

# ***FCC TEST REPORT***

FCC ID : A5MW770  
Applicant : Lenovo (Beijing) Limited  
Address : No.6 Chuang Ye Road, Shangdi Information Industry Base, Haidian District, Beijing, China

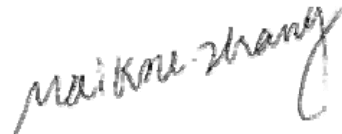
**Equipment Under Test (EUT) :**

Product Name : Lenovo Wireless Headset W770  
Model No. : W770

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



<b>Test Result</b>	<b>: PASS</b>
--------------------	---------------

**Prepared By:**

Waltek Services (Shenzhen) Co., Ltd.  
1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District,  
Shenzhen 518105, China

Tel :+86-755-27553488  
Fax:+86-755-27553868

## 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

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

### 3 Contents

	<b>Page</b>
<b>1 COVER PAGE</b> .....	<b>1</b>
<b>2 TEST SUMMARY</b> .....	<b>2</b>
<b>3 CONTENTS</b> .....	<b>3</b>
<b>4 GENERAL INFORMATION</b> .....	<b>5</b>
4.1 CLIENT INFORMATION .....	5
4.2 GENERAL DESCRIPTION OF E.U.T. ....	5
4.3 DETAILS OF E.U.T. ....	5
4.4 DESCRIPTION OF SUPPORT UNITS .....	5
4.5 STANDARDS APPLICABLE FOR TESTING .....	5
4.6 TEST FACILITY .....	6
4.7 TEST LOCATION .....	6
<b>5 EQUIPMENT USED DURING TEST</b> .....	<b>7</b>
<b>6 CONDUCTED EMISSION</b> .....	<b>9</b>
6.1 E.U.T. OPERATION .....	9
6.2 EUT SETUP .....	10
6.3 CONDUCTED EMISSION TEST RESULT .....	10
6.4 PHOTOGRAPH – CONDUCTED EMISSION TEST SETUP .....	13
<b>7 RADIATED SPURIOUS EMISSIONS</b> .....	<b>14</b>
7.1 EUT OPERATION : .....	14
7.2 MEASUREMENT UNCERTAINTY .....	14
7.3 TEST SETUP .....	15
7.4 SPECTRUM ANALYZER SETUP .....	16
7.5 TEST PROCEDURE .....	17
7.6 CORRECTED AMPLITUDE & MARGIN CALCULATION .....	17
7.7 SUMMARY OF TEST RESULTS .....	18
7.8 PHOTOGRAPH – RADIATION SPURIOUS EMISSION TEST SETUP .....	27
<b>8 BAND EDGE MEASUREMENT</b> .....	<b>28</b>
8.1 TEST RESULT: .....	29
<b>9 20 DB BANDWIDTH MEASUREMENT</b> .....	<b>33</b>
9.1 TEST PROCEDURE:.....	33
9.2 TEST RESULT: .....	33
<b>10 MAXIMUM PEAK OUTPUT POWER</b> .....	<b>35</b>
10.1 TEST PROCEDURE:.....	35
10.2 TEST RESULT:.....	35
<b>11 HOPPING CHANNEL SEPARATION</b> .....	<b>36</b>
11.1 TEST PROCEDURE:.....	36
11.2 TEST RESULT:.....	36
<b>12 NUMBER OF HOPPING FREQUENCY</b> .....	<b>39</b>
12.1 TEST PROCEDURE:.....	39
12.2 TEST RESULT:.....	39
<b>13 DWELL TIME</b> .....	<b>40</b>
13.1 TEST PROCEDURE:.....	40
13.2 TEST RESULT:.....	40
<b>14 ANTENNA REQUIREMENT</b> .....	<b>43</b>

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

**15 RF EXPOSURE ..... 44**

15.1 REQUIRMENTS: ..... 44

15.2 MEASUREMENT RESULT: ..... 44

**16 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS..... 45**

16.1 PRODUCT VIEW ..... 45

16.2 EUT – APPEARANCE VIEW ..... 45

16.3 EUT – OPEN VIEW ..... 46

16.4 EUT – PCB VIEW ..... 47


16.5 BATTERY - VIEW ..... 48

**17 FCC LABEL..... 49**

## 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 W770  
**Model No.** : W770  
**Remark** : *The product maybe have different color.*

### 4.3 Details of E.U.T.

**Technical Data** : Input: 5.0VDC (Charging mode)  
 Internal Li-ion Battery: 3.7V  
**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	SCHWARZB ECK MESS- ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Broad-band Horn Antenna	SCHWARZB ECK 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	SCHWARZB ECK MESS- ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
Broad-band Horn Antenna	SCHWARZB ECK MESS- ELEKTROM / BBHA 9170	399	W2008005	15-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1.5dB
Broadband Preamplifier	SCHWARZB ECK 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	SCHWARZB ECK MESS- ELEKTROM / AK 9515 H	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
10m 50 Ohm Coaxial Cable	SCHWARZB ECK 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	SUNSP0/ SP-14C	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-

The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Lenovo (Beijing) Limited

FCC ID: A5MW770

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
Test Receiver	ROHDE&SC HWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Two-Line V- Network	ROHDE&SC HWARZ/ 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 RFelectricity 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

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

WALTEK SERVICES

Reference No.: WT11116684R1-D-E-F



## 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 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V 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:

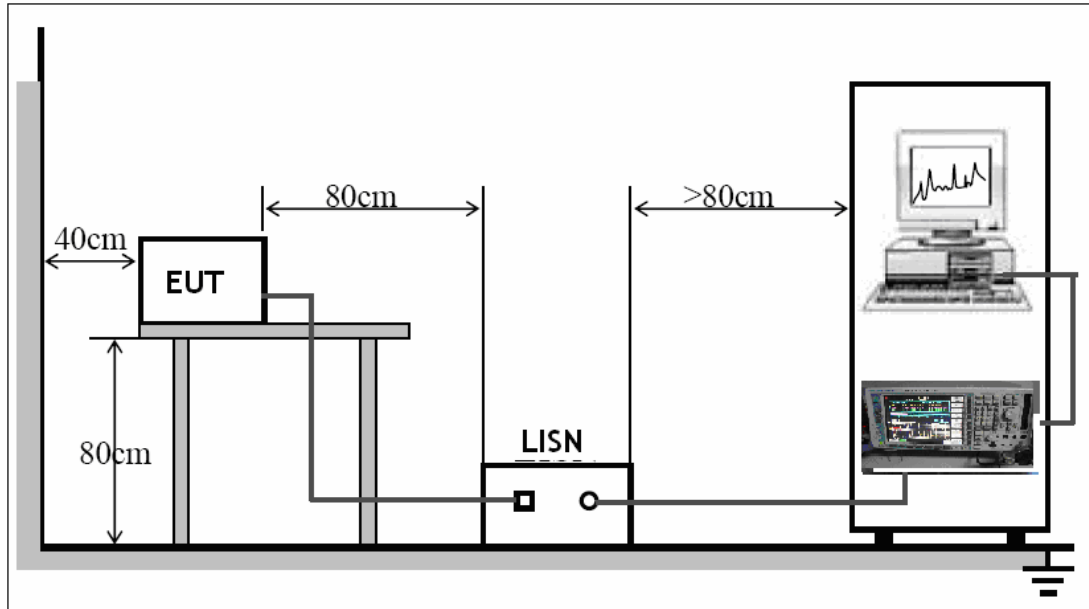
The EUT was tested in charging by PC mode.

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 Part15.207 limits.



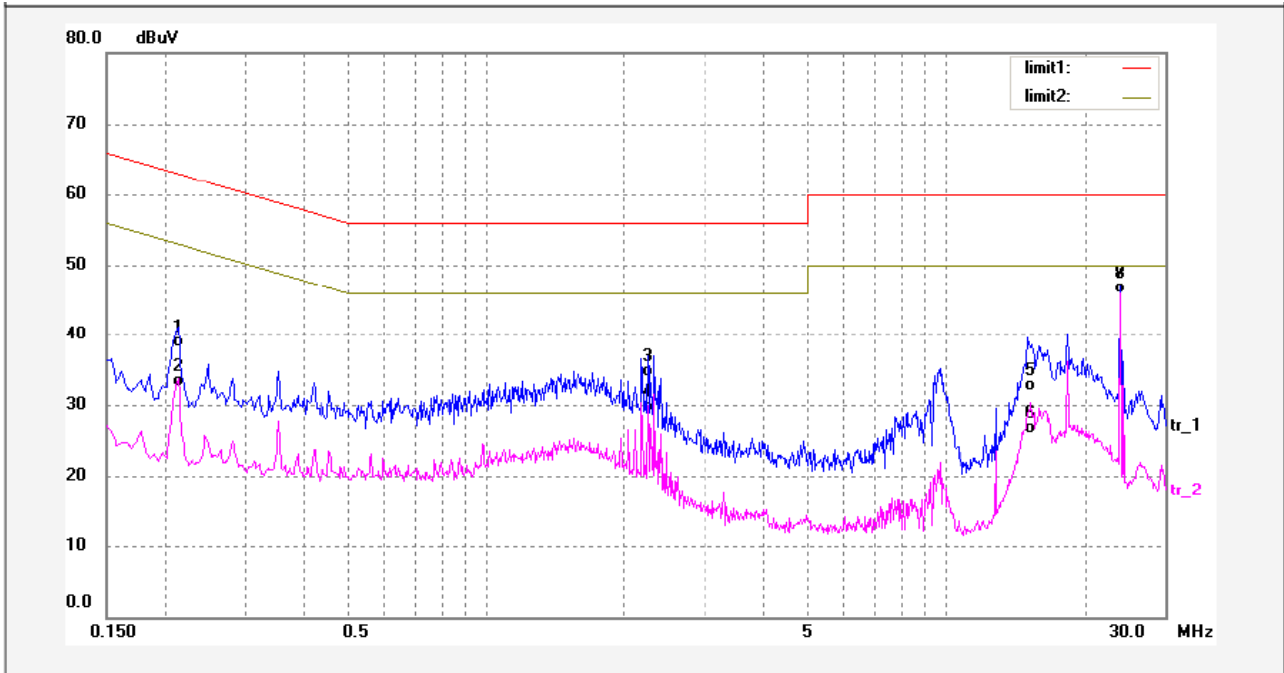
The EUT was placed on the test table in shielding room

## 6.3 Conducted Emission Test Result

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

The EUT was tested in charging mode.

