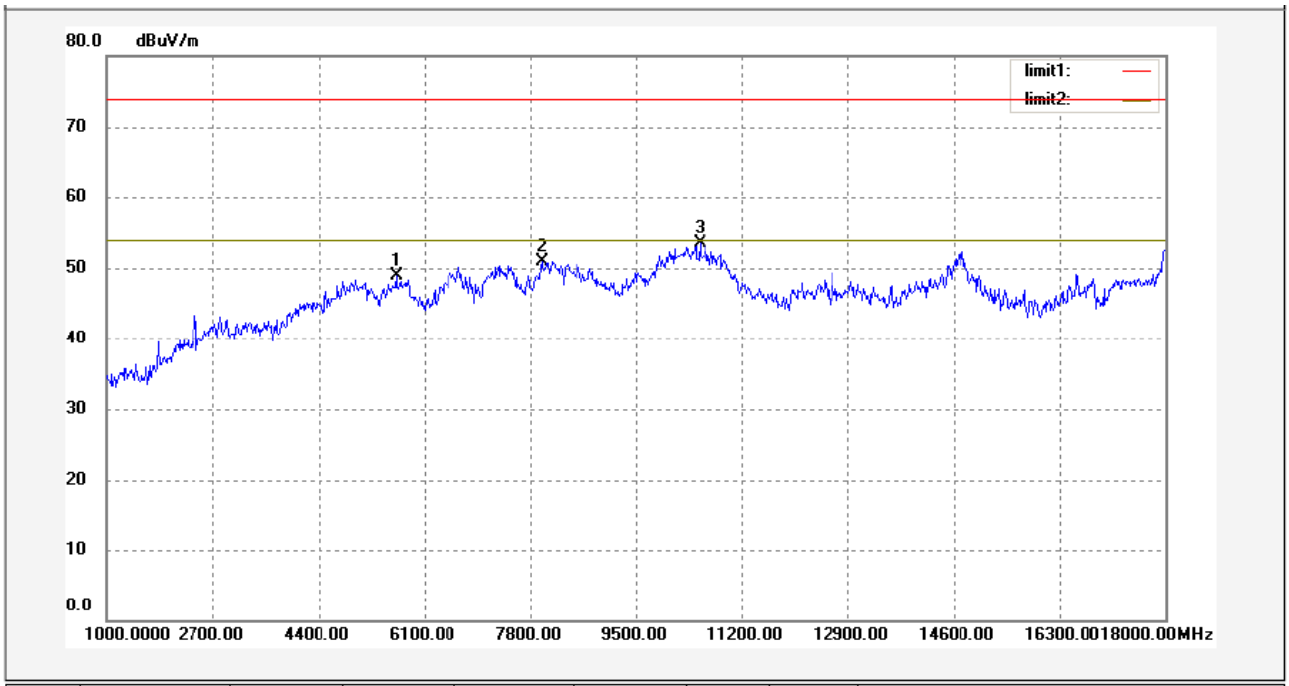
Remark: No any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4985.972	39.15	5.12	44.27	74.00	-29.73	peak	
2	8188.377	36.98	14.58	51.56	74.00	-22.44	peak	
3	10522.044	34.45	18.52	52.97	74.00	-21.03	peak	

Antenna polarization: Horizontal



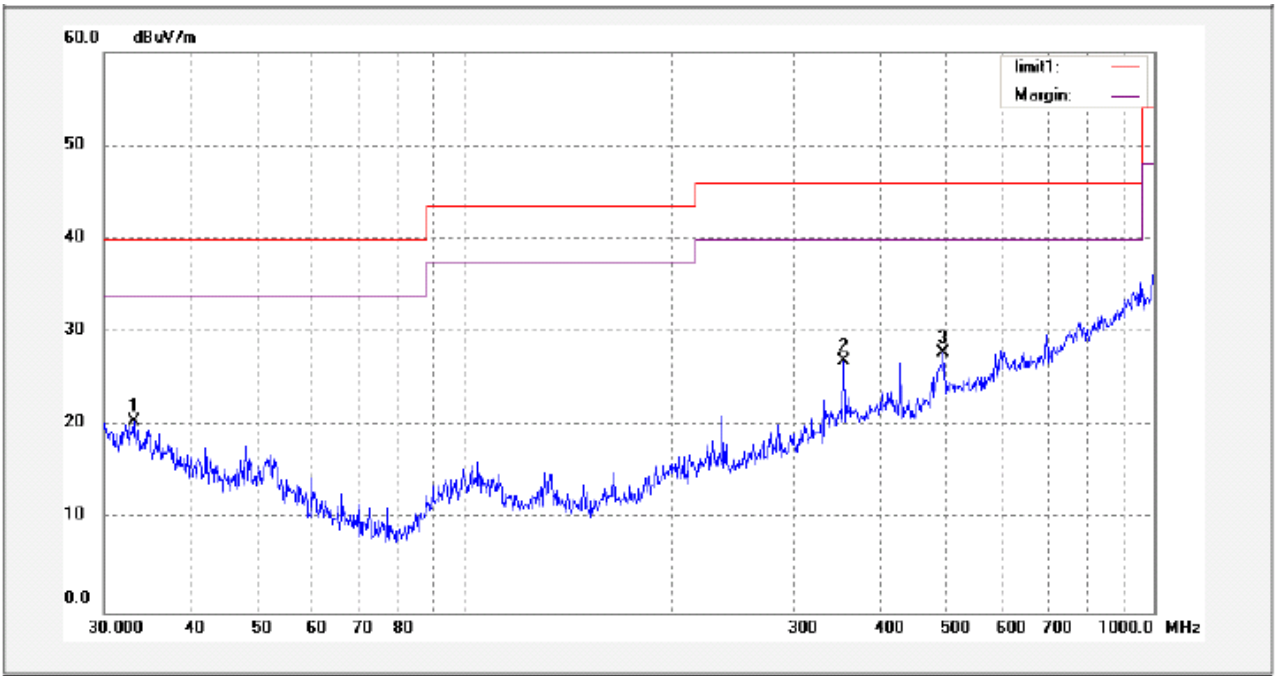
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	5650.301	39.56	9.37	48.93	74.00	-25.07	peak	
2	7983.968	32.74	18.16	50.90	74.00	-23.10	peak	
3	10522.044	32.60	20.84	53.44	74.00	-20.56	peak	

