TEST REPORT

FCC ID	: PB4-MT550
Applicant	: Imation Corp.
Address	: 1 Imation Way, Oakdale, MN 55128-3421 USA.
Manufacturer	: Imation Corp.
Address	: 1 Imation Way, Oakdale, MN 55128-3421 USA.

Equipment Under Test (EUT) :

Product Name	: Portable Wireless Speaker
Model No.	: MW550,TW550
Brand	: memorex is the brand for MW550, TDK Life on Record is the brand for TW550
Rules	: FCC CFR47 Part15 Section 15.247:2010
Date of Test	: July 22~31, 2012
Date of Issue	: July 31, 2012
Test Result	**: PASS***

Remark:

* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

PERPARED BY:
Waltek Services (Shenzhen) Co., Ltd.
1/F, Fukangtai Building, West of Baima Road., Songgang Street, Bao'an District,
Shenzhen, China
Tel: +86-755-83551033 Fax: +86-755-83552400

Compiled by:

Zero Zhou / Project Engineer

Approved by:

Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	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
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	: Portable Wireless Speaker
Model No.	: MW550,TW550
Model Description	: Only the model name is different.
Type of Modulation	: GFSK,Pi/4DQPSK,8DQPSK
Note	: All the modulation modes were tested, all the test data deeply conform to the standard and the data of the worst mode (GFSK) were recorded in the following pages. That all modulation methods do not exceed the above mentioned limits.
Frequency Range	: 2402-2480MHz, 79Channels in total
Oscillator	: 26 MHz
Antenna Gain	: 0dBi
Antenna installation	: PCB Printed Antenna
Antenna Power	: 2.14 mW
PCB Type	: E09-00946-01
Software Version	: V2.1

4.2 Details of E.U.T.

Technical Data	: DC 5V 2A powered by adapter (input:AC100-240V 50/60Hz) or 4*1.5V"AA"size batteries
Adapter manufacturer	: Imation Corp
M/N	: Y12FE-050-2000U

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 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, July 10, 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, May 26, 2011.

4.5 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

4.6 General condition

Ambient Condition: 25.5 ℃ 51 %RH

4.6.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	DC 5V
Rated voltage	New Batteries DC 6V

4.6.2 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.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	2402MHz	2441MHz	2480MHz
Receiving	2402MHz	2441MHz	2480MHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	101178	Aug. 13,2011	Aug. 13,2012
2.	LISN	R&S	ENV216	101215	Aug. 13,2011	Aug. 13,2012
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	2230300	Aug.14,2011	Aug. 14,2012
4.	Switch	---	RSU/M2	---	Aug. 14,2011	Aug. 14,2012
3m Semi-anechoic Chamber for Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2011	Aug.13,2012
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2011	Aug. 13,2012
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Aug. 13,2011	Aug. 13,2012
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2011	Aug. 13,2012
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2011	Aug. 13,2012
6.	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-254	Aug. 13,2011	Aug. 13,2012
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2011	Aug.13,2012
8.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug.14,2011	Aug. 14,2012
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 14,2011	Aug. 14,2012
10.	Positioning Controller	C&C LAB	CC-C-IF	-	Aug. 14,2011	Aug.14,2012
11.	Color Monitor	SUNSPO	SP-14C	-	Aug. 14,2011	Aug.14,2012

5.2 Measurement Uncertainty

Parameter	**Uncertainty**
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 2.46 dB (AC mains 150KHz~30MHz)

5.3 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:	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. Test Condition

Operating Environment:

