

TEST REPORT

Reference No. : WTS14S0918283E
FCC ID..... : 2AC9QMLNHB
Applicant..... : Axio Inc
Address : Apt #104, 22 Navy St, Venice, CA State, United State America
Manufacturer : Edu-science (H.K.) Ltd.
Address : Suite 2001-05 Delta House, 3 On Yiu Street, Shatin, N.T., Hong Kong
Product Name : Melon Headband
Model No. : MLNHB
Standards..... : FCC CFR47 Part 15 Section 15.247:2014
Date of Receipt sample..... : Sep. 12, 2014
Date of Test..... : Sep. 12, 2014 ~ Dec. 19, 2014
Date of Issue : Jan. 08, 2015
Test Result..... : **Pass**

Remarks:

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. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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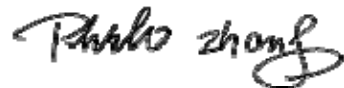
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Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Emissions	15.247 15.205(a) 15.209(a)	PASS
Conducted Emissions	15.207(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Melon Headband
Model No.	: MLNHB
Model Description	: Only the color is different.
Operation Frequency	: 2402MHz ~ 2480MHz, separated by 2MHz, 40 channels in total
The lowest oscillator	: 16MHz
Type of modulation	: GFSK(BLE only)

4.2 Details of E.U.T.

Technical Data	:: Battery DC 3.7V 110mAh
	DC 5V, 1.0A, charging by USB port or wall adaptor

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Table 1 Tests Carried Out Under FCC part 15.247

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2440MHz	2480MHz

4.5 Test Facility

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

- **IC – Registration No.: 7760A-1**

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 number 7760A-1, July 12, 2012.

- **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, April 29, 2014.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions at Mains Terminals Disturbance Voltage						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.15,2014	Sep.14,2015
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2014	Sep.14,2015
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2014	Sep.14,2015
4.	Cable	LARGE	RF300	-	Sep.15,2014	Sep.14,2015
3m Semi-anechoic Chamber for Radiation						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2014	Sep.14,2015
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2014	Sep.14,2015
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2014	Apr.18,2015
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2014	Sep.14,2015
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2014	Apr.18,2015
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	669	Apr.19,2014	Apr.18,2015
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2014	Mar.16,2015
8	Coaxial Cable (above 1GHz)	Top	1000MHz-25GHz	EW02014-7	Apr.10,2014	Apr.09,2015
9	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Sep.15,2014	Sep.14,2015
10	Universal Radio Communication Tester	R&S	CMU 200	112461	Apr.11,2014	Apr.10,2015
11	Signal Generator	R&S	SMR20	100046	Sep.15,2014	Sep.14,2015
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Aug. 15,2014	Aug.14,2015
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Aug. 15,2014	Aug.14,2015
3.	Humidity Chamber	GF	GTH-225-40-1P	IAA061213	Aug. 15,2014	Aug.14,2015

5.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
Note book	Apple	N/A	N/A

5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

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/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

6.1 E.U.T. Operation

Operating Environment :

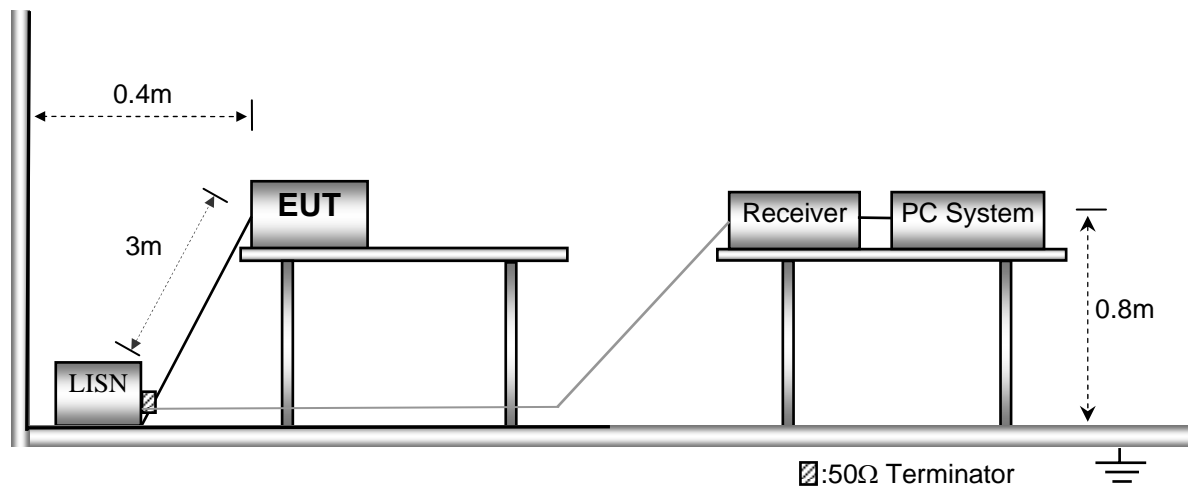
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

The test was performed in transmitting mode(BT BLE).

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



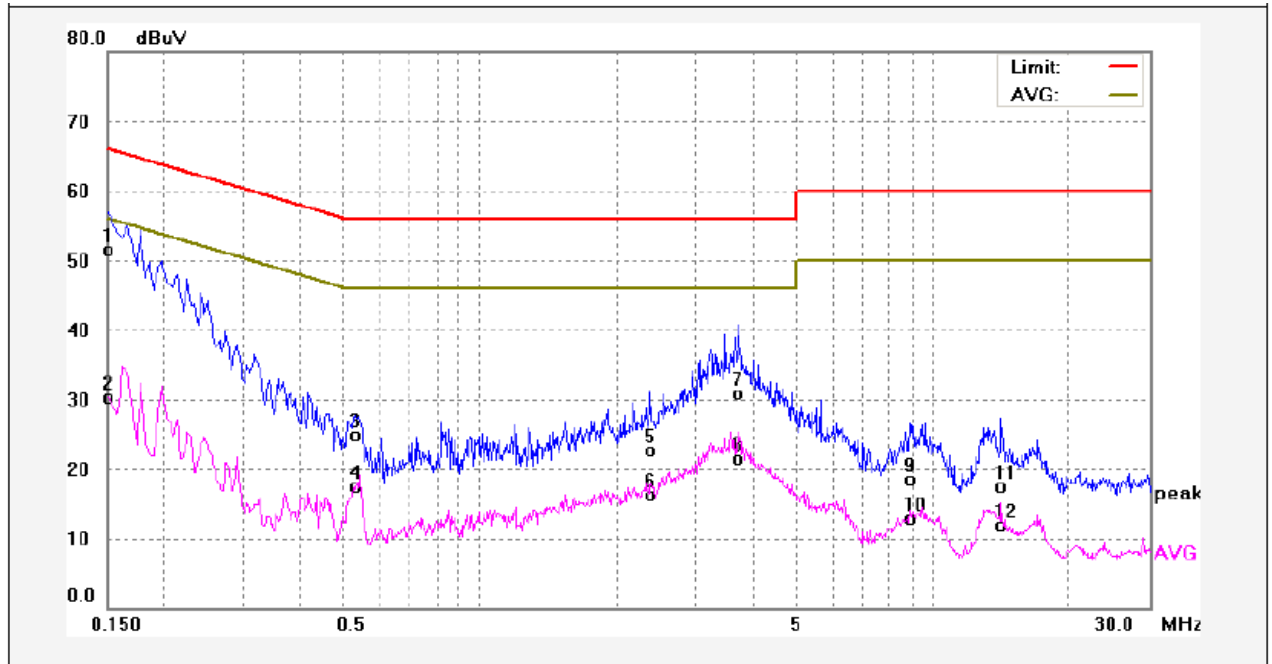
6.3 Measurement Description

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.

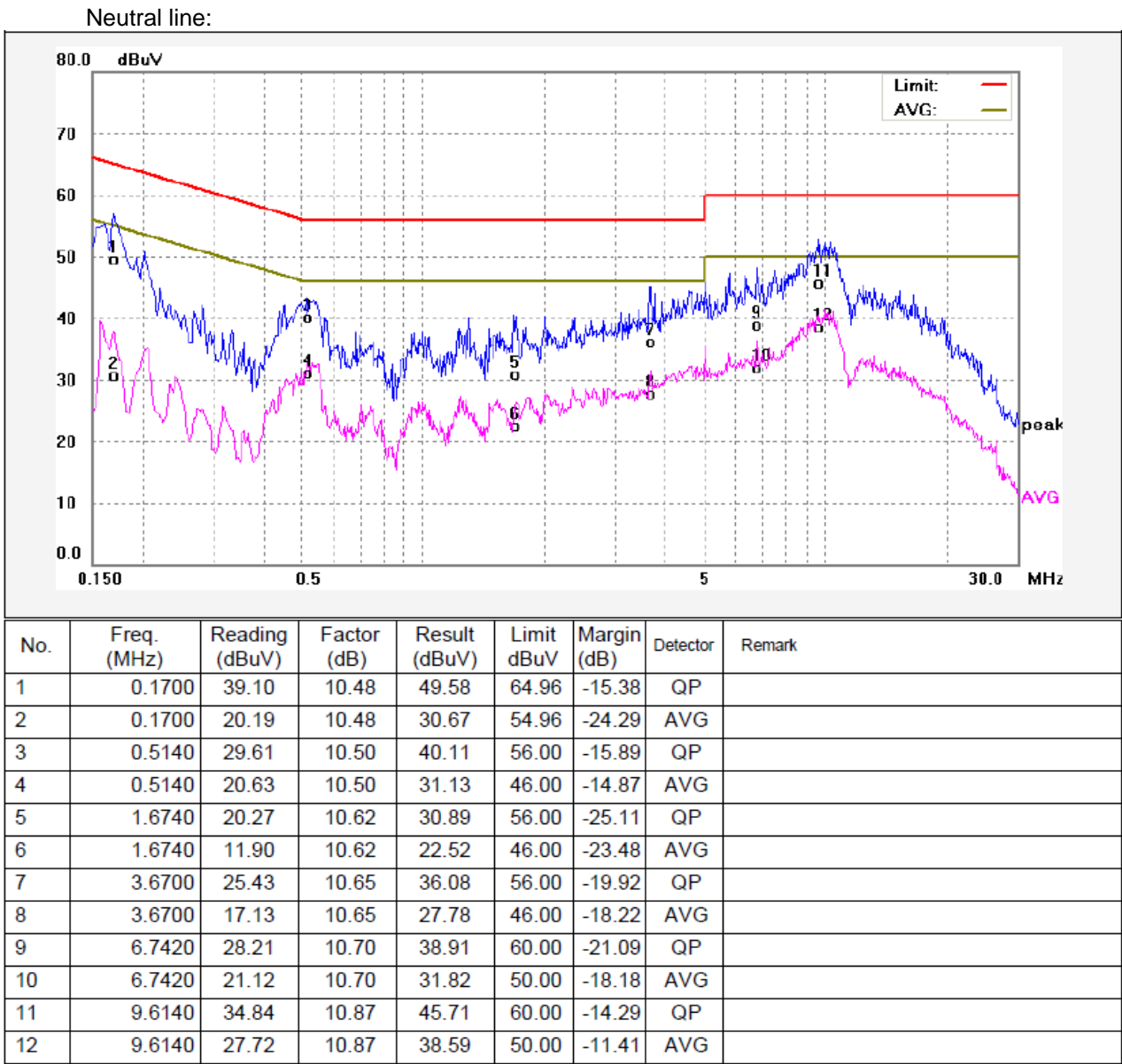
6.4 Conducted Emission Test Result

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

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	41.01	10.48	51.49	65.99	-14.50	QP	
2	0.1500	19.86	10.48	30.34	55.99	-25.65	AVG	
3	0.5299	14.42	10.50	24.92	56.00	-31.08	QP	
4	0.5299	6.94	10.50	17.44	46.00	-28.56	AVG	
5	2.3740	12.06	10.63	22.69	56.00	-33.31	QP	
6	2.3740	5.60	10.63	16.23	46.00	-29.77	AVG	
7	3.7180	20.27	10.65	30.92	56.00	-25.08	QP	
8	3.7180	10.78	10.65	21.43	46.00	-24.57	AVG	
9	8.8940	7.76	10.82	18.58	60.00	-41.42	QP	
10	8.8940	2.05	10.82	12.87	50.00	-37.13	AVG	
11	14.0740	6.36	11.14	17.50	60.00	-42.50	QP	
12	14.0740	0.77	11.14	11.91	50.00	-38.09	AVG	



7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.4:2003

Test Result: PASS

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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

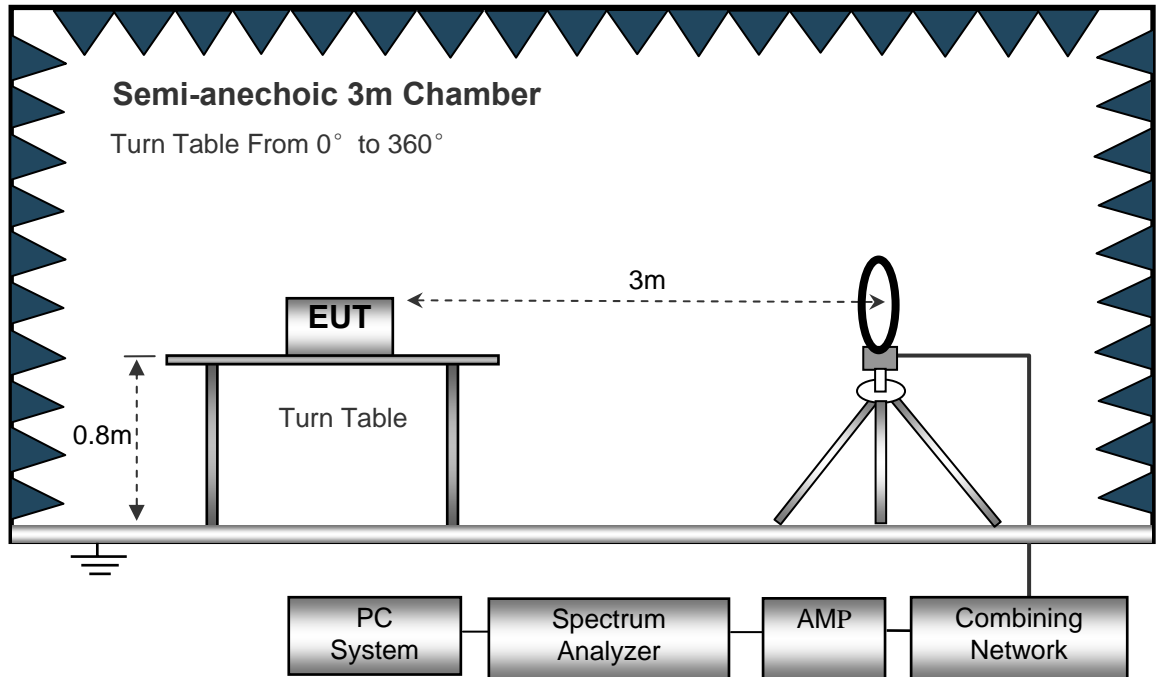
EUT Operation :

The test was performed in transmitting mode.