Test mode: continuously transmit mode

Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

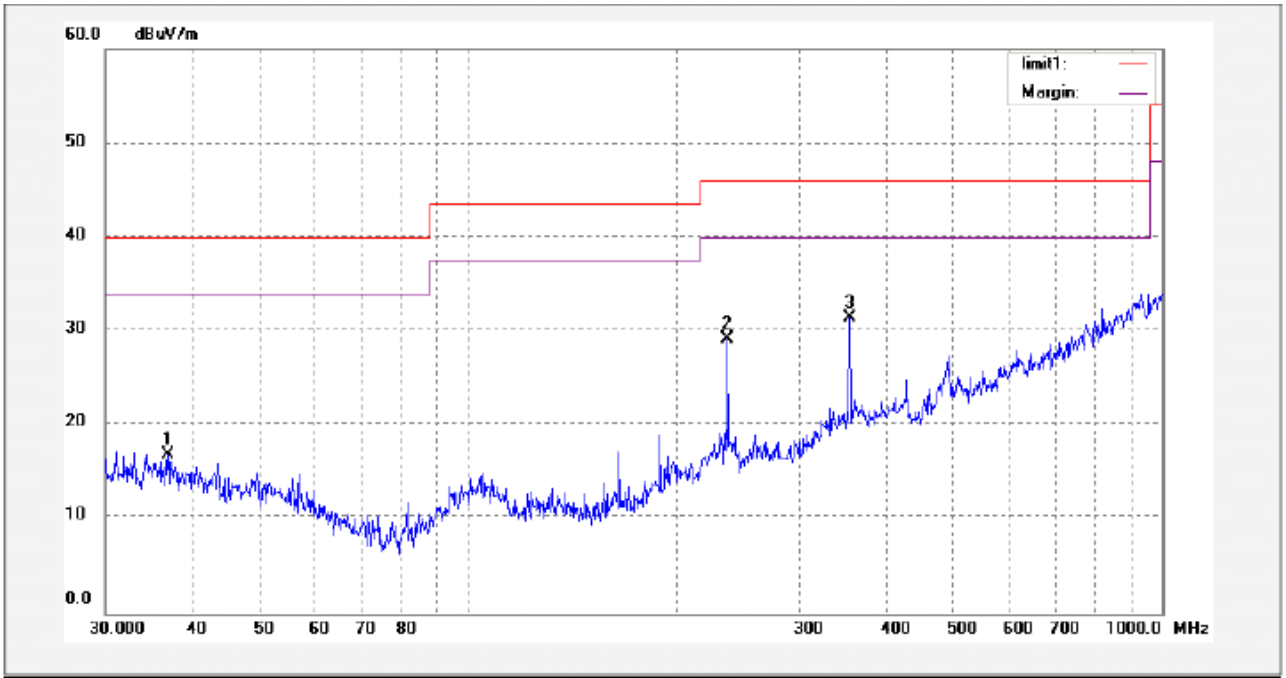
Test Frequency : 30MHz ~ 1000MHz

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	33.1015	2.85	16.56	19.41	40.00	-20.59	peak	
2	354.6912	7.54	20.43	27.97	46.00	-18.03	peak	
3	495.2379	4.41	24.38	28.79	46.00	-17.21	peak	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	36.80	1.41	16.47	17.88	40.00	-22.12	peak	
2	236.7928	12.45	15.66	28.11	46.00	-17.83	peak	
3	354.69	12.00	20.43	32.43	46.00	-13.27	peak	

Test Frequency: 1GHz ~ 25GHz

And the below is the Fundamental and Harmonic

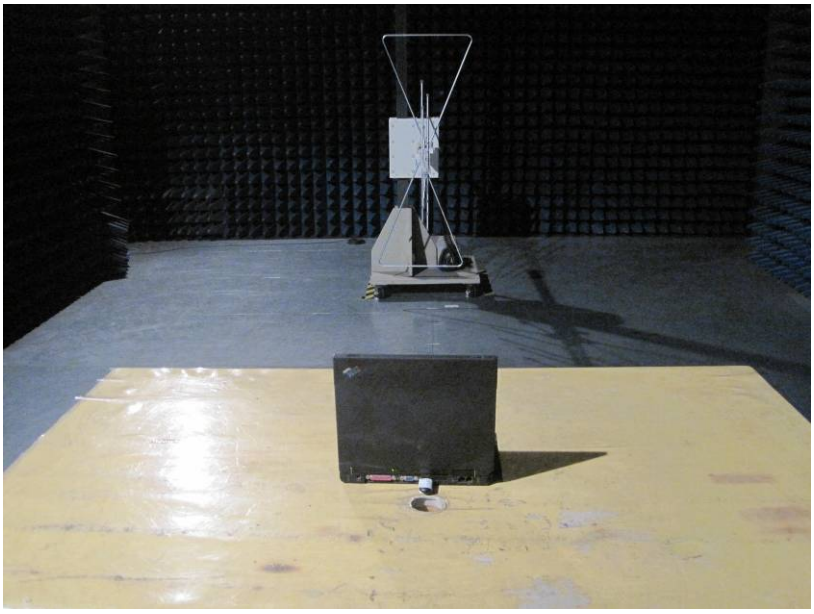
Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Low frequency							
2404.00	AV	Vertical	95.44		(Fund.)	1.5	60
4808.00	AV	Vertical	46.33	54.00	-7.67	1.4	95
7212.00	AV	Vertical	47.27	54.00	-6.73	1.7	180
9616.00	AV	Vertical	44.00	54.00	-10.00	2.0	110
12020.00	AV	Vertical	40.36	54.00	-13.64	1.4	195
14424.00	AV	Vertical	41.65	54.00	-12.35	1.6	150
16828.00	AV	Vertical	38.46	54.00	-15.54	1.5	150
19232.00	AV	Vertical	36.74	54.00	-17.26	1.7	140
21636.00	AV	Vertical	34.52	54.00	-19.48	1.4	60
24040.00	AV	Vertical	35.67	54.00	-18.33	1.4	115
2404.00	AV	Horizontal	89.34		(Fund.)	1.3	50
4808.00	AV	Horizontal	45.50	54.00	-8.50	1.4	180
7212.00	AV	Horizontal	43.25	54.00	-10.75	1.3	115
9616.00	AV	Horizontal	40.36	54.00	-13.64	1.4	130
12020.00	AV	Horizontal	42.34	54.00	-11.66	1.3	115
14424.00	AV	Horizonta	37.25	54.00	-16.75	1.4	190
16828.00	AV	Horizontal	43.35	54.00	-10.65	1.3	170
19232.00	AV	Horizontal	35.20	54.00	-18.80	2.0	150
21636.00	AV	Horizontal	36.53	54.00	-17.47	1.0	150
24040.00	AV	Horizontal	38.30	54.00	-15.70	1.7	75
2404.00	PK	Vertical	107.60		(Fund.)	1.7	45
4808.00	PK	Vertical	59.74	74.00	-14.26	2.0	100
7212.00	PK	Vertical	60.68	74.00	-13.32	1.4	140
9616.00	PK	Vertical	57.41	74.00	-16.59	1.6	250
12020.00	PK	Vertical	53.77	74.00	-20.23	1.0	135
14424.00	PK	Vertical	55.06	74.00	-18.94	1.4	100
16828.00	PK	Vertical	51.87	74.00	-22.13	1.2	195
19232.00	PK	Vertical	50.15	74.00	-23.85	1.4	180
21636.00	PK	Vertical	47.93	74.00	-26.07	1.5	105
24040.00	PK	Vertical	49.08	74.00	-24.92	1.6	135
2404.00	PK	Horizontal	101.30		(Fund.)	2.1	100
4808.00	PK	Horizontal	46.24	74.00	-27.76	2.0	170
7212.00	PK	Horizontal	43.99	74.00	-30.01	1.6	130
9616.00	PK	Horizontal	41.10	74.00	-32.90	1.4	40
12020.00	PK	Horizontal	43.08	74.00	-30.92	1.0	200
14424.00	PK	Horizontal	37.99	74.00	-36.01	1.7	50
16828.00	PK	Horizontal	44.09	74.00	-29.91	1.6	235
19232.00	PK	Horizontal	35.94	74.00	-38.06	1.7	100