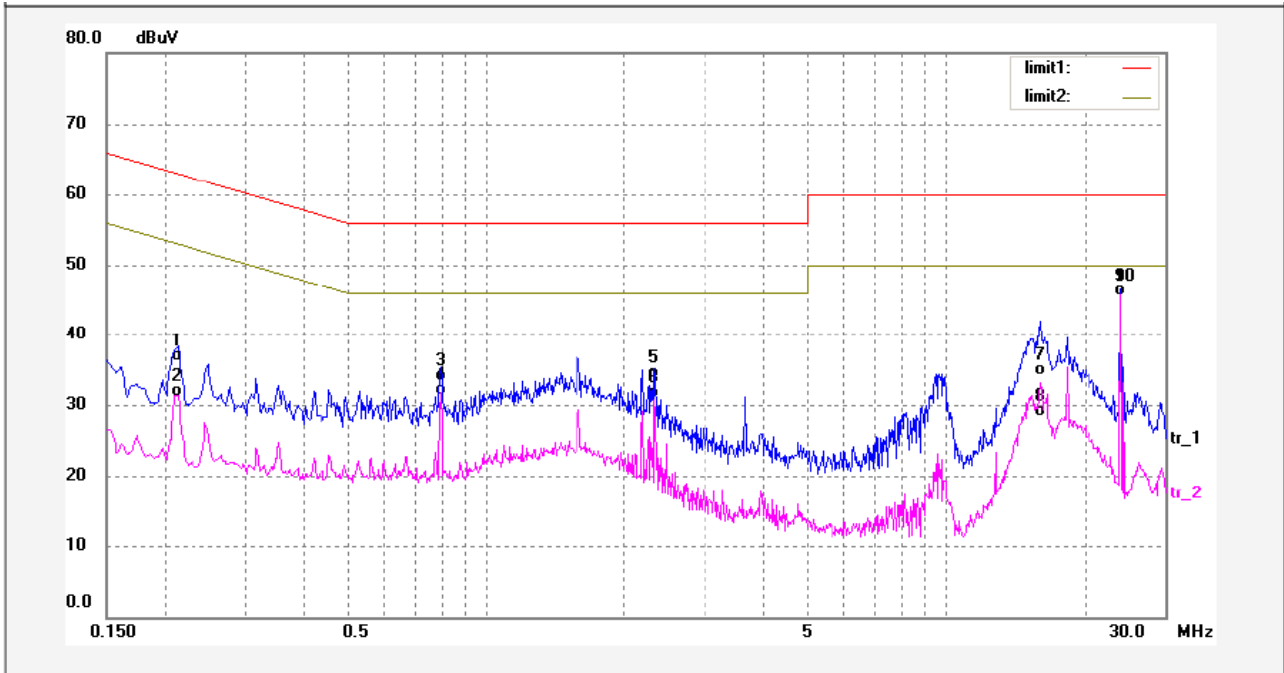
Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2140	27.53	10.66	38.19	63.04	-24.85	QP	
2	0.2140	21.88	10.66	32.54	53.04	-20.50	AVG	
3	2.2580	21.67	12.26	33.93	56.00	-22.07	QP	
4	2.2580	16.69	12.26	28.95	46.00	-17.05	AVG	
5	15.1340	19.73	12.10	31.83	60.00	-28.17	QP	
6	15.1340	13.72	12.10	25.82	50.00	-24.18	AVG	
7	24.0740	33.42	12.48	45.90	60.00	-14.10	QP	
8	24.0740	33.33	12.48	45.81	50.00	-4.19	AVG	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

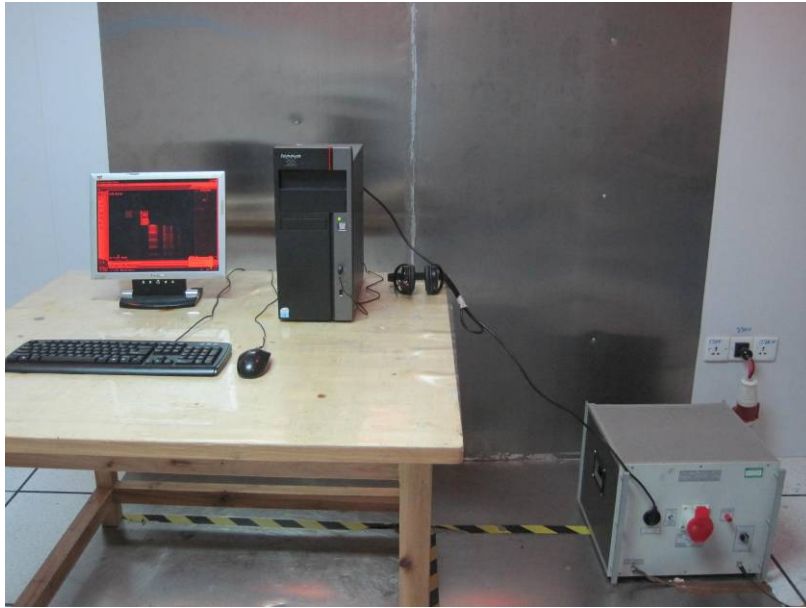
Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2140	25.48	10.66	36.14	63.04	-26.90	QP	
2	0.2140	20.52	10.66	31.18	53.04	-21.86	AVG	
3	0.7980	21.13	12.17	33.30	56.00	-22.70	QP	
4	0.7980	19.09	12.17	31.26	46.00	-14.74	AVG	
5	2.3300	21.40	12.26	33.66	56.00	-22.34	QP	
6	2.3300	18.56	12.26	30.82	46.00	-15.18	AVG	
7	16.0660	21.86	12.17	34.03	60.00	-25.97	QP	
8	16.0660	16.08	12.17	28.25	50.00	-21.75	AVG	
9	24.0740	32.99	12.48	45.47	60.00	-14.53	QP	
10	24.0740	33.10	12.48	45.58	50.00	-4.42	AVG	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

### 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

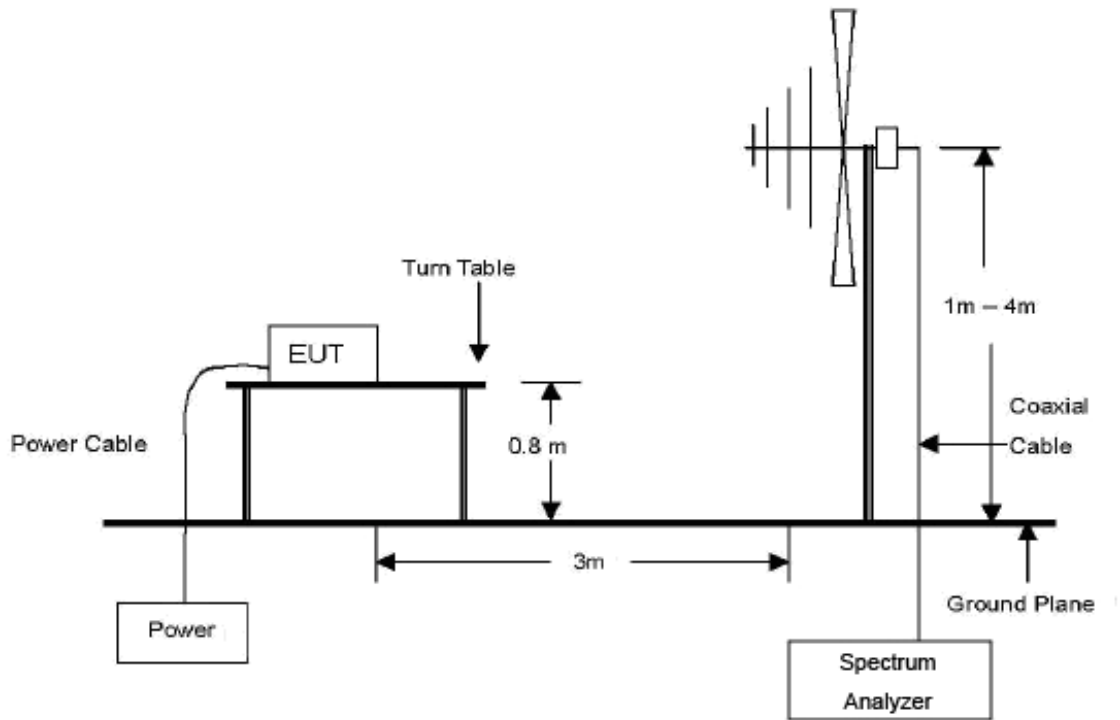
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor 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  $\pm 5.03$ dB.

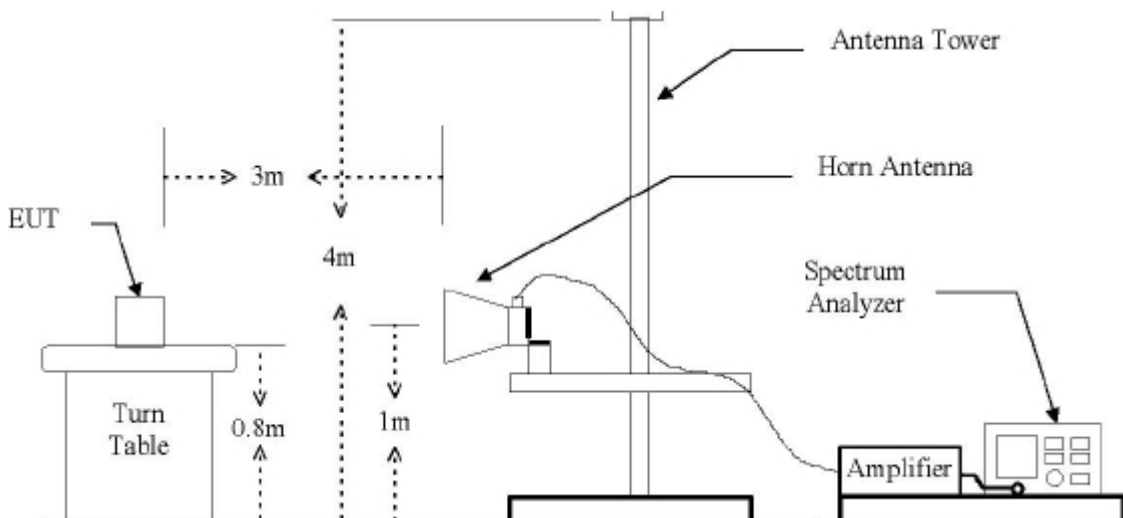
### 7.3 Test Setup

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.