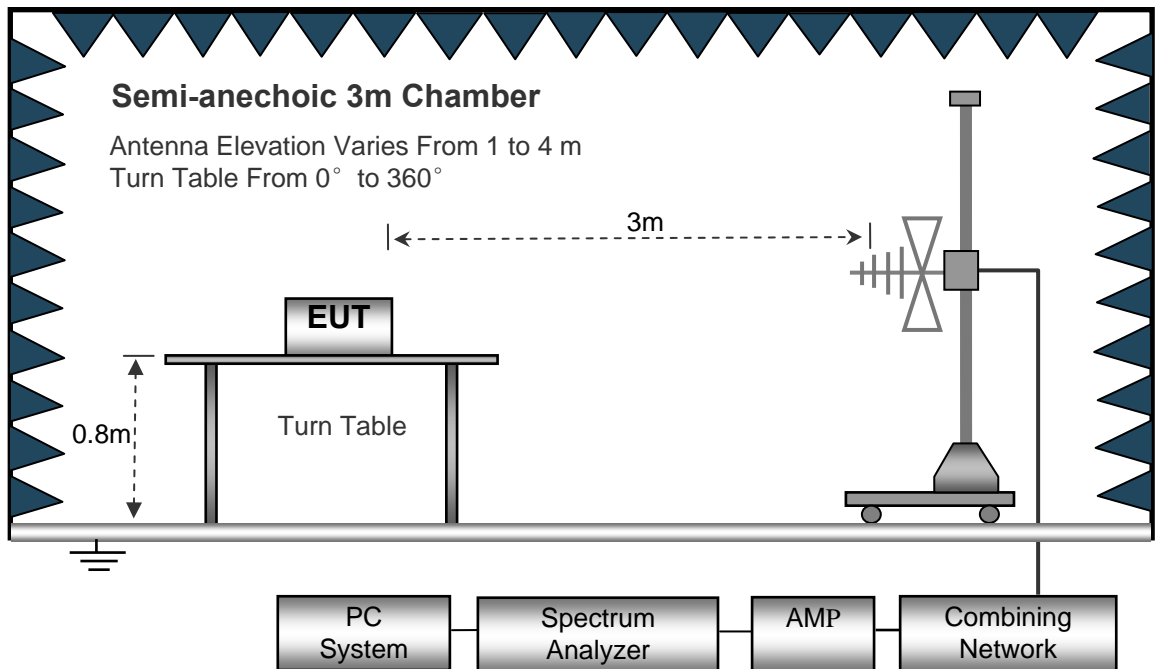
7.2 Test Setup

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

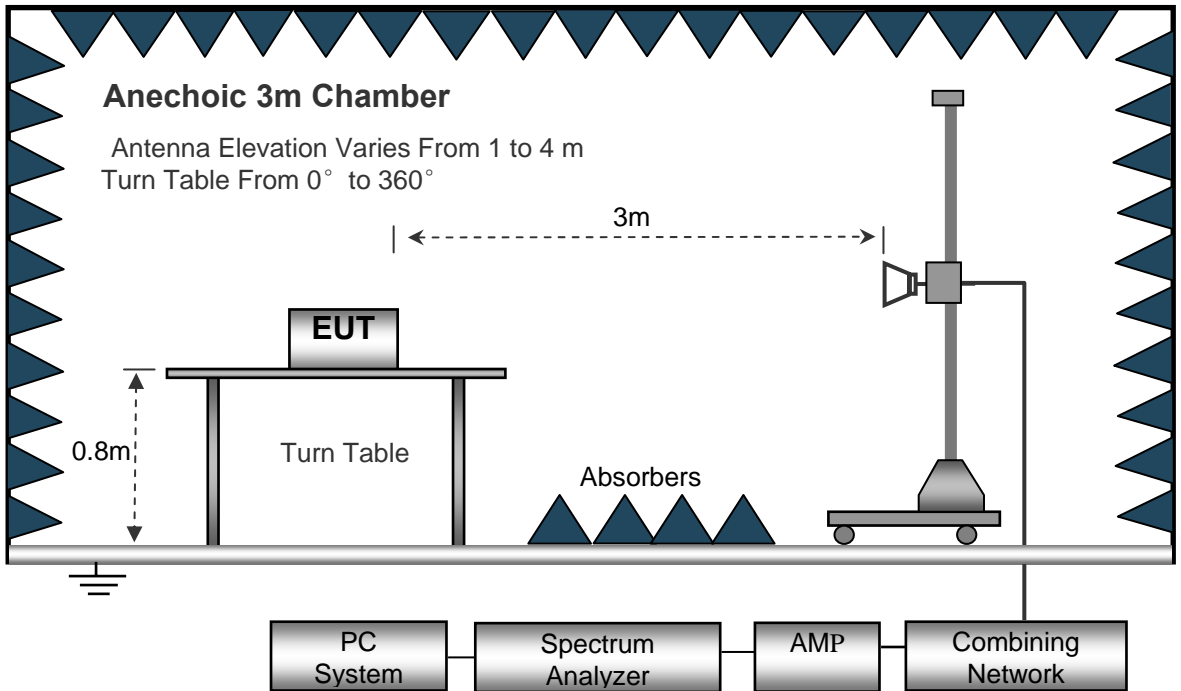
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
IF Bandwidth.....10kHz
Video Bandwidth.....10kHz
Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep Speed Auto
DetectorPK
Resolution Bandwidth.....100kHz
Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed Auto
DetectorPK
Resolution Bandwidth.....1MHz
Video Bandwidth.....3MHz
DetectorAve.
Resolution Bandwidth.....1MHz
Video Bandwidth.....10Hz

7.4 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,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high -pass filter is used during radiated emissions above 1GHz measurement.

7.5 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:

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

7.6 Summary of Test Results

Test Frequency : 16MHz ~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
169.67	22.51	QP	223	1.2	H	11.13	33.64	43.50	-9.86
169.67	21.12	QP	114	1.4	V	11.13	32.25	43.50	-11.25
4804.00	52.98	PK	81	1.2	V	-1.06	51.92	74.00	-22.08
4804.00	43.63	Ave	81	1.2	V	-1.06	42.57	54.00	-11.43
7206.00	42.04	PK	242	1.8	H	1.33	43.37	74.00	-30.63
7206.00	37.28	Ave	242	1.8	H	1.33	38.61	54.00	-15.39
2311.11	46.76	PK	119	1.8	V	-13.19	33.57	74.00	-40.43
2311.11	37.74	Ave	119	1.8	V	-13.19	24.55	54.00	-29.45
2376.44	43.37	PK	270	1.6	H	-13.14	30.23	74.00	-43.77
2376.44	36.32	Ave	270	1.6	H	-13.14	23.18	54.00	-30.82
2494.29	43.47	PK	343	1.2	V	-13.08	30.39	74.00	-43.61
2494.29	38.56	Ave	343	1.2	V	-13.08	25.48	54.00	-28.52

Frequency	Receiver Reading	Detector	Turntable Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2440MHz									
169.67	22.82	QP	111	1.8	H	11.13	33.95	43.50	-9.55
169.67	21.94	QP	197	1.6	V	11.13	33.07	43.50	-10.43
4880.00	53.80	PK	272	1.0	V	-0.62	53.18	74.00	-20.82
4880.00	44.30	Ave	272	1.0	V	-0.62	43.68	54.00	-10.32
7320.00	42.21	PK	85	1.9	H	2.21	44.42	74.00	-29.58
7320.00	37.23	Ave	85	1.9	H	2.21	39.44	54.00	-14.56
2316.94	46.60	PK	39	1.7	V	-13.19	33.41	74.00	-40.59
2316.94	39.10	Ave	39	1.7	V	-13.19	25.91	54.00	-28.09
2362.93	43.93	PK	45	1.4	H	-13.14	30.79	74.00	-43.21
2362.93	36.69	Ave	45	1.4	H	-13.14	23.55	54.00	-30.45
2498.04	42.85	PK	228	1.2	V	-13.08	29.77	74.00	-44.23
2498.04	36.22	Ave	228	1.2	V	-13.08	23.14	54.00	-30.86

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
169.67	22.31	QP	157	1.3	H	11.13	33.44	43.50	-10.06
169.67	20.40	QP	190	1.0	V	11.13	31.53	43.50	-11.97
4960.00	53.64	PK	110	1.8	V	-0.24	53.40	74.00	-20.60
4960.00	43.55	Ave	110	1.8	V	-0.24	43.31	54.00	-10.69
7440.00	41.76	PK	230	1.6	H	2.84	44.60	74.00	-29.40
7440.00	36.58	Ave	230	1.6	H	2.84	39.42	54.00	-14.58
2343.72	46.29	PK	251	1.6	V	-13.19	33.10	74.00	-40.90
2343.72	38.07	Ave	251	1.6	V	-13.19	24.88	54.00	-29.12
2358.08	44.95	PK	143	1.0	H	-13.14	31.81	74.00	-42.19
2358.08	36.79	Ave	143	1.0	H	-13.14	23.65	54.00	-30.35
2498.11	42.05	PK	272	1.3	V	-13.08	28.97	74.00	-45.03
2498.11	38.54	Ave	272	1.3	V	-13.08	25.46	54.00	-28.54

Test Frequency: 18GHz~25GHz

The measurements were more than 20 dB below the limit and not reported.

8 Band Edge Measurement

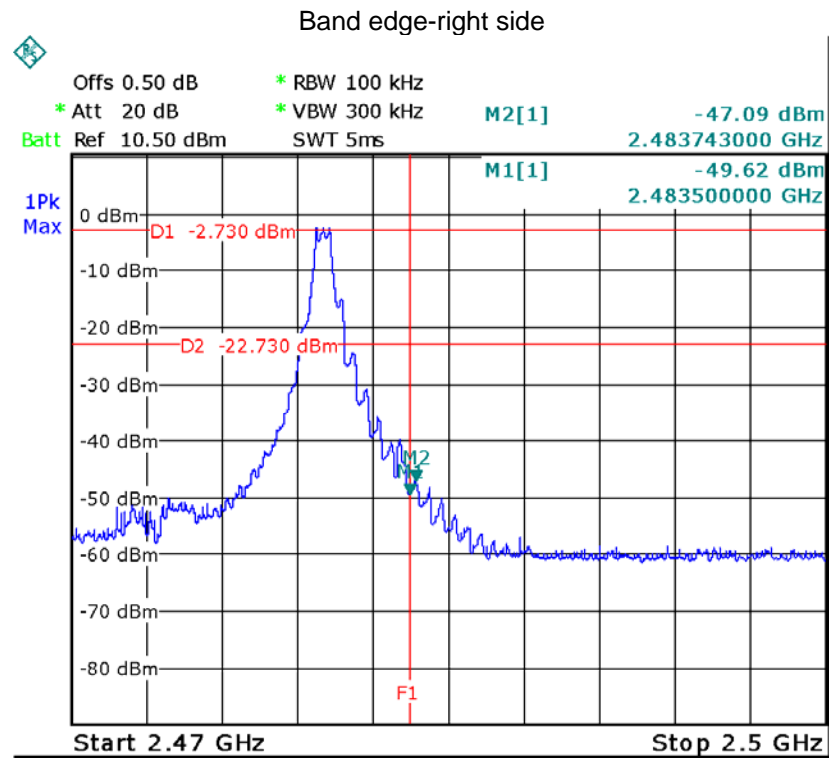
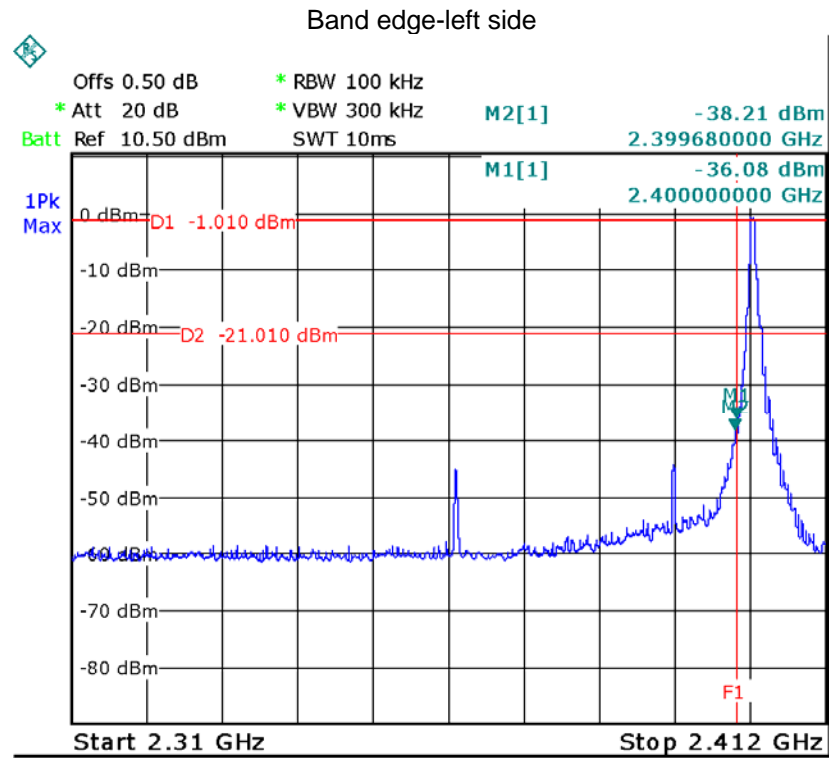
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	KDB 558074 D01 v03r02 06/05/2014
Test Mode:	Transmitting