21636.00	PK	Horizontal	37.27	74.00	-36.73	1.0	160
24040.00	PK	Horizontal	39.04	74.00	-34.96	1.4	145
Middle frequency							
2440.00	AV	Vertical	95.12		(Fund.)	1.2	60
4880.00	AV	Vertical	45.88	54.00	-8.12	1.2	140
7320.00	AV	Vertical	43.99	54.00	-10.01	1.2	160
9760.00	AV	Vertical	42.85	54.00	-11.15	1.4	70
12200.00	AV	Vertical	46.09	54.00	-7.91	1.3	60
14640.00	AV	Vertical	38.76	54.00	-15.24	1.2	180
17080.00	AV	Vertical	42.01	54.00	-11.99	1.3	50
19520.00	AV	Vertical	36.82	54.00	-17.18	1.7	90
21960.00	AV	Vertical	40.81	54.00	-13.19	1.5	260
24400.00	AV	Vertical	33.87	54.00	-20.13	1.2	145
2440.00	AV	Horizontal	89.48		(Fund.)	1.1	170
4880.00	AV	Horizontal	43.81	54.00	-10.19	1.2	150
7320.00	AV	Horizontal	45.54	54.00	-8.46	1.2	335
9760.00	AV	Horizontal	39.65	54.00	-14.35	1.2	170
12200.00	AV	Horizontal	42.40	54.00	-11.60	1.4	205
14640.00	AV	Horizontal	37.80	54.00	-16.20	1.6	250
17080.00	AV	Horizontal	34.99	54.00	-19.01	1.3	205
19520.00	AV	Horizontal	37.68	54.00	-16.32	1.4	150
21960.00	AV	Horizontal	38.91	54.00	-15.09	1.3	220
24400.00	AV	Horizontal	33.59	54.00	-20.41	1.9	185
2440.00	PK	Vertical	106.83		(Fund.)	1.1	45
4880.00	PK	Vertical	62.29	74.00	-11.71	1.1	130
7320.00	PK	Vertical	60.40	74.00	-13.60	1.2	160
9760.00	PK	Vertical	56.26	74.00	-17.74	1.5	210
12200.00	PK	Vertical	59.50	74.00	-14.50	1.4	255
14640.00	PK	Vertical	52.17	74.00	-21.83	1.2	40
17080.00	PK	Vertical	55.42	74.00	-18.58	1.2	60
19520.00	PK	Vertical	50.23	74.00	-23.77	1.7	190
21960.00	PK	Vertical	54.22	74.00	-19.78	1.2	200
24400.00	PK	Vertical	47.28	74.00	-26.72	1.2	165
2440.00	PK	Horizontal	99.43		(Fund.)	1.3	40
4880.00	PK	Horizontal	57.55	74.00	-16.45	1.9	125
7320.00	PK	Horizontal	59.28	74.00	-14.72	1.3	170
9760.00	PK	Horizontal	53.39	74.00	-20.61	1.5	120
12200.00	PK	Horizontal	56.14	74.00	-17.86	1.2	215
14640.00	PK	Horizontal	51.54	74.00	-22.46	1.4	200
17080.00	PK	Horizontal	48.73	74.00	-25.27	1.4	175
19520.00	PK	Horizontal	51.42	74.00	-22.58	1.5	200
21960.00	PK	Horizontal	52.65	74.00	-21.35	1.3	60
24400.00	PK	Horizontal	47.33	74.00	-26.67	1.8	220
High frequency							

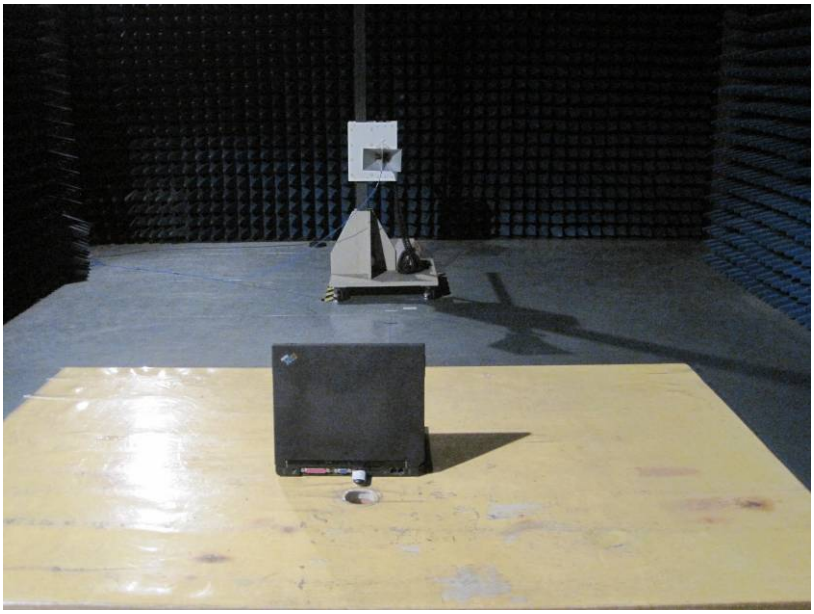
2476.00	AV	Vertical	94.36		(Fund.)	1.2	190
4952.00	AV	Vertical	45.64	54.00	-8.36	1.2	10
7428.00	AV	Vertical	42.07	54.00	-11.93	1.4	130
9904.00	AV	Vertical	44.53	54.00	-9.47	1.6	75
12380.00	AV	Vertical	39.63	54.00	-14.37	1.6	105
14856.00	AV	Vertical	46.18	54.00	-7.82	1.8	130
17332.00	AV	Vertical	40.21	54.00	-13.79	1.3	110
19808.00	AV	Vertical	41.08	54.00	-12.92	1.3	210
22284.00	AV	Vertical	39.40	54.00	-14.60	1.1	145
24760.00	AV	Vertical	33.02	54.00	-20.98	1.5	145
2476.00	AV	Horizontal	88.28		(Fund.)	1.1	150
4952.00	AV	Horizontal	43.99	54.00	-10.01	2.0	170
7428.00	AV	Horizontal	42.30	54.00	-11.70	1.5	125
9904.00	AV	Horizontal	43.12	54.00	-10.88	1.5	175
12380.00	AV	Horizontal	40.98	54.00	-13.02	1.4	145
14856.00	AV	Horizontal	35.17	54.00	-18.83	1.4	170
17332.00	AV	Horizontal	39.38	54.00	-14.62	1.1	210
19808.00	AV	Horizontal	34.05	54.00	-19.95	1.8	60
22284.00	AV	Horizontal	36.88	54.00	-17.12	1.4	105
24760.00	AV	Horizontal	32.26	54.00	-21.74	1.8	110
2476.00	PK	Vertical	106.22		(Fund.)	1.1	205
4952.00	PK	Vertical	61.15	74.00	-12.85	1.2	30
7428.00	PK	Vertical	57.58	74.00	-16.42	1.6	110
9904.00	PK	Vertical	60.04	74.00	-13.96	1.7	135
12380.00	PK	Vertical	55.14	74.00	-18.86	1.1	120
14856.00	PK	Vertical	61.69	74.00	-12.31	1.2	80
17332.00	PK	Vertical	55.72	74.00	-18.28	1.0	110
19808.00	PK	Vertical	56.59	74.00	-17.41	1.4	130
22284.00	PK	Vertical	54.91	74.00	-19.09	1.3	130
24760.00	PK	Vertical	48.53	74.00	-25.47	1.4	135
2476.00	PK	Horizontal	97.81		(Fund.)	1.4	200
4952.00	PK	Horizontal	57.73	74.00	-16.27	1.6	100
7428.00	PK	Horizontal	56.04	74.00	-17.96	1.2	140
9904.00	PK	Horizontal	56.86	74.00	-17.14	1.3	185
12380.00	PK	Horizontal	54.72	74.00	-19.28	1.0	110
14856.00	PK	Horizontal	48.91	74.00	-25.09	1.9	120
17332.00	PK	Horizontal	53.12	74.00	-20.88	2.1	165
19808.00	PK	Horizontal	47.79	74.00	-26.21	1.5	140
22284.00	PK	Horizontal	50.62	74.00	-23.38	2.0	125
24760.00	PK	Horizontal	46.00	74.00	-28.00	1.2	220