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

#### 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

**7.7 Summary of Test Results**

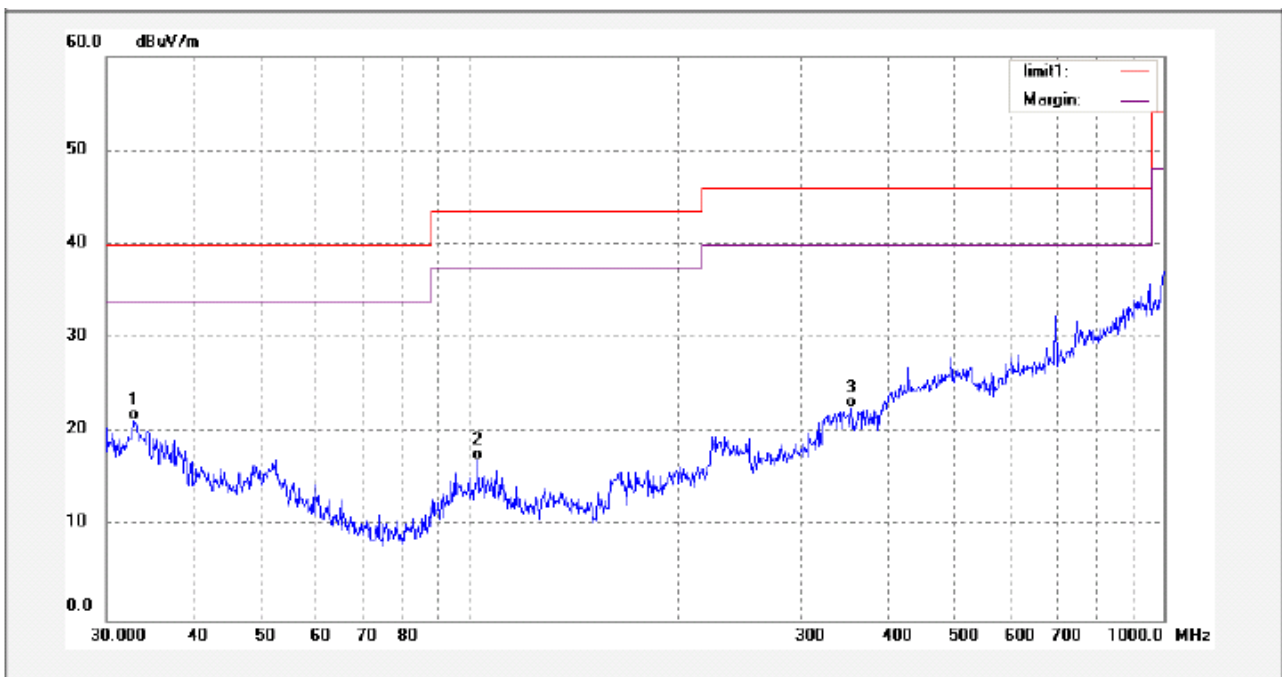
According to the data in this section, the EUT complied with the FCC CFR47 Part 15 Section 15.209 & 15.247 standards.

**Test mode: continuously receive 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

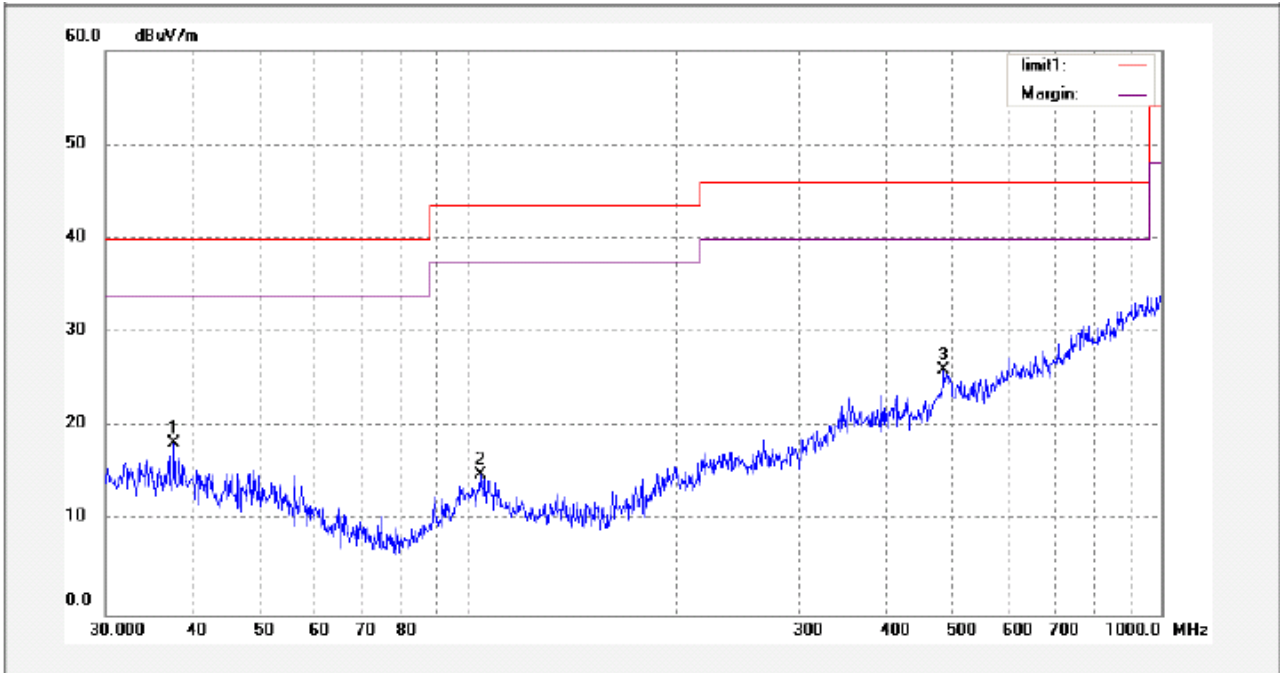
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	32.8697	4.4	16.57	20.97	40.00	-19.03	QP	
2	102.9728	2.77	14.15	16.92	43.50	-26.58	QP	
3	354.6911	2.69	20.43	23.12	46.00	-22.88	QP	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Antenna polarization: Horizontal



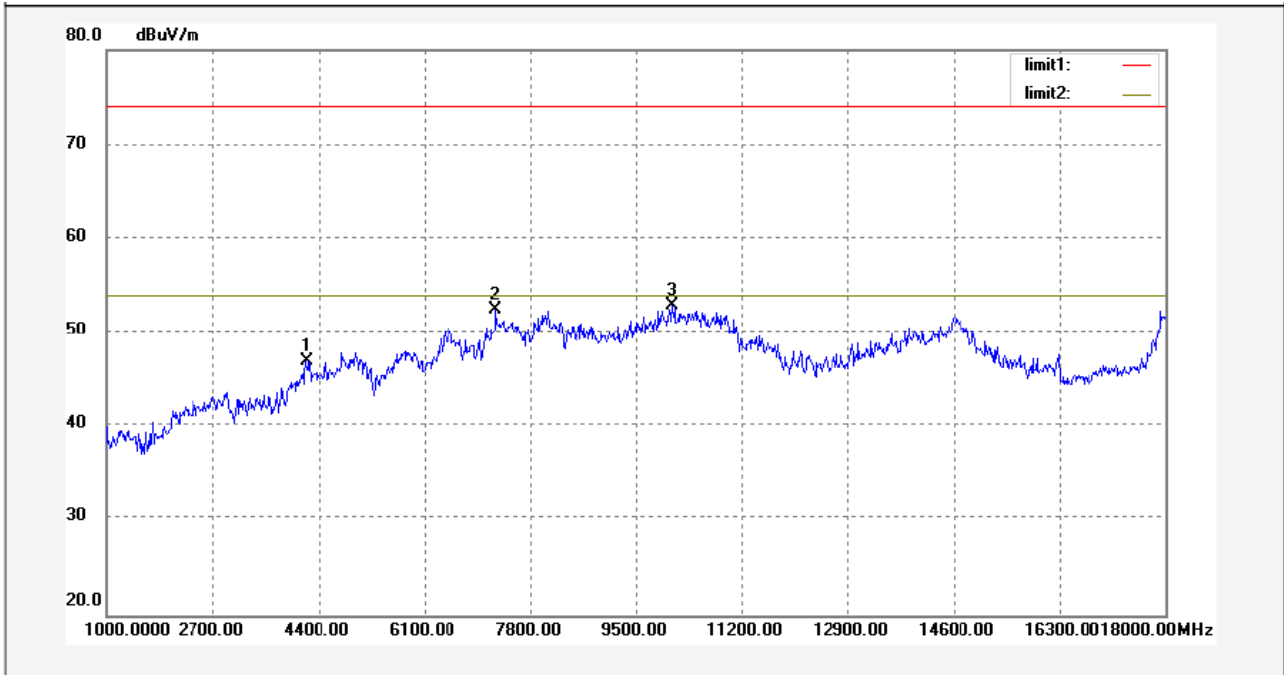
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	37.6970	2.44	16.64	19.08	40.00	-20.92	peak	
2	104.0640	1.7	14.20	15.69	43.50	-27.81	peak	
3	486.6136	2.42	24.72	27.14	46.00	-18.86	peak	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

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.