8.1 Test Produce

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

8.2 Test Result

Test result plots shown as follows:



9 6 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 v03r02 06/05/2014

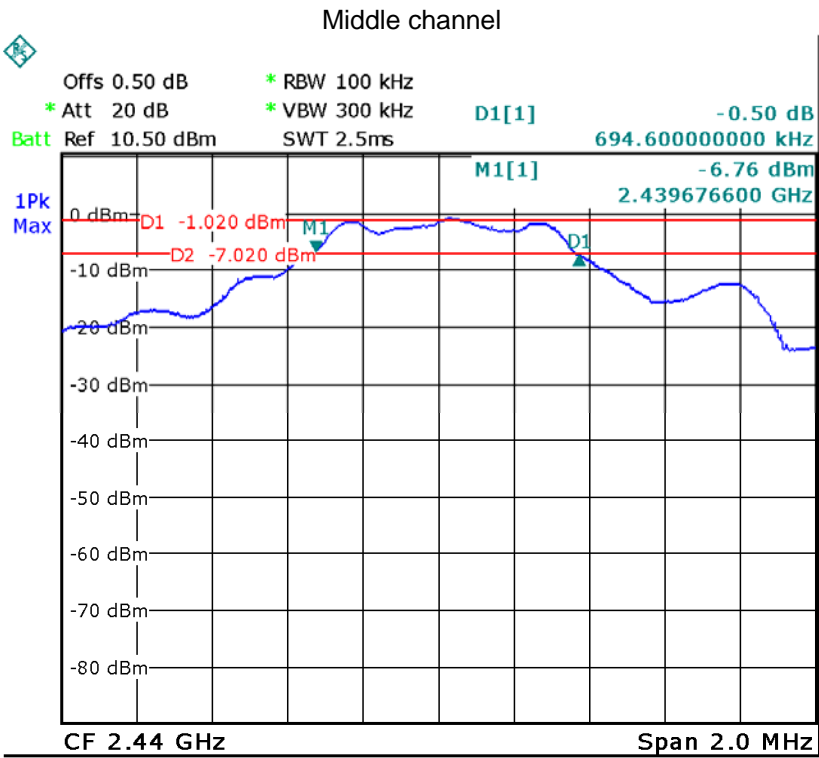
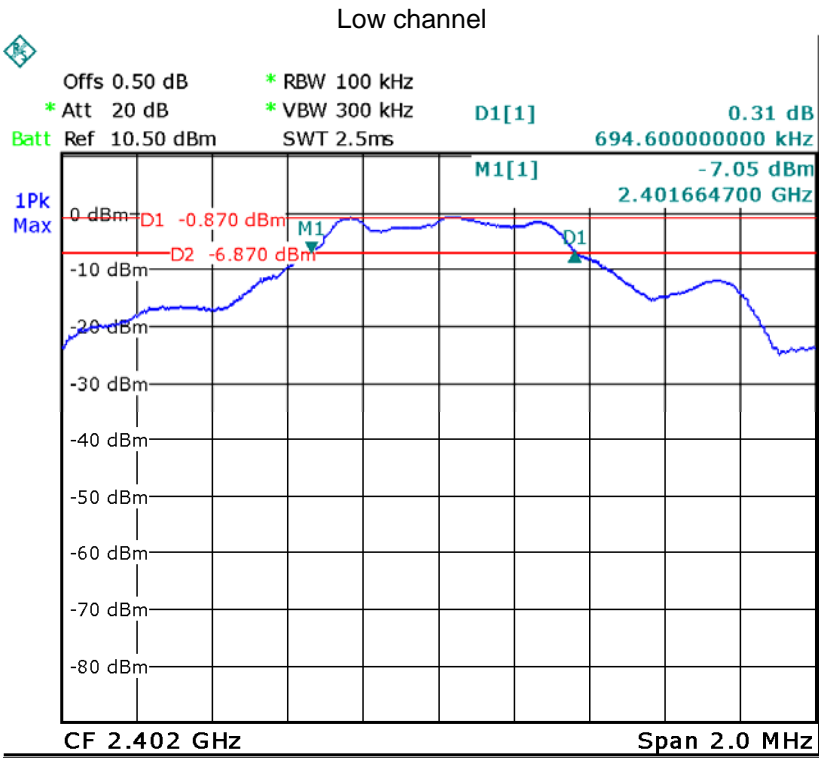
9.1 Test Procedure:

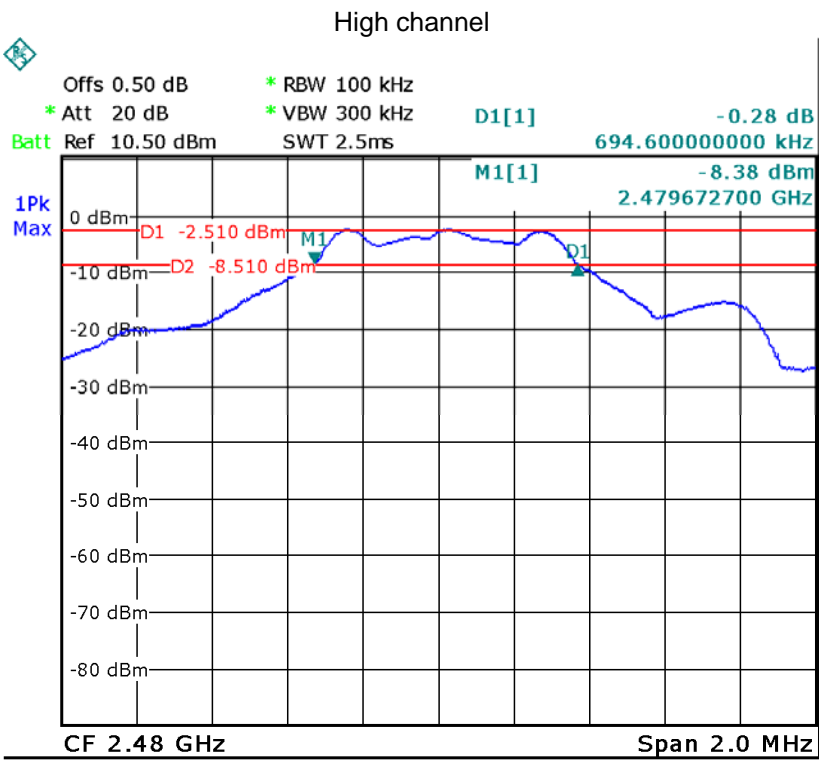
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

9.2 Test Result:

Operation Channel	Bandwidth (MHz)
Low channel	0.694
Middle channel	0.694
High channel	0.694

Test result plot as follows:





10 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

KDB 558074 D01 v03r02 06/05/2014

10.1 Test Procedure:

KDB 558074 D01 v03r02 06/05/2014

section 9.1.1

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- a) Set the $RBW \geq DTS$ bandwidth.
- b) Set $VBW \geq 3 \times RBW$.
- c) Set $span \geq 3 \times RBW$.
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

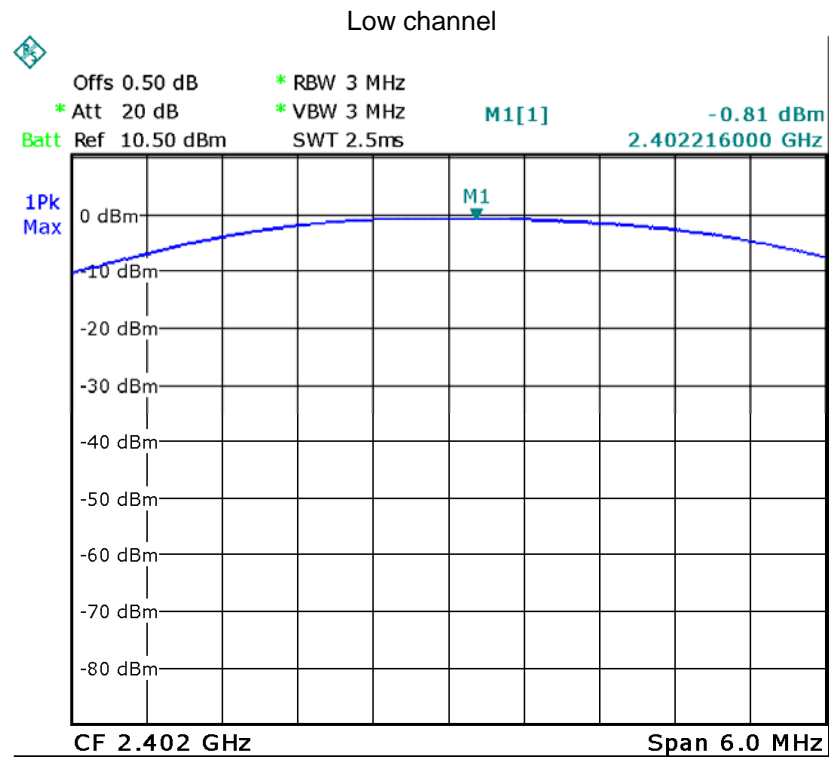
section 9.1.2

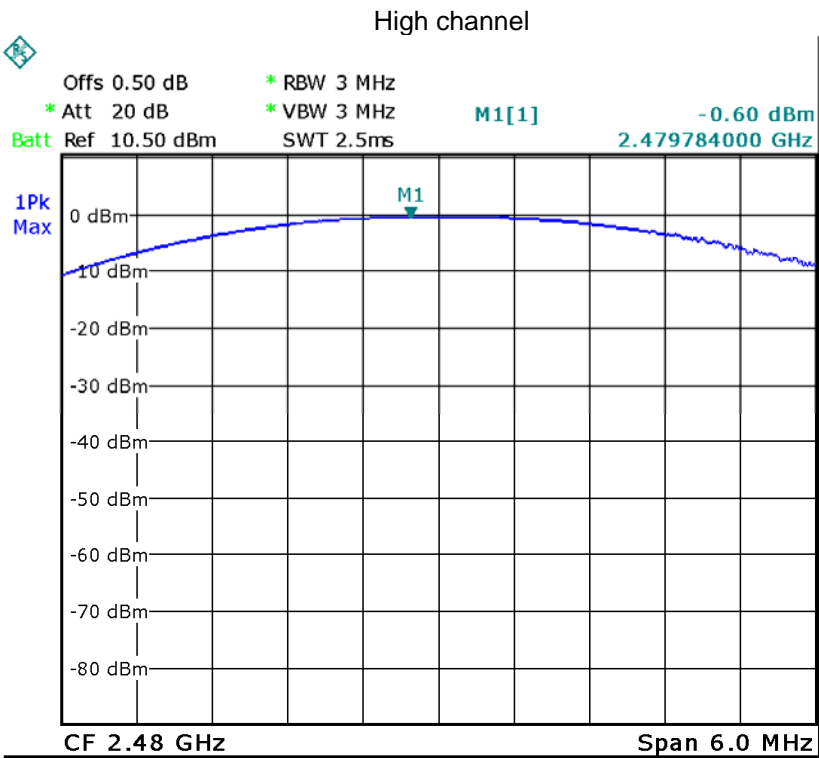
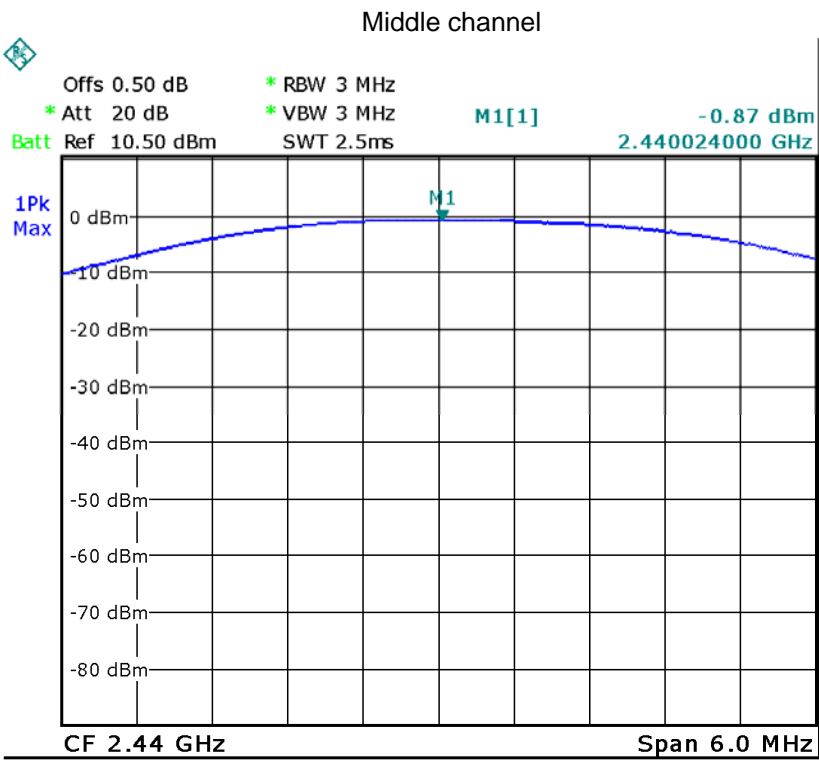
This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

- a) Set the $RBW = 1 \text{ MHz}$.
- b) Set the $VBW \geq 3 \times RBW$.
- c) Set the $span \geq 1.5 \times DTS$ bandwidth.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

10.2 Test Result:

Maximum Peak Output Power (dBm)		
Low channel	Middle channel	High channel
-0.81	-0.87	-0.60
Limit		
1W/30dBm		





11 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: KDB 558074 D01 v03r02 06/05/2014

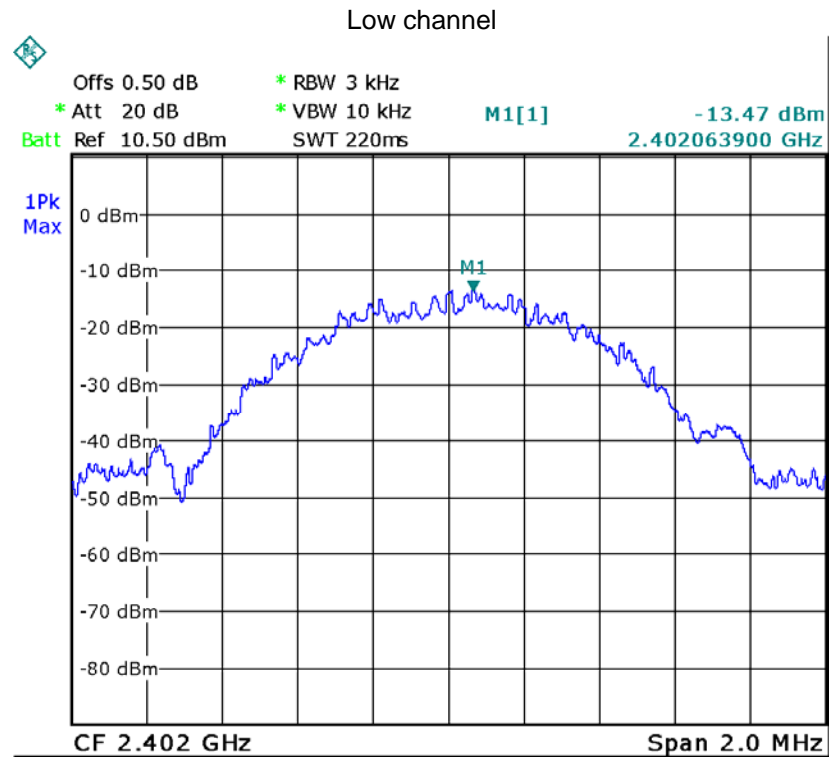
11.1 Test Procedure:

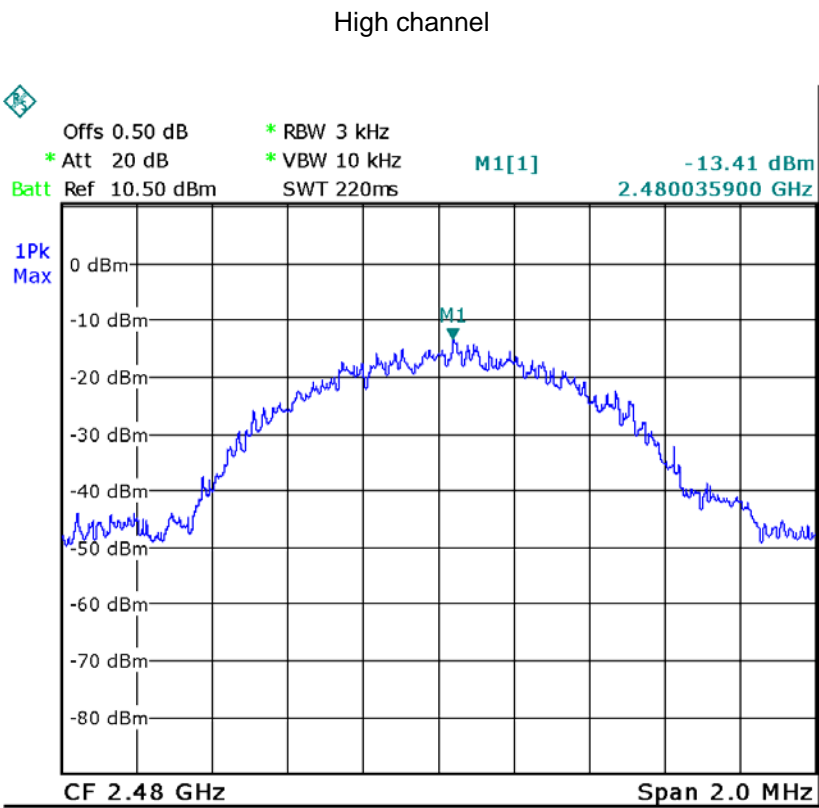
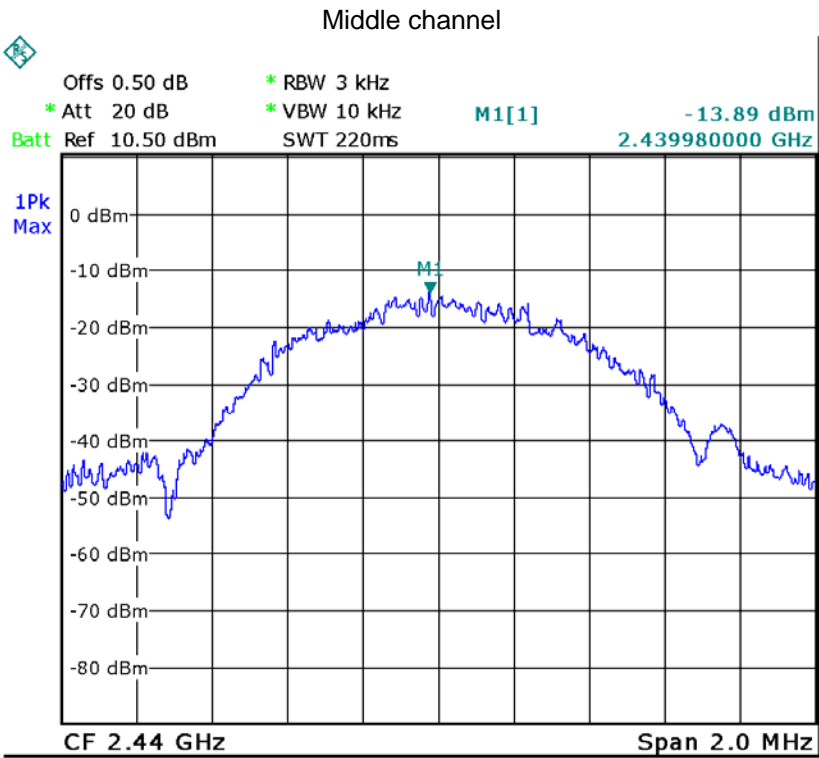
KDB 558074 D01 v03r02 06/05/2014 section 10.2

- 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 = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). 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:

Power Spectral Density		
Low channel	Middle channel	High channel
-13.47	-13.89	-13.41
Limit		
8dBm per 3kHz		





12 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. This product has an integrated antenna which meet the requirement of this section.

13 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method KDB 447498 D01 v05r02 General RF Exposure Guidance v05

13.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR where}$$

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

13.2 The procedures / limit

Conducted Peak power(dBm)	Conducted Peak power(mW)	Source-based time-averaged maximum conducted output power(mW)	Minimum test separation distance required for the exposure conditions (mm)	SAR Test Exclusion Thresholds(mW)
-0.60	0.871	0.871	5	10

Remark: Max. duty factor is 100%

Calculation formula: Source-based time-averaged maximum conducted output power(mW) =Conducted peak power(mW)*Duty factor