7.8 Photograph – Radiation Spurious Emission Test Setup

Below 1GHz



Above 1GHz

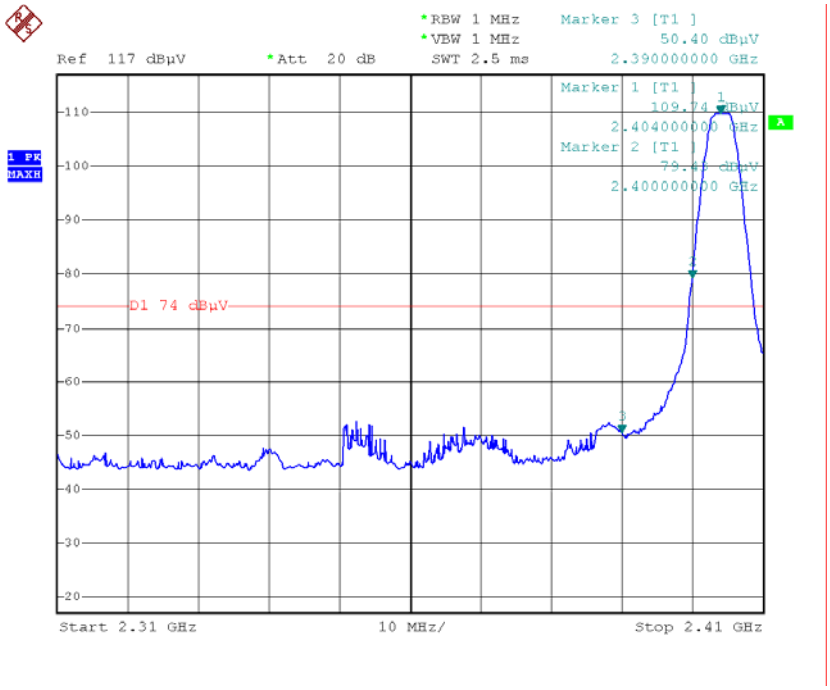


8 Band Edge Measurement

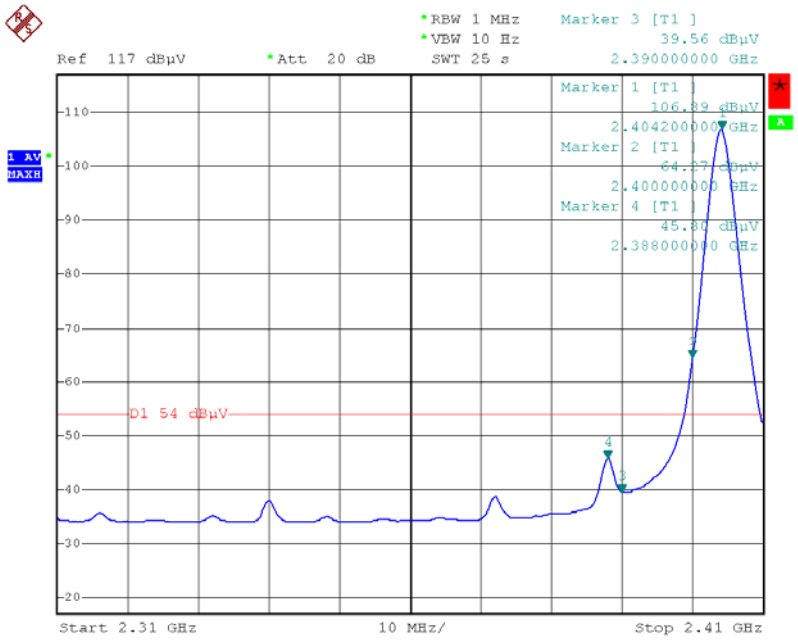
Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	Based on DA 00-705
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz
Detector:	For Peak value: RBW = 1 MHz for f ≥ 1 GHz VBW ≥ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for f ≥ 1 GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold

8.1 Test Result:

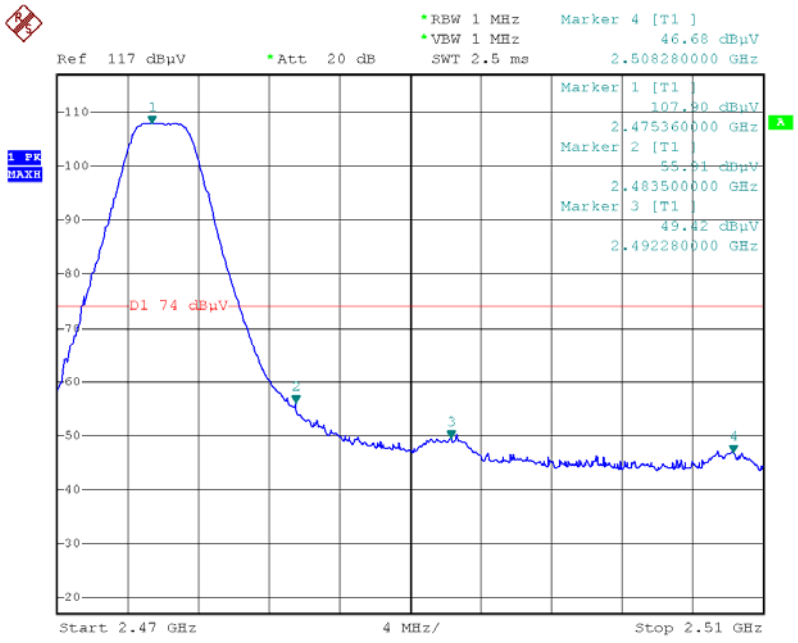
Low Channel – Peak



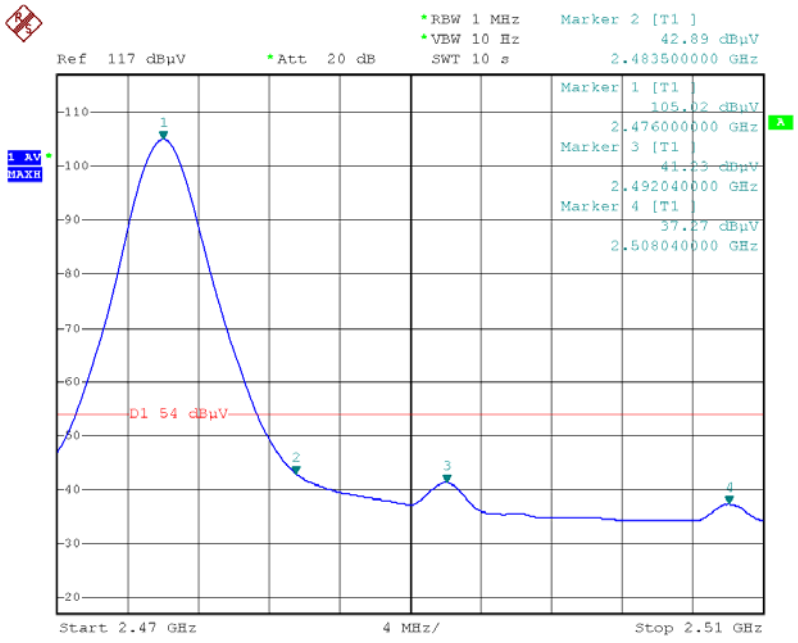
Low Channel – AV



High Channel – Peak



High Channel – AV



9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: Based on DA 00-705

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

9.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

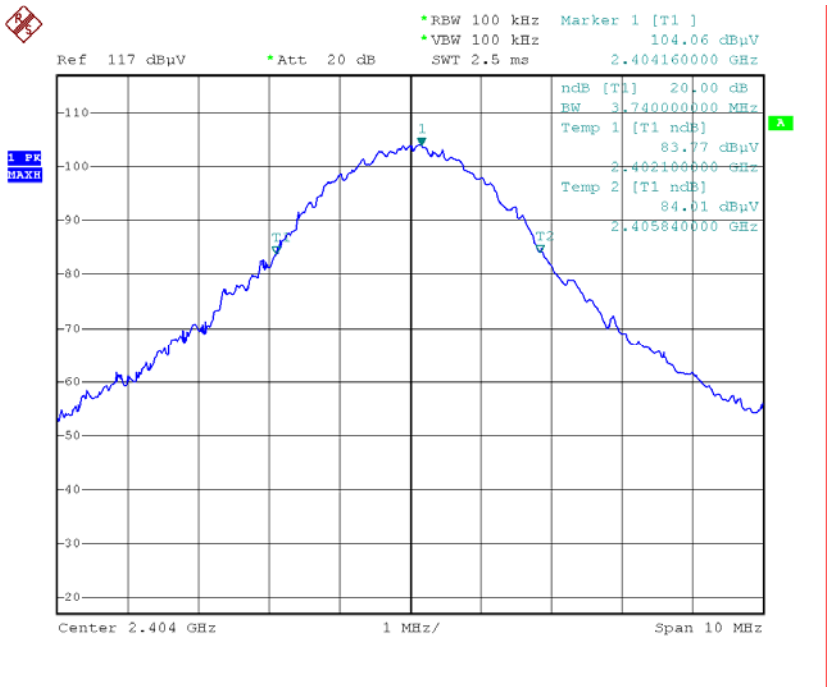
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