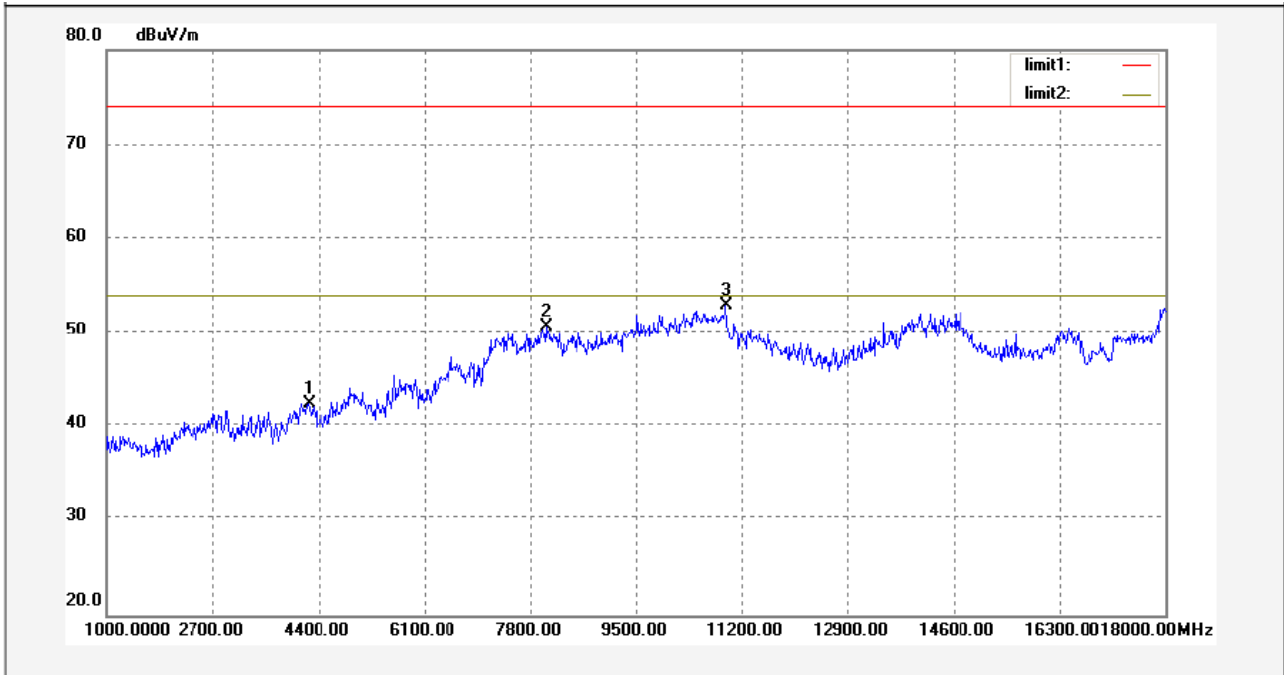
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4185.371	40.52	6.46	46.98	74.00	-27.02	peak	
2	7251.503	36.63	15.85	52.48	74.00	-21.52	peak	
3	10079.158	32.27	20.58	52.85	74.00	-21.15	peak	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4236.473	39.30	3.10	42.40	74.00	-31.60	peak	
2	8052.104	35.75	14.91	50.66	74.00	-23.34	peak	
3	10947.896	33.63	19.31	52.94	74.00	-21.06	peak	

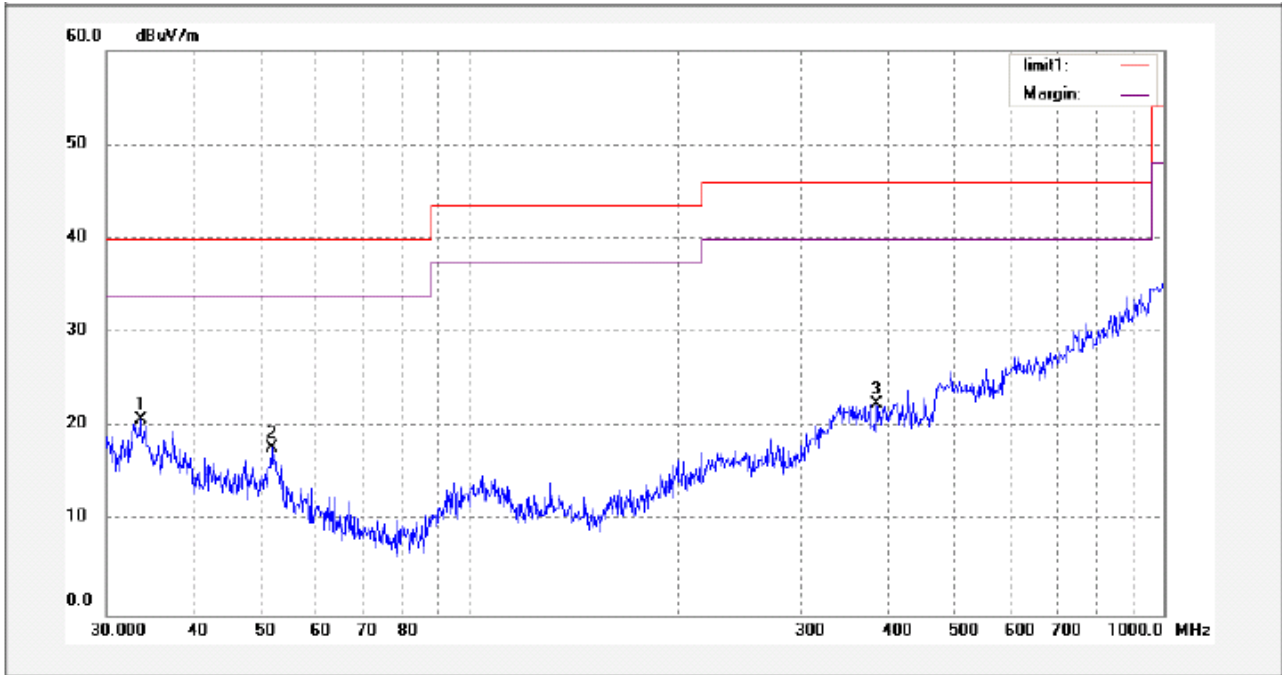
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

**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

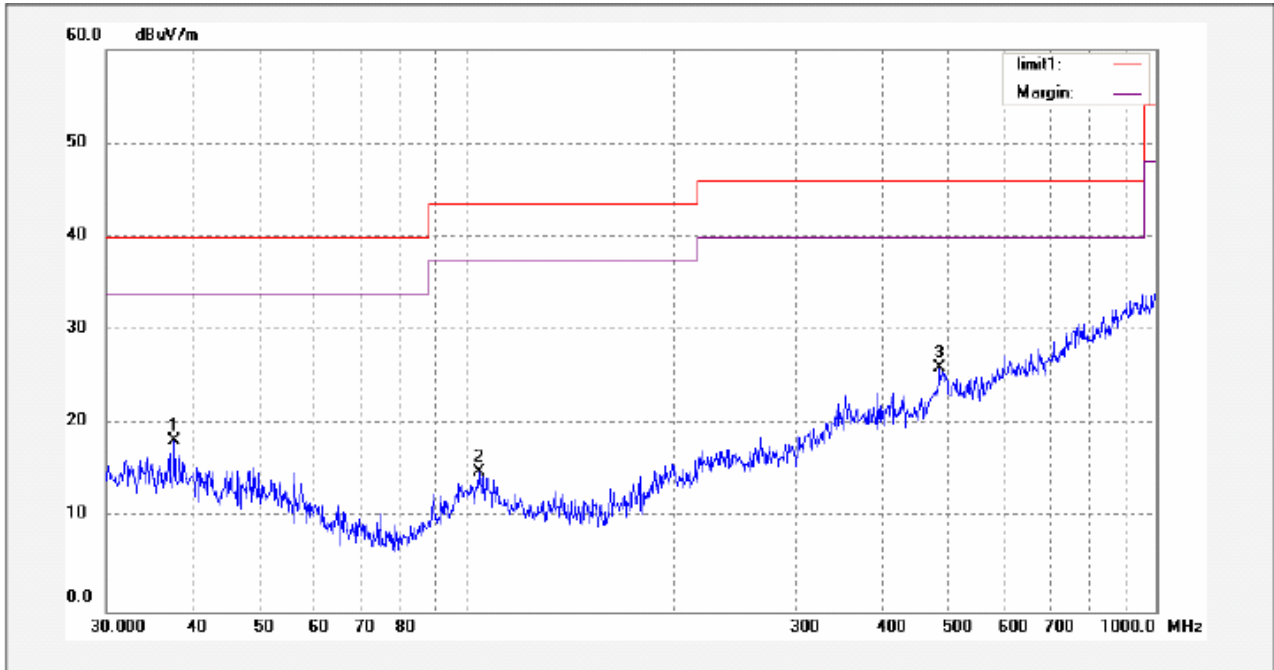
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	33.5700	5	16.55	21.55	40.00	-18.45	peak	
2	51.8998	3.76	14.51	18.07	40.00	-21.73	peak	
3	385.8982	2.79	20.33	23.12	46.00	-24.28	peak	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	37.6970	0.22	16.64	24.94	40.00	-19.95	peak	
2	104.0640	0.19	14.20	14.39	43.50	-29.12	peak	
3	486.6136	0.34	24.72	16.98	46.00	-20.62	peak	

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

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 (°)
<b>Low frequency</b>							
2404.00	AV	Vertical	85.23		(Fund.)	1.1	20
4808.00	AV	Vertical	45.47	54.00	-8.53	1.3	75
7212.00	AV	Vertical	46.41	54.00	-7.59	1.4	150
9616.00	AV	Vertical	43.14	54.00	-10.86	1.9	80
12020.00	AV	Vertical	39.50	54.00	-14.50	1.5	170
14424.00	AV	Vertical	40.79	54.00	-13.21	1.5	140
16828.00	AV	Vertical	37.60	54.00	-16.40	1.6	130
19232.00	AV	Vertical	35.88	54.00	-18.12	1.6	90
21636.00	AV	Vertical	33.66	54.00	-20.34	1.5	20
24040.00	AV	Vertical	34.81	54.00	-19.19	1.3	95
2404.00	AV	Horizontal	78.96		(Fund.)	1.1	20
4808.00	AV	Horizontal	44.78	54.00	-9.22	1.3	150
7212.00	AV	Horizontal	42.53	54.00	-11.47	1.4	90
9616.00	AV	Horizontal	39.64	54.00	-14.36	1.3	120
12020.00	AV	Horizontal	41.62	54.00	-12.38	1.4	95
14424.00	AV	Horizontal	36.53	54.00	-17.47	1.3	140
16828.00	AV	Horizontal	42.63	54.00	-11.37	1.4	130
19232.00	AV	Horizontal	34.48	54.00	-19.52	1.9	130
21636.00	AV	Horizontal	35.81	54.00	-18.19	1.1	120
24040.00	AV	Horizontal	37.58	54.00	-16.42	1.6	45
2404.00	PK	Vertical	97.11		(Fund.)	1.4	20
4808.00	PK	Vertical	58.47	74.00	-15.53	1.9	90
7212.00	PK	Vertical	59.41	74.00	-14.59	1.5	120
9616.00	PK	Vertical	56.14	74.00	-17.86	1.5	200
12020.00	PK	Vertical	52.50	74.00	-21.50	1.1	95
14424.00	PK	Vertical	53.79	74.00	-20.21	1.3	80
16828.00	PK	Vertical	50.60	74.00	-23.40	1.3	165
19232.00	PK	Vertical	48.88	74.00	-25.12	1.3	150
21636.00	PK	Vertical	46.66	74.00	-27.34	1.6	80
24040.00	PK	Vertical	47.81	74.00	-26.19	1.5	125
2404.00	PK	Horizontal	90.46		(Fund.)	1.7	80
4808.00	PK	Horizontal	44.78	74.00	-29.22	1.9	120
7212.00	PK	Horizontal	42.53	74.00	-31.47	1.7	90
9616.00	PK	Horizontal	39.64	74.00	-34.36	1.3	20
12020.00	PK	Horizontal	41.62	74.00	-32.38	1.1	170
14424.00	PK	Horizontal	36.53	74.00	-37.47	1.6	20
16828.00	PK	Horizontal	42.63	74.00	-31.37	1.7	210
19232.00	PK	Horizontal	34.48	74.00	-39.52	1.6	90

The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.