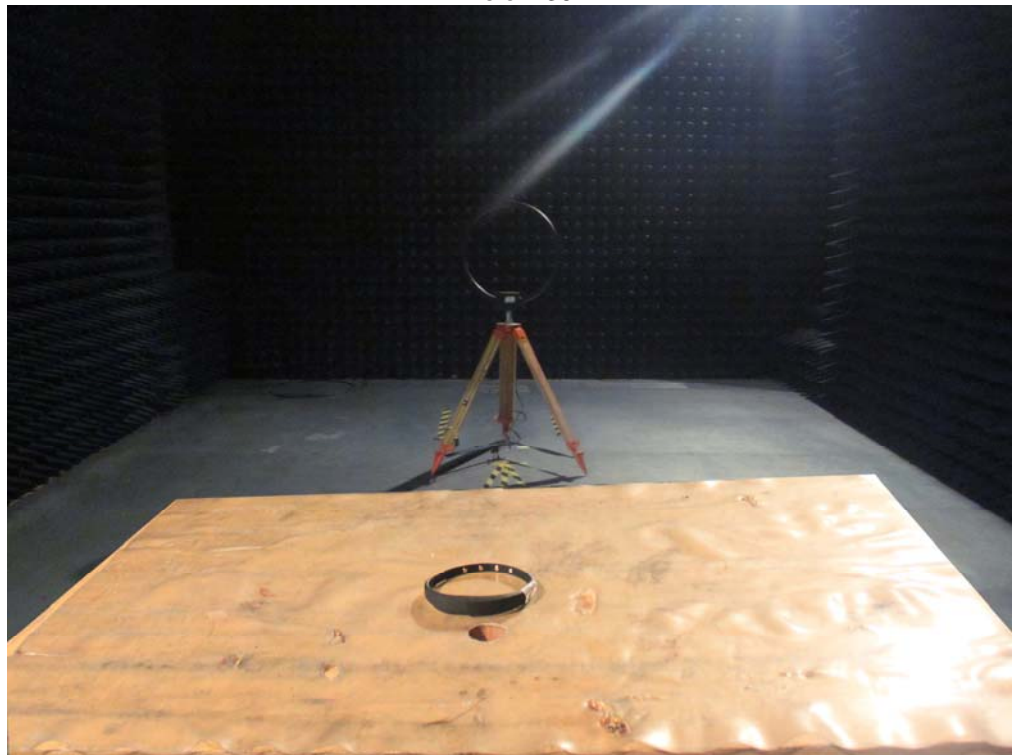
14 Photographs –Model MLNHB Test Setup

14.1 Photograph – Conducted Emission Test Setup

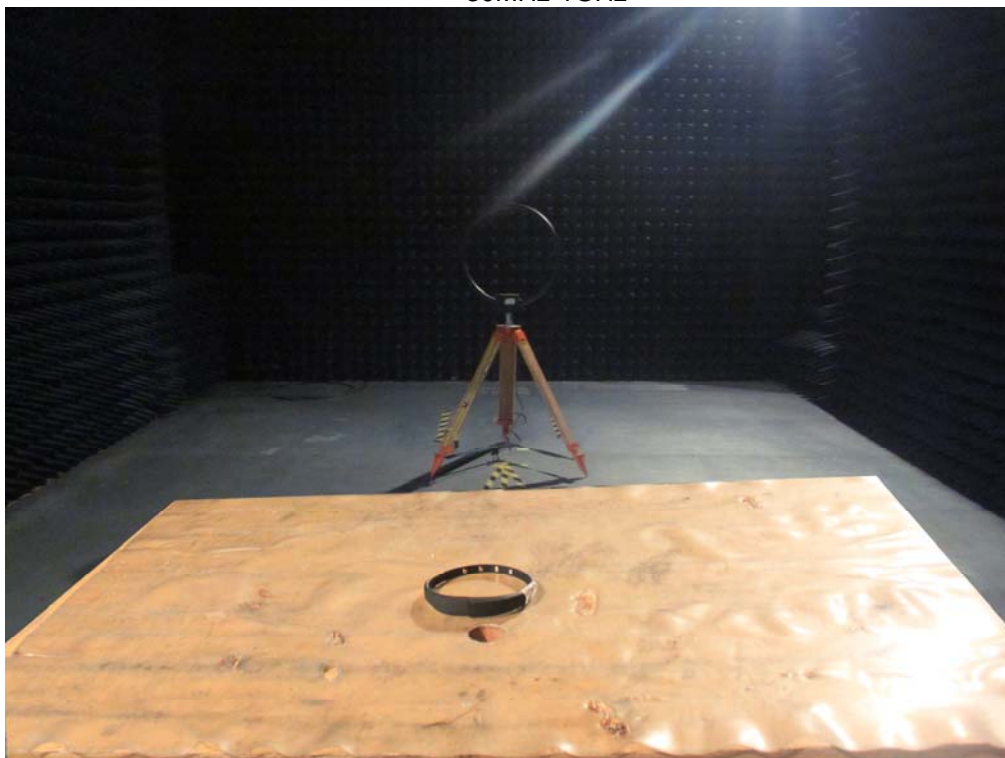


14.2 Photograph – Radiation Spurious Emission Test Setup

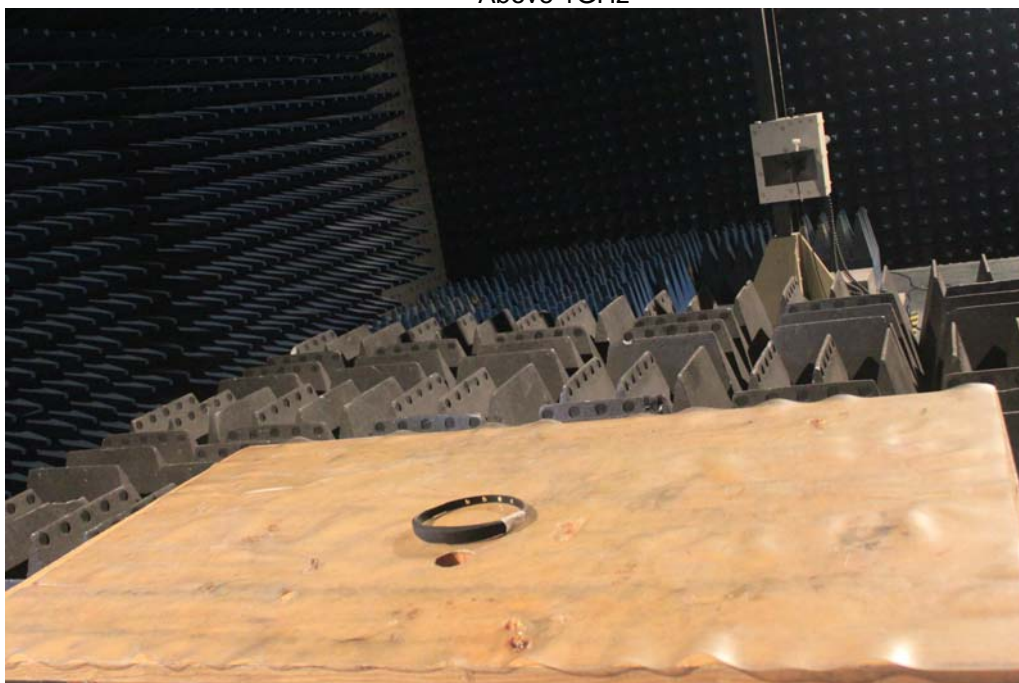
Below 30MHz



30MHz-1GHz

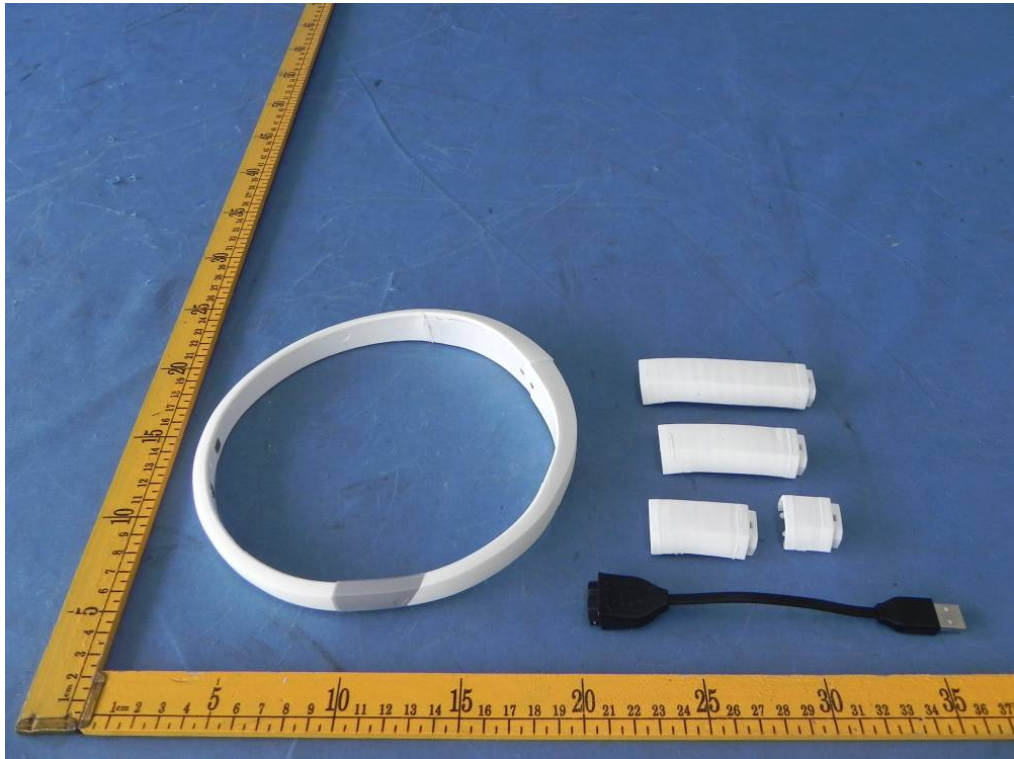


Above 1GHz