9.2 Test Result:

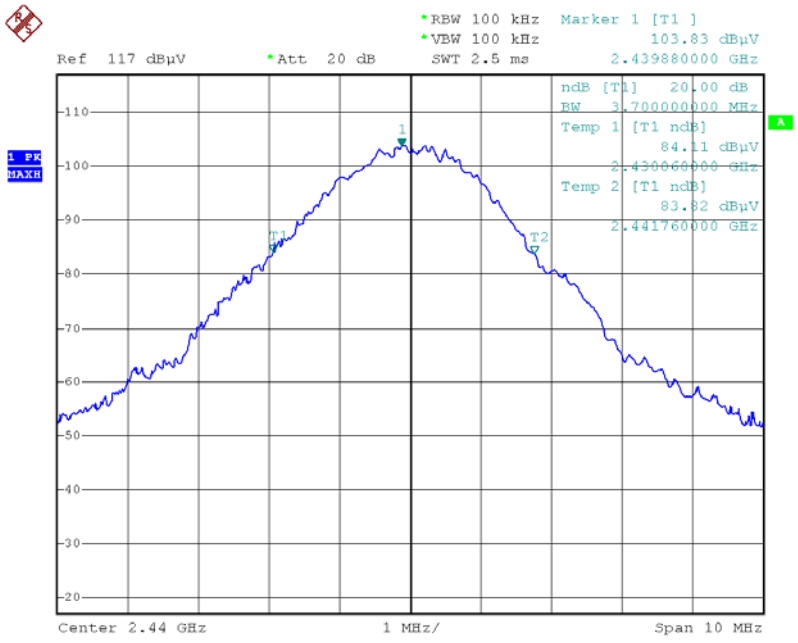
Test Channel	Bandwidth
Low	3.74MHz
Middle	3.70MHz
High	3.76MHz

Test result plot as follows:

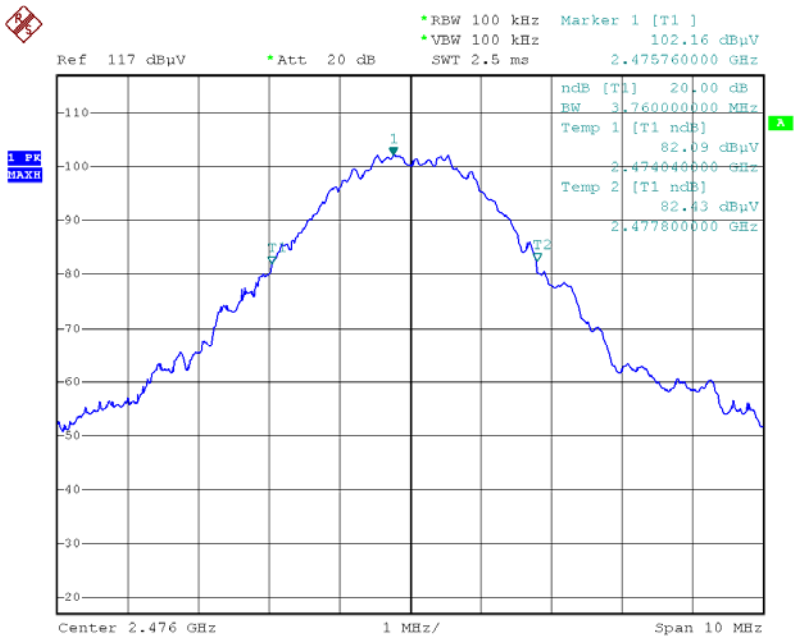
Low Channel



Middle Channel



High Channel



10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 5 MHz. VBW = 5 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2 Test Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Low	3.92	20.97
Middle	2.47	20.97
High	1.26	20.97

11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode:	Test in hopping transmitting operating mode.

11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 100kHz , Span = 6MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

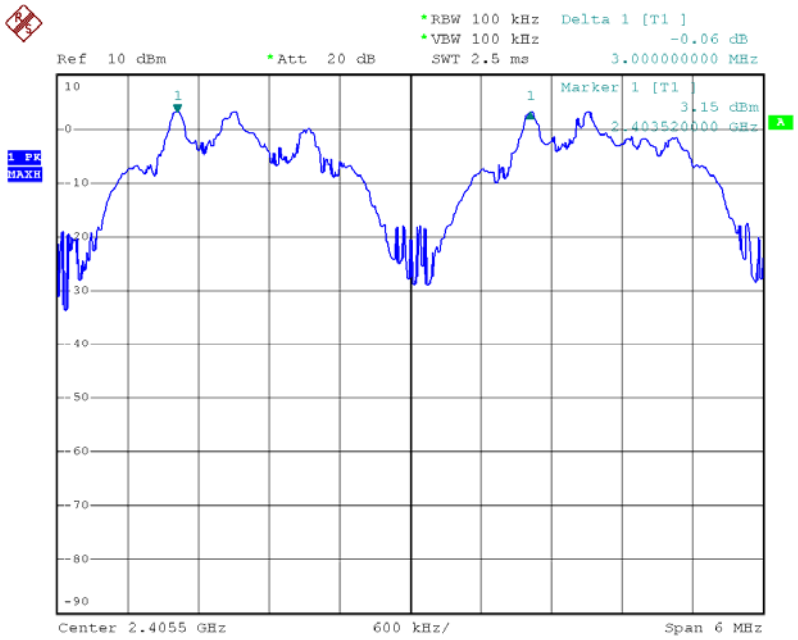
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