21636.00	PK	Horizontal	35.81	74.00	-38.19	1.1	140
24040.00	PK	Horizontal	37.58	74.00	-36.42	1.3	95
<b>Middle frequency</b>							
2440.00	AV	Vertical	85.88		(Fund.)	1.4	50
4880.00	AV	Vertical	45.02	54.00	-8.98	1.3	120
7320.00	AV	Vertical	43.13	54.00	-9.87	1.3	130
9760.00	AV	Vertical	41.99	54.00	-12.01	1.3	40
12200.00	AV	Vertical	45.23	54.00	-8.77	1.1	35
14640.00	AV	Vertical	37.90	54.00	-16.10	1.3	170
17080.00	AV	Vertical	41.15	54.00	-12.85	1.4	30
19520.00	AV	Vertical	35.96	54.00	-18.04	1.6	60
21960.00	AV	Vertical	39.95	54.00	-14.05	1.7	230
24400.00	AV	Vertical	33.01	54.00	-20.99	1.3	120
2440.00	AV	Horizontal	80.11		(Fund.)	1.2	160
4880.00	AV	Horizontal	43.09	54.00	-10.91	1.1	130
7320.00	AV	Horizontal	44.82	54.00	-9.18	1.4	305
9760.00	AV	Horizontal	38.93	54.00	-15.07	1.3	140
12200.00	AV	Horizontal	41.68	54.00	-12.32	1.1	180
14640.00	AV	Horizontal	37.08	54.00	-16.92	1.5	240
17080.00	AV	Horizontal	34.27	54.00	-19.73	1.5	185
19520.00	AV	Horizontal	36.96	54.00	-17.04	1.5	120
21960.00	AV	Horizontal	38.19	54.00	-15.81	1.1	190
24400.00	AV	Horizontal	32.87	54.00	-21.13	1.8	160
2440.00	PK	Vertical	97.90		(Fund.)	1.3	35
4880.00	PK	Vertical	61.02	74.00	-12.98	1.2	110
7320.00	PK	Vertical	59.13	74.00	-14.87	1.3	130
9760.00	PK	Vertical	54.99	74.00	-19.01	1.4	180
12200.00	PK	Vertical	58.23	74.00	-15.77	1.6	230
14640.00	PK	Vertical	50.90	74.00	-23.10	1.3	30
17080.00	PK	Vertical	54.15	74.00	-19.85	1.3	40
19520.00	PK	Vertical	48.96	74.00	-25.04	1.6	160
21960.00	PK	Vertical	52.95	74.00	-21.05	1.4	170
24400.00	PK	Vertical	46.01	74.00	-27.99	1.3	140
2440.00	PK	Horizontal	91.01		(Fund.)	1.4	30
4880.00	PK	Horizontal	56.09	74.00	-17.91	1.8	105
7320.00	PK	Horizontal	57.82	74.00	-16.18	1.5	140
9760.00	PK	Horizontal	51.93	74.00	-22.07	1.6	90
12200.00	PK	Horizontal	54.68	74.00	-19.32	1.3	190
14640.00	PK	Horizontal	50.08	74.00	-23.92	1.3	190
17080.00	PK	Horizontal	47.27	74.00	-26.73	1.0	155
19520.00	PK	Horizontal	49.96	74.00	-24.04	1.6	170
21960.00	PK	Horizontal	51.19	74.00	-22.81	1.0	30
24400.00	PK	Horizontal	45.87	74.00	-28.13	1.7	195
<b>High frequency</b>							

The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Lenovo (Beijing) Limited

FCC ID: A5MW770

2476.00	AV	Vertical	86.51		(Fund.)	1.4	200
4952.00	AV	Vertical	46.88	54.00	-7.12	1.3	30
7428.00	AV	Vertical	43.31	54.00	-10.69	1.5	160
9904.00	AV	Vertical	45.77	54.00	-8.23	1.5	100
12380.00	AV	Vertical	40.87	54.00	-13.13	1.4	125
14856.00	AV	Vertical	47.42	54.00	-6.58	1.9	140
17332.00	AV	Vertical	41.45	54.00	-12.55	1.0	130
19808.00	AV	Vertical	42.32	54.00	-11.68	1.2	240
22284.00	AV	Vertical	40.64	54.00	-13.36	1.3	170
24760.00	AV	Vertical	34.26	54.00	-19.74	1.6	165
2476.00	AV	Horizontal	80.66		(Fund.)	1.2	160
4952.00	AV	Horizontal	43.27	54.00	-10.73	1.9	190
7428.00	AV	Horizontal	41.58	54.00	-12.42	1.1	155
9904.00	AV	Horizontal	42.40	54.00	-11.60	1.6	200
12380.00	AV	Horizontal	40.26	54.00	-13.74	1.1	165
14856.00	AV	Horizontal	34.45	54.00	-19.55	1.3	180
17332.00	AV	Horizontal	38.66	54.00	-15.34	1.3	230
19808.00	AV	Horizontal	33.33	54.00	-20.67	1.9	90
22284.00	AV	Horizontal	36.16	54.00	-17.84	1.2	130
24760.00	AV	Horizontal	31.54	54.00	-22.46	1.7	130
2476.00	PK	Vertical	98.48		(Fund.)	1.3	215
4952.00	PK	Vertical	59.88	74.00	-14.12	1.3	50
7428.00	PK	Vertical	56.31	74.00	-17.69	1.7	140
9904.00	PK	Vertical	58.77	74.00	-15.23	1.6	160
12380.00	PK	Vertical	53.87	74.00	-20.13	1.3	140
14856.00	PK	Vertical	60.42	74.00	-13.58	1.3	90
17332.00	PK	Vertical	54.45	74.00	-19.55	1.1	130
19808.00	PK	Vertical	55.32	74.00	-18.68	1.3	160
22284.00	PK	Vertical	53.64	74.00	-20.36	1.5	155
24760.00	PK	Vertical	47.26	74.00	-26.74	1.5	155
2476.00	PK	Horizontal	90.68		(Fund.)	1.5	210
4952.00	PK	Horizontal	56.27	74.00	-17.73	1.5	120
7428.00	PK	Horizontal	54.58	74.00	-19.42	1.4	170
9904.00	PK	Horizontal	55.40	74.00	-18.60	1.4	210
12380.00	PK	Horizontal	53.26	74.00	-20.74	1.1	130
14856.00	PK	Horizontal	47.45	74.00	-26.55	1.8	130
17332.00	PK	Horizontal	51.66	74.00	-22.34	1.7	185
19808.00	PK	Horizontal	46.33	74.00	-27.67	1.6	170
22284.00	PK	Horizontal	49.16	74.00	-24.84	1.7	150
24760.00	PK	Horizontal	44.54	74.00	-29.46	1.1	240

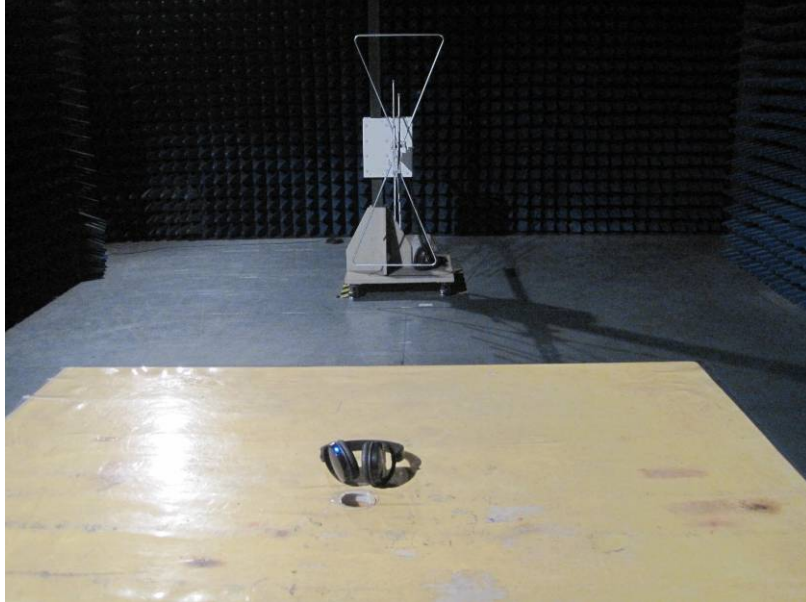
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