15 Photographs - Constructional Details

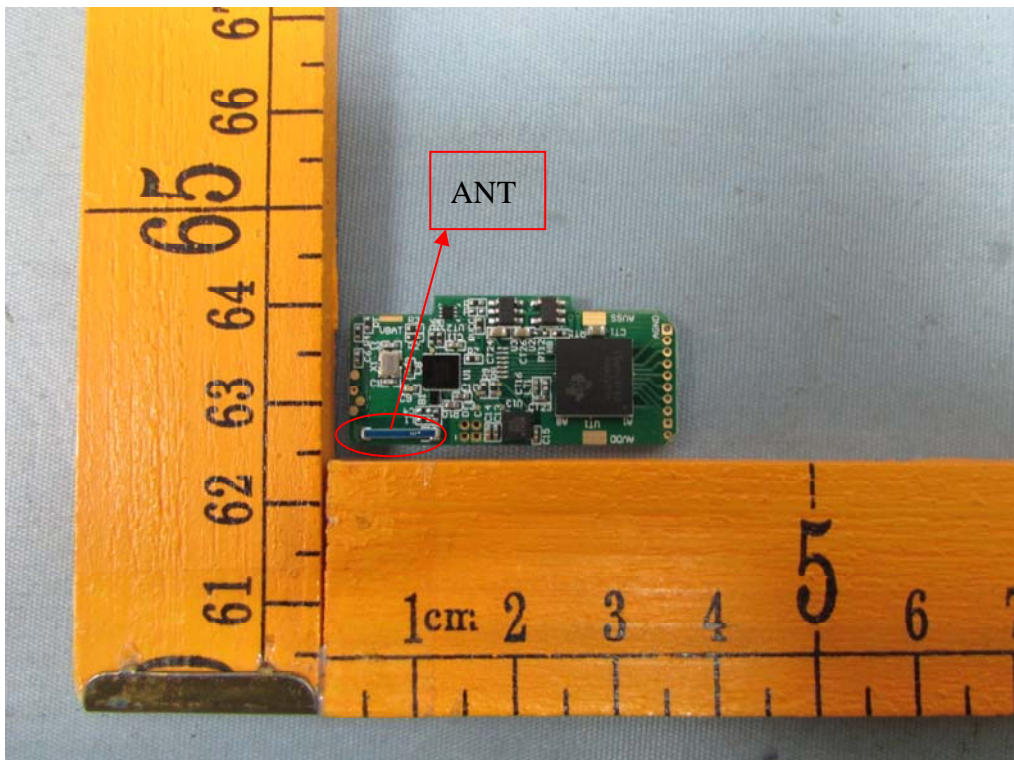
15.1 Model MLNHB External View

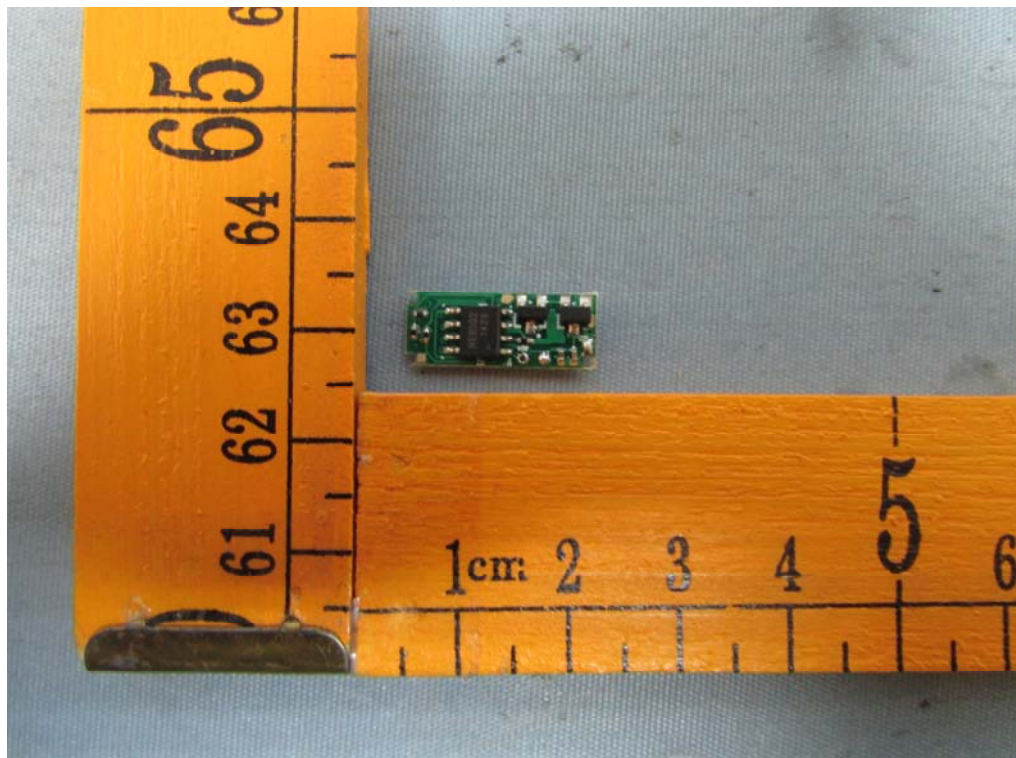
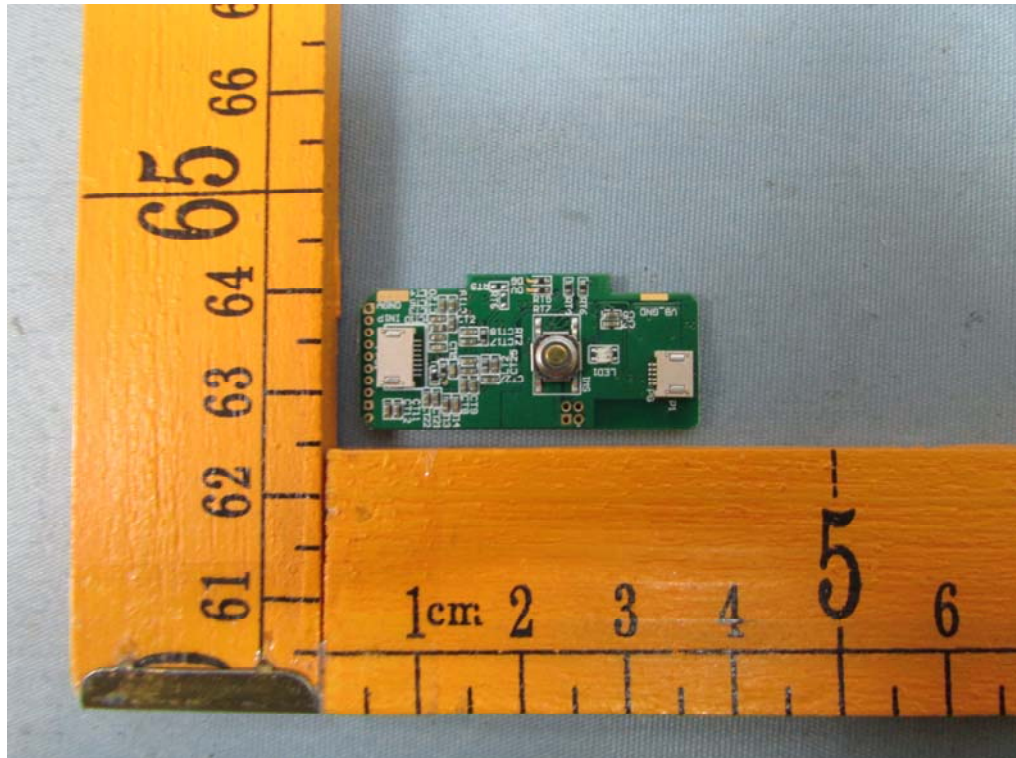


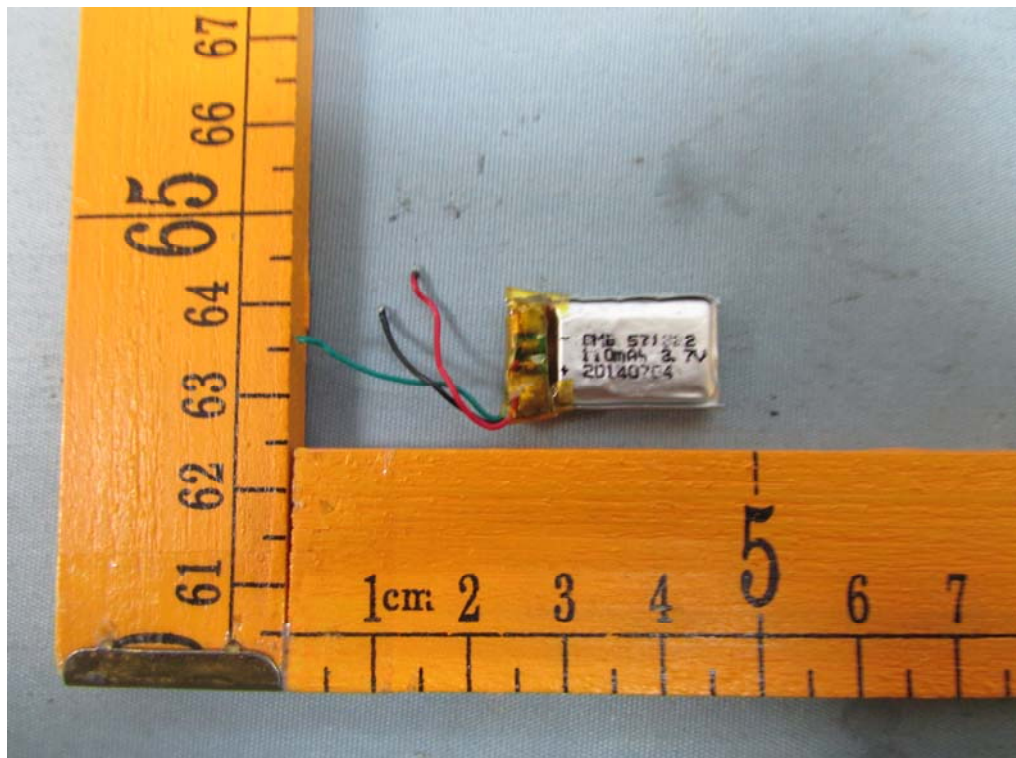
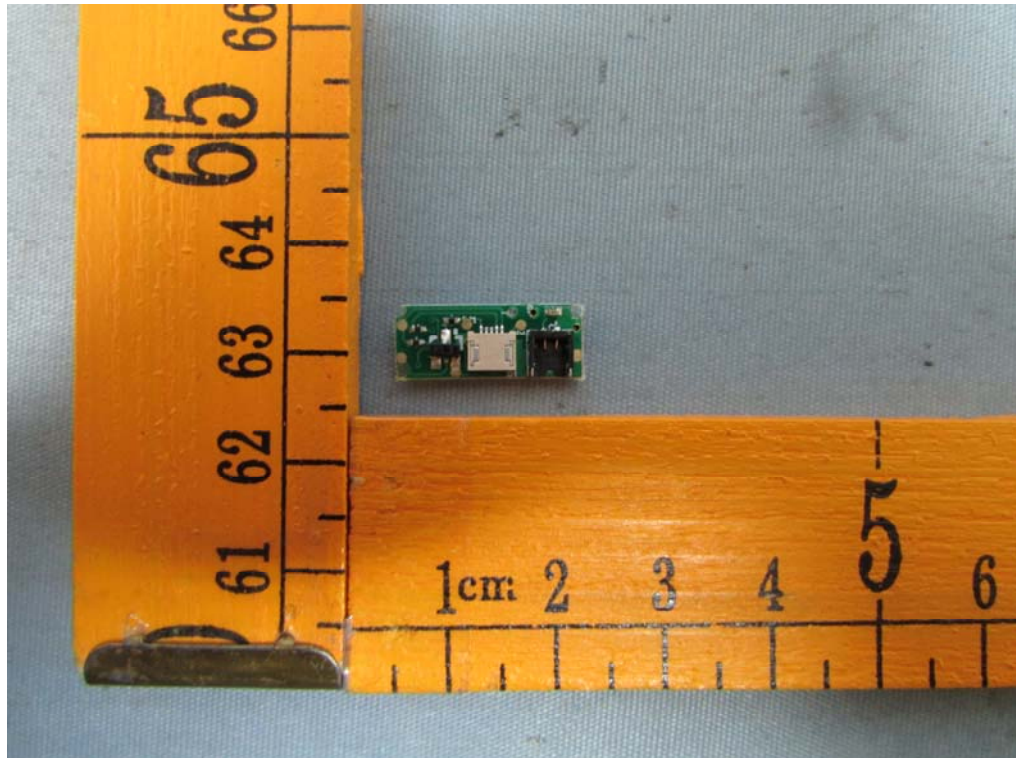




15.2 Model MLNHB Internal View







===== End of Report =====