11.2 Test Result:

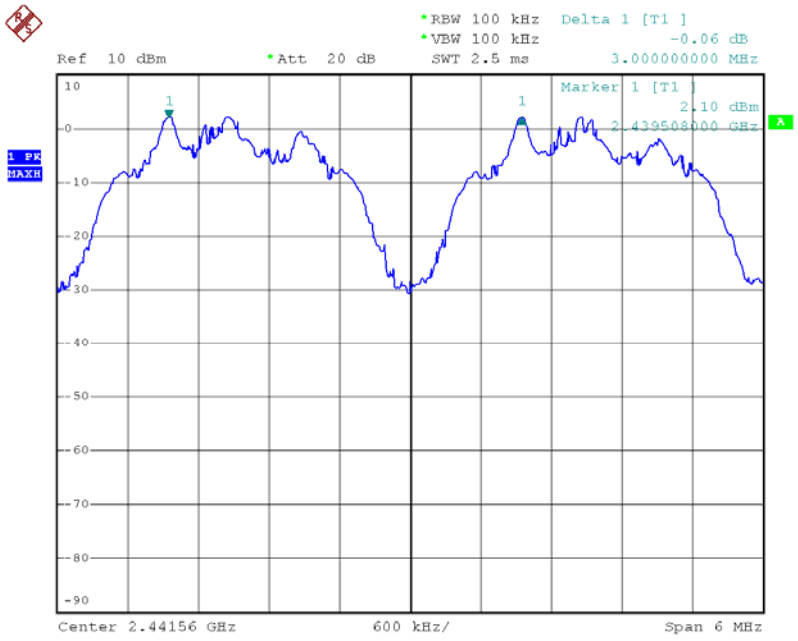
Test Channel	Separation (MHz)	Result
Low	3.000	PASS
Middle	3.000	PASS
High	3.000	PASS

Test result plot as follows:

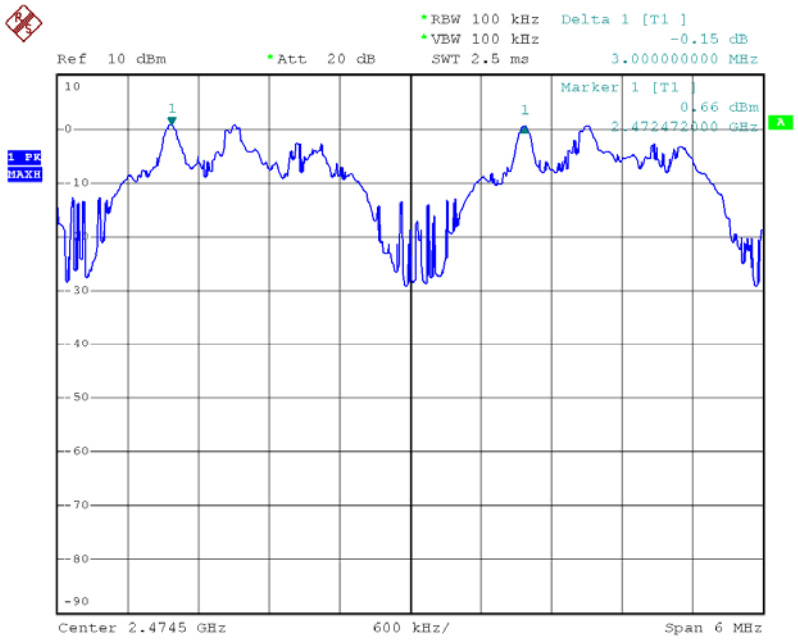
Low Channel:



Middle Channel



High Channel



12 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

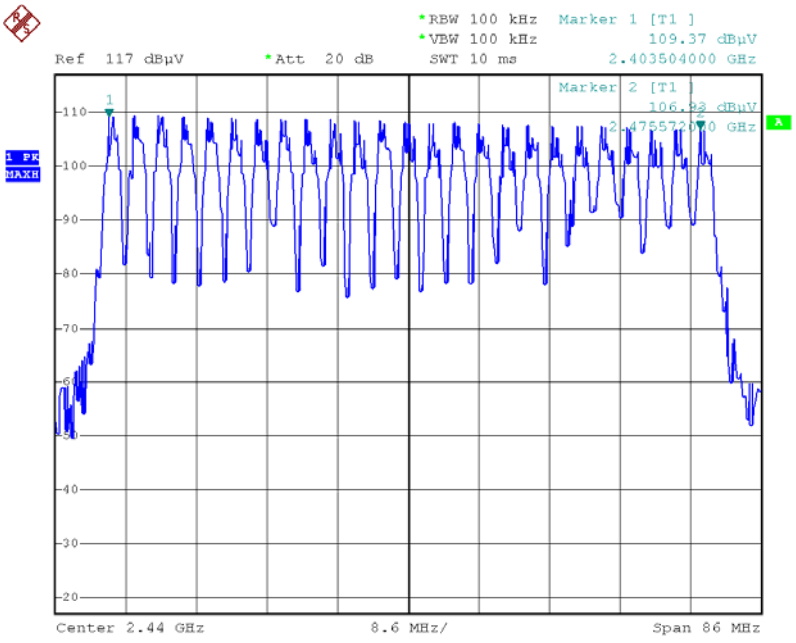
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

4. Set the spectrum analyzer: Center Frequency = 2441MHz, Span = 86MHz. Submit the test result graph.

12.2 Test Result:

Total Channels are 25 Channels.



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

13.1 Test Procedure:

1.Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2.Set spectrum analyzer span = 0. centered on a hopping channel;

3.Set RBW = 1MHz and VBW = 1MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.

4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

13.2 Test Result:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period: T= 0.4(s) * 25 = 10 (s)

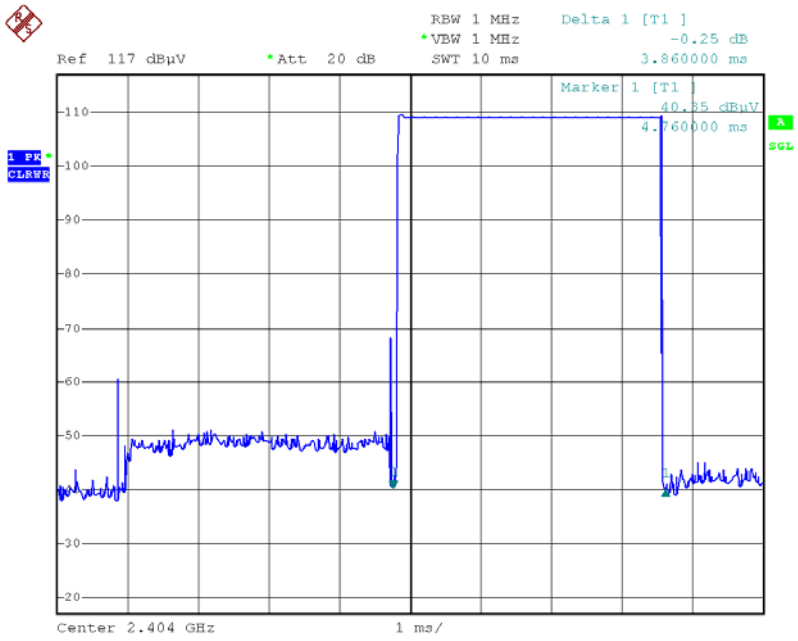
So, the Dwell Time can be calculated as follows:

Dwell time = 10 * 10 * (MkrDelta) / 1000

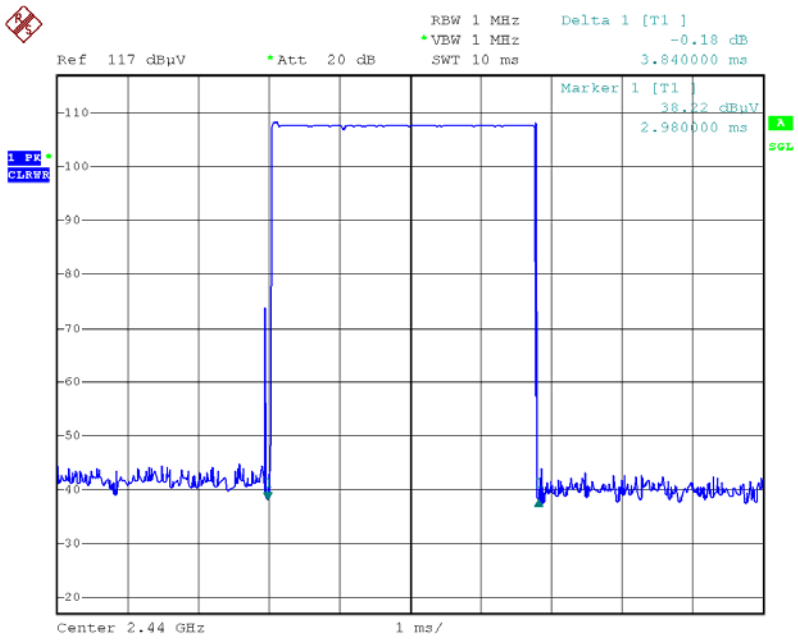
Note : Mkr Delta is once pulse time.

Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
2402 MHz	3.86	0.386	0.400	Pass
2441 MHz	3.84	0.384	0.400	Pass
2480 MHz	3.82	0.382	0.400	Pass

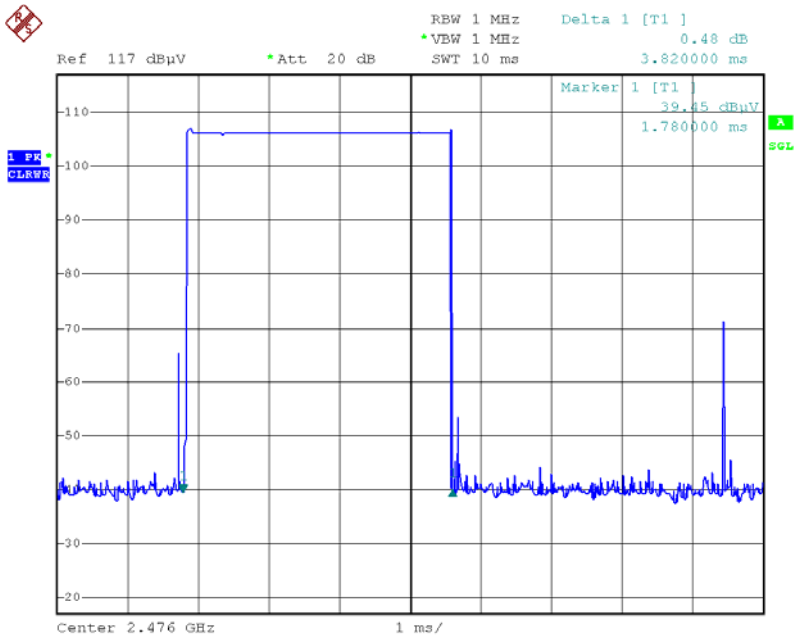
Low Channel



Middle Channel



High Channel



14 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product has a permanent PCB antenna, fulfill the requirement of this section.

15 RF Exposure

15.1 Requiments:

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a portable device.

15.2 Measurement Result:

Antenna Gain (dBi)	Antenna Gain (numeric)	Conducted Power (dBm)	Conducted Power (mW)	Radiated Power (e.i.r.p) (mW)
0	1	3.92	2.466	2.466
0	1	2.47	1.766	1.766
0	1	1.26	1.337	1.337

The EUT works on the 2.4G ISM band, and the max output power (conducted) of which is 2.466 mW lower than low threshold 60/f (GHz) mW (24.48mW), d < 2.5cm in general population category.

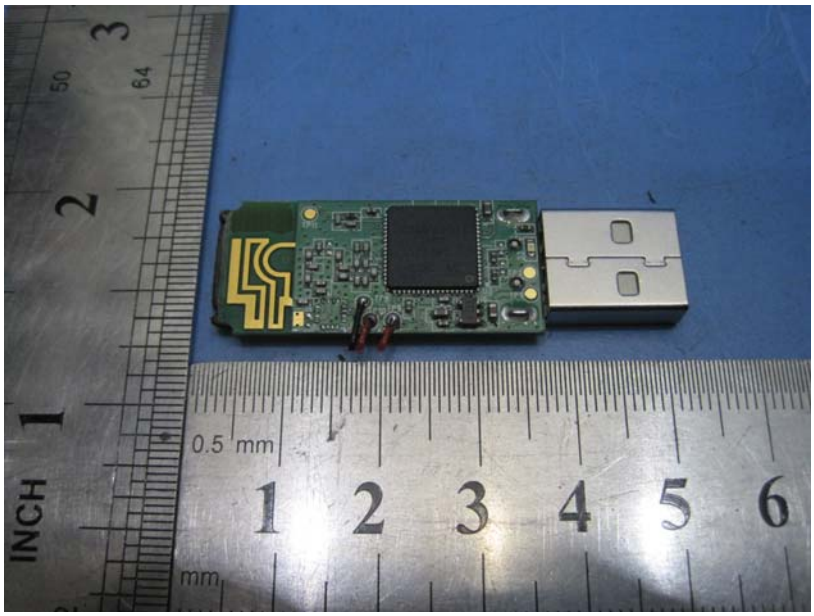
The SAR evaluation is not required.

16 Photographs - Constructional Details

16.1 EUT – Appearance View

16.2 EUT – Open View

16.3 EUT – PCB View



17 FCC Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT

EUT Top View/ proposed FCC Label Location