WALTEK SERVICES

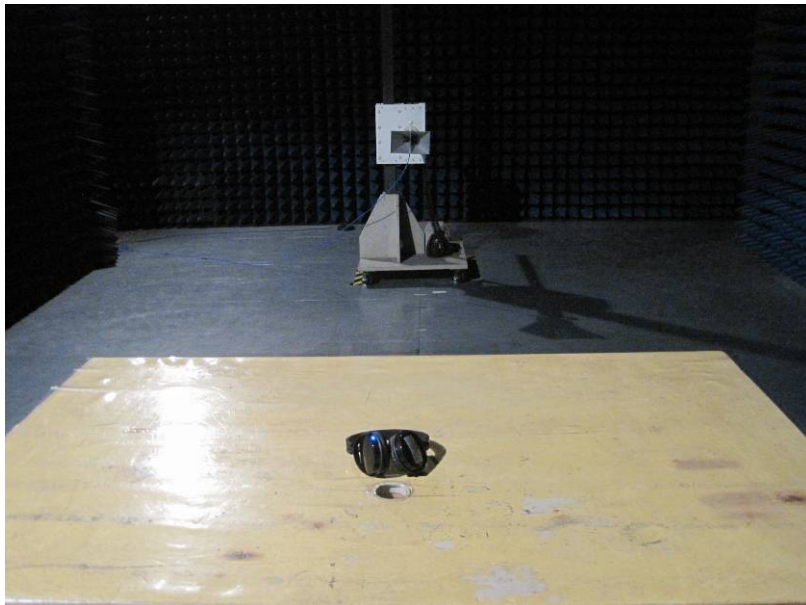
Reference No.: WT11116684R1-D-E-F

### 7.8 Photograph – Radiation Spurious Emission Test Setup

Below 1GHz



Above 1GHz



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

WALTEK SERVICES

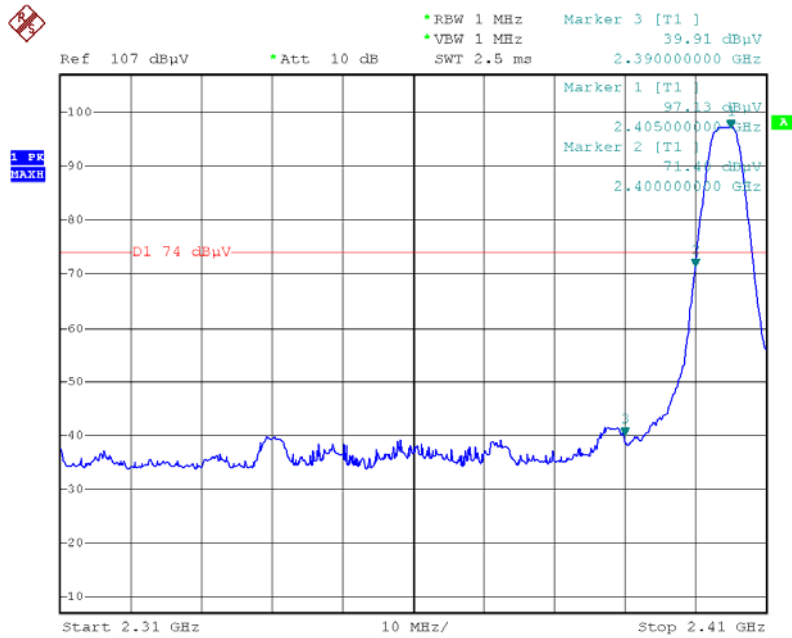
Reference No.: WT11116684R1-D-E-F

## 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 $f \geq 1$ GHz VBW $\geq$ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for $f \geq 1$ GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold

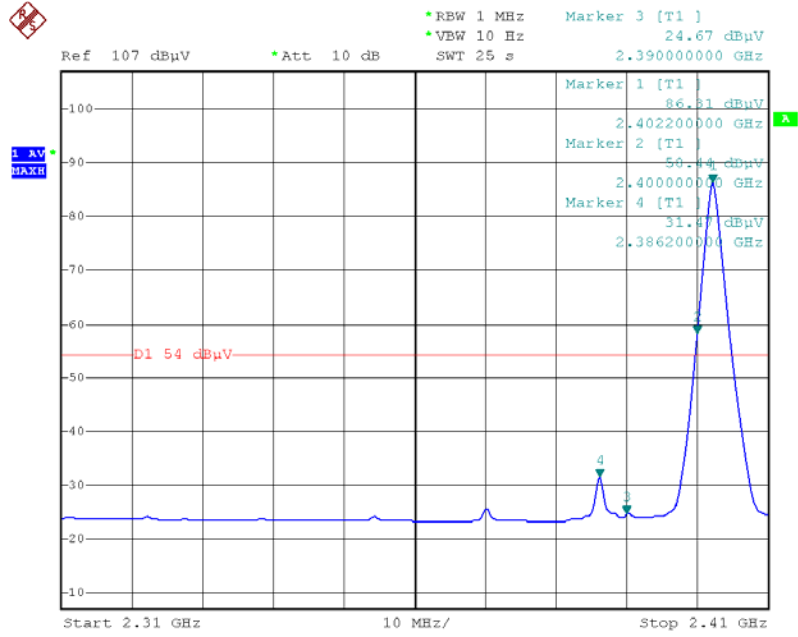
### 8.1 Test Result:

#### Low Channel – Peak



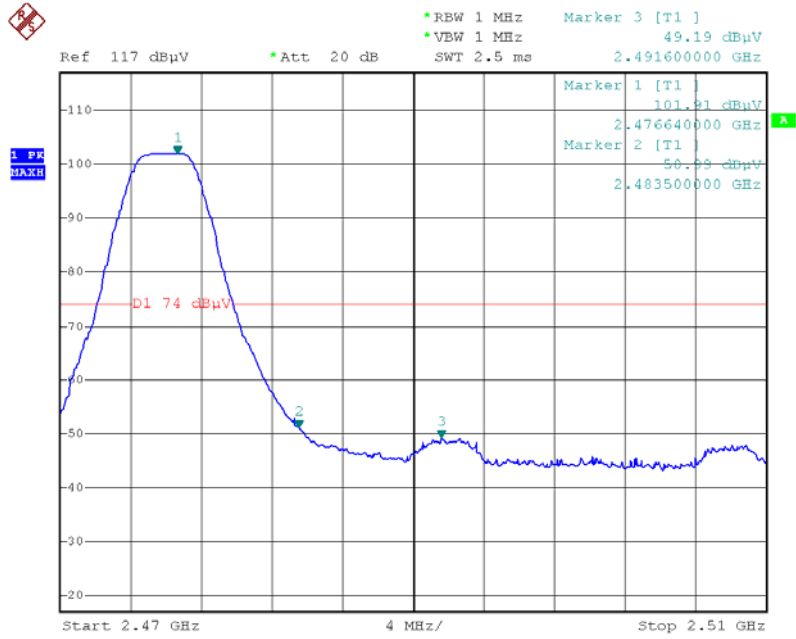
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Low Channel – AV



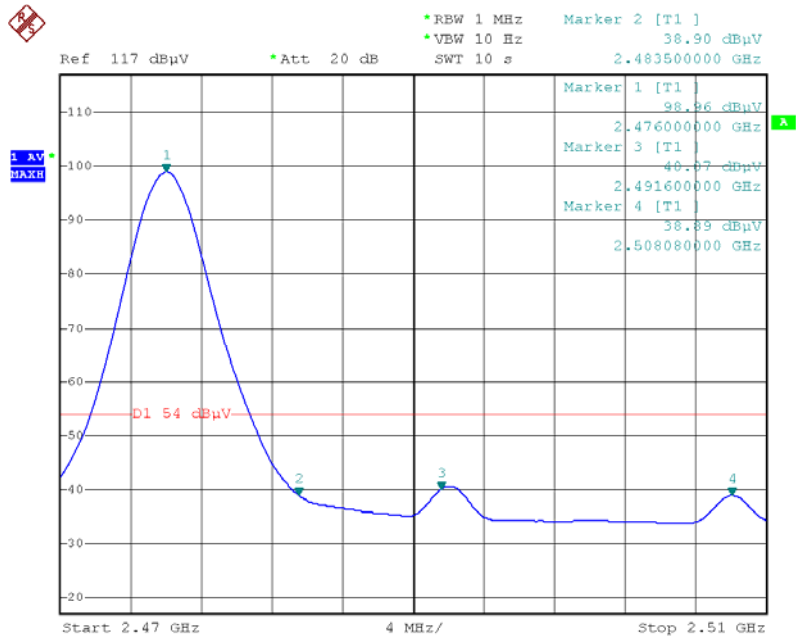
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel – Peak



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel – AV



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.



## 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:

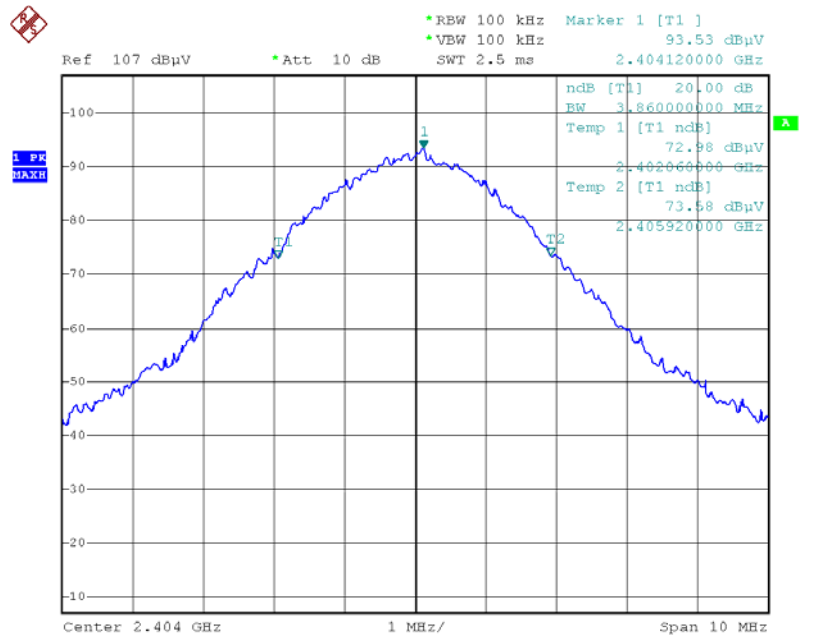
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

### 9.2 Test Result:

Test Channel	Bandwidth
Low	3.86MHz
Middle	3.86MHz
High	3.84MHz

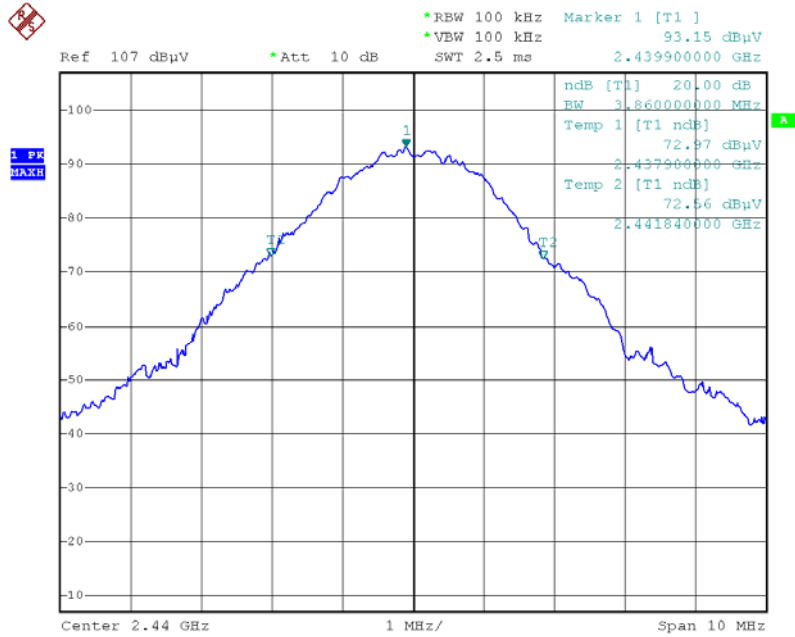
Test result plot as follows:

Low Channel

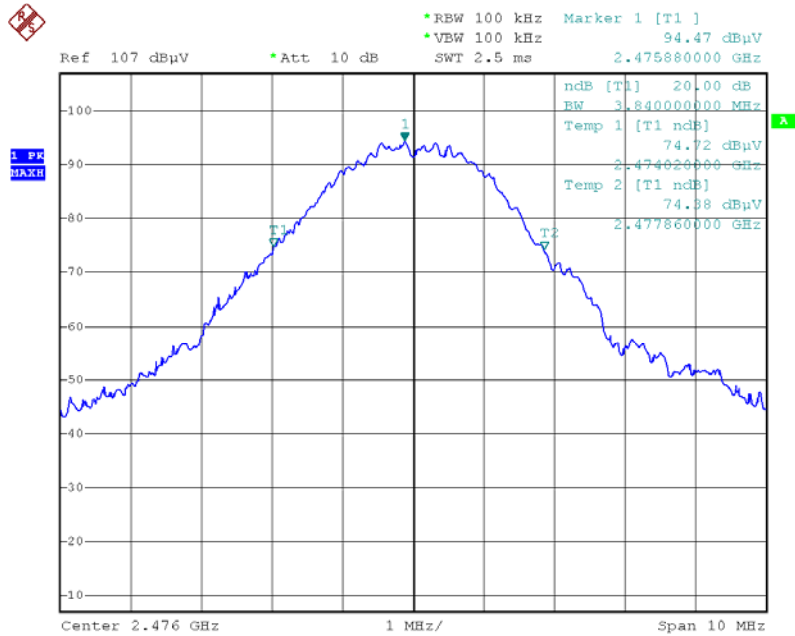


The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Middle Channel



High Channel



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

## 10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on ANSI C63.4:2003
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	-6.27	20.97
Middle	-5.78	20.97
High	-4.92	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:

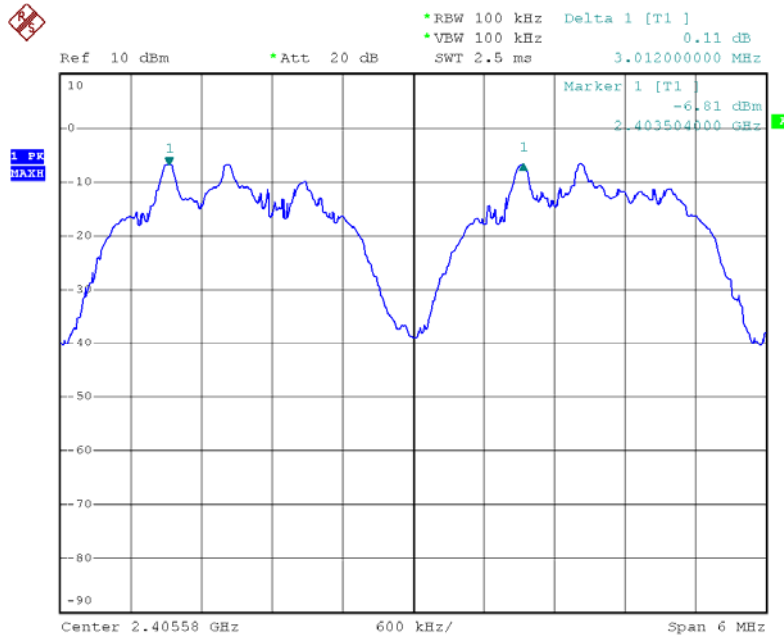
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 100kHz , Span = 6MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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:

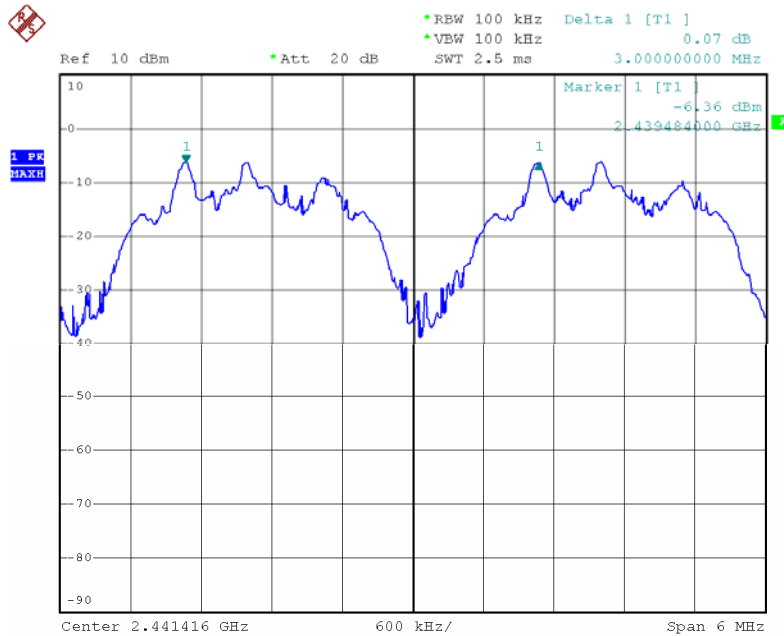
Test Channel	Separation (MHz)	Result
Low	3.012	PASS
Middle	3.000	PASS
High	3.000	PASS

Test result plot as follows:

Low Channel:

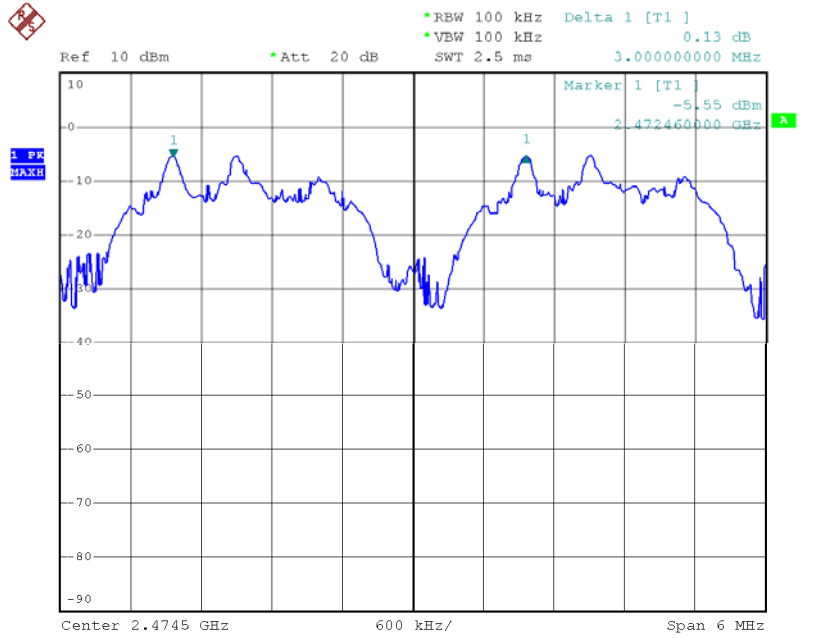


Middle Channel



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

## 12 Number of Hopping Frequency

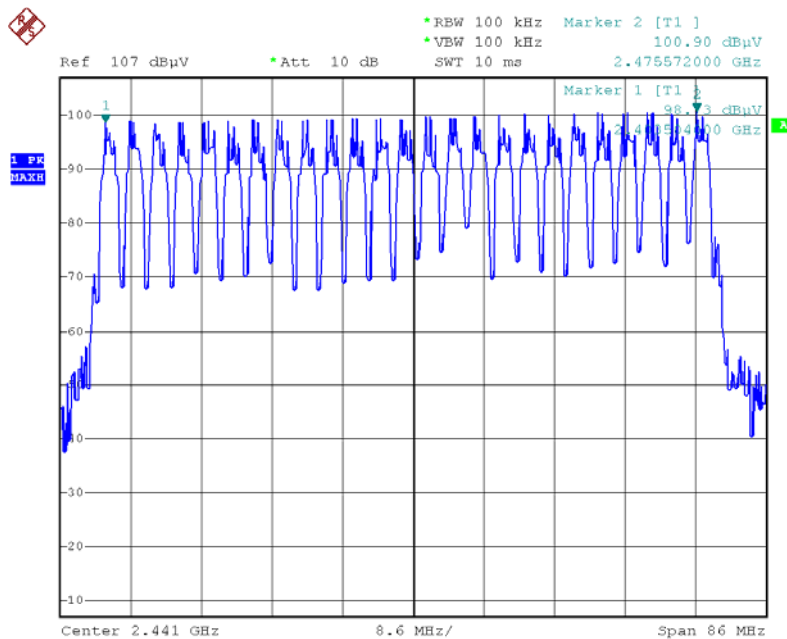
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

### 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.**



The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.

### 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 =  $10 * 10 * (MkrDelta) / 1000$

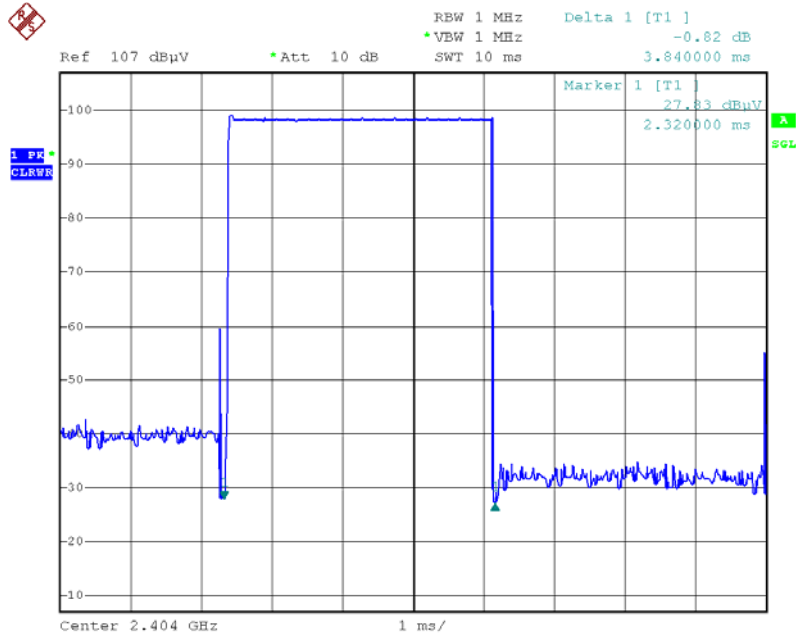
Note : Mkr Delta is once pulse time.

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

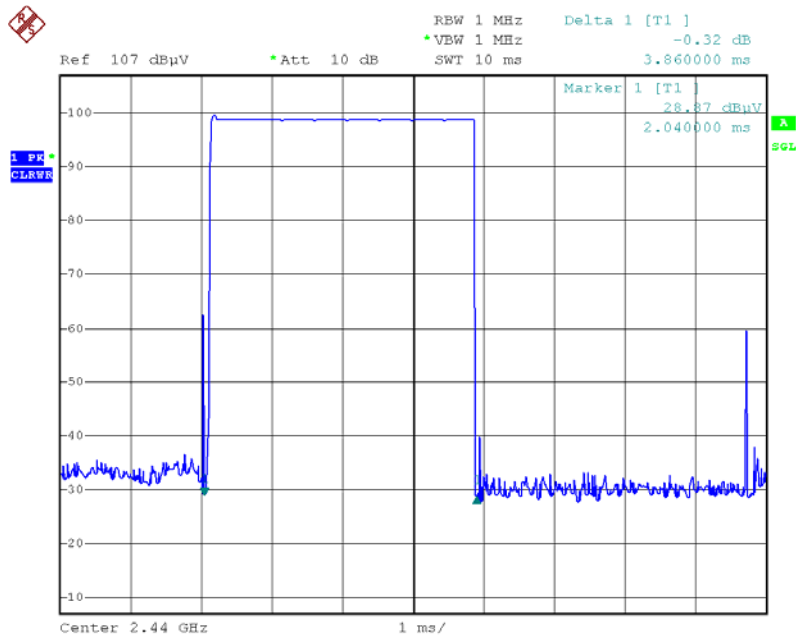
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.



### Low Channel

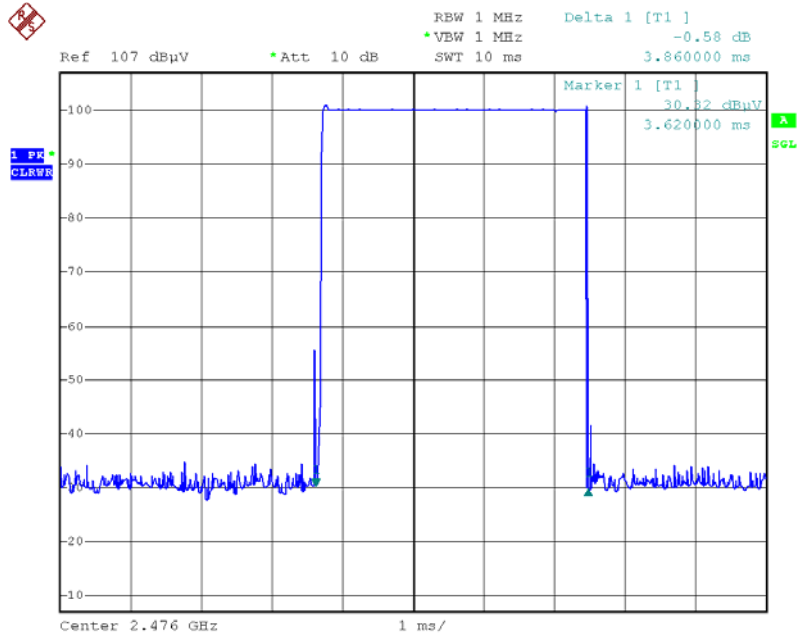


### Middle Channel



The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel



The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

## **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 Requirments:

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	-6.27	0.236	0.236
0	1	-5.78	0.264	0.264
0	1	-4.92	0.322	0.322

The EUT works on the 2.4G ISM band, and the max output power (conducted) of which is 0.322 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 Product View



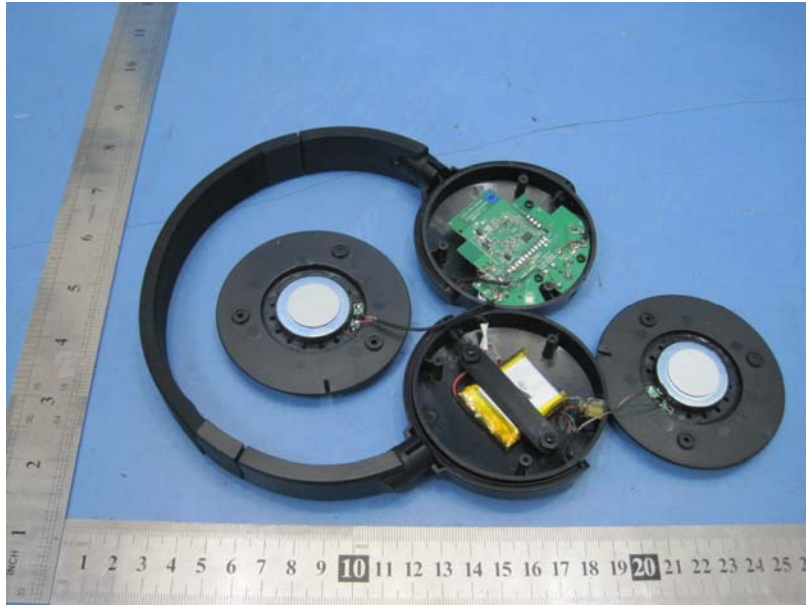
### 16.2 EUT – Appearance View



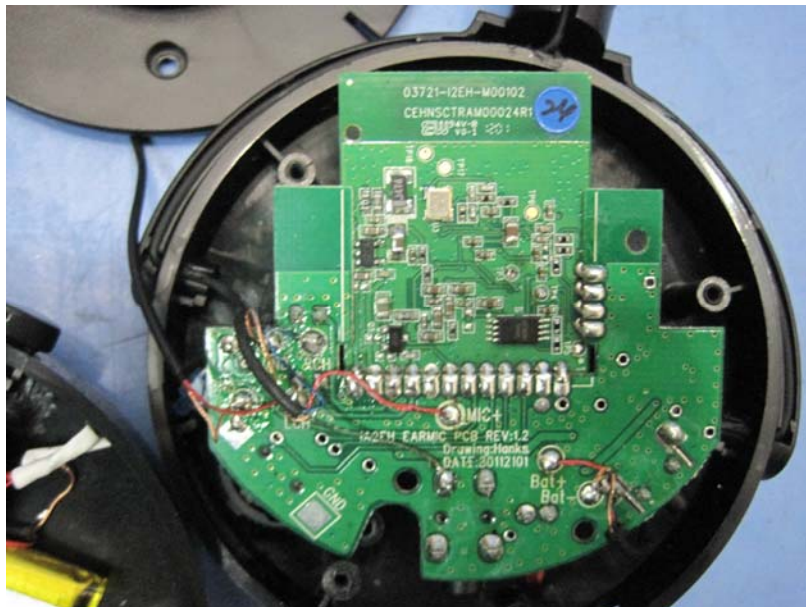


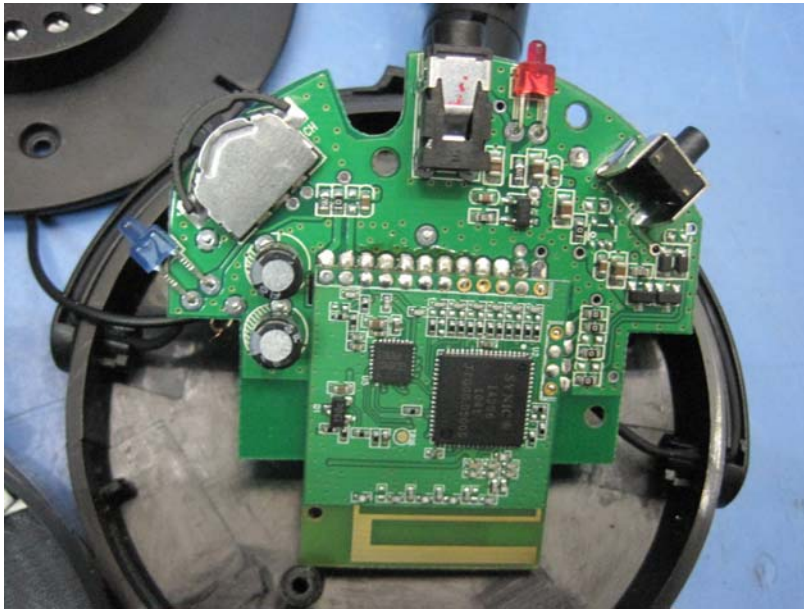
### 16.3 EUT – Open View



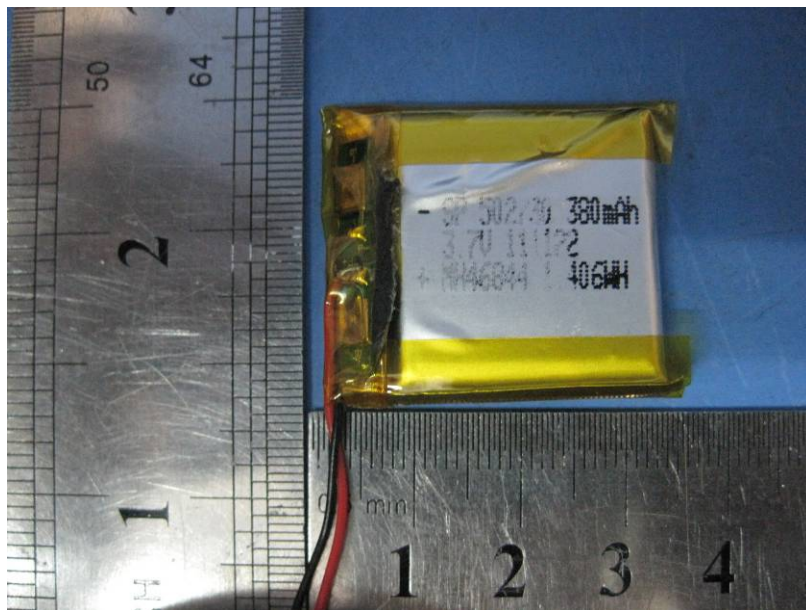


#### 16.4 EUT – PCB View





### 16.5 Battery - 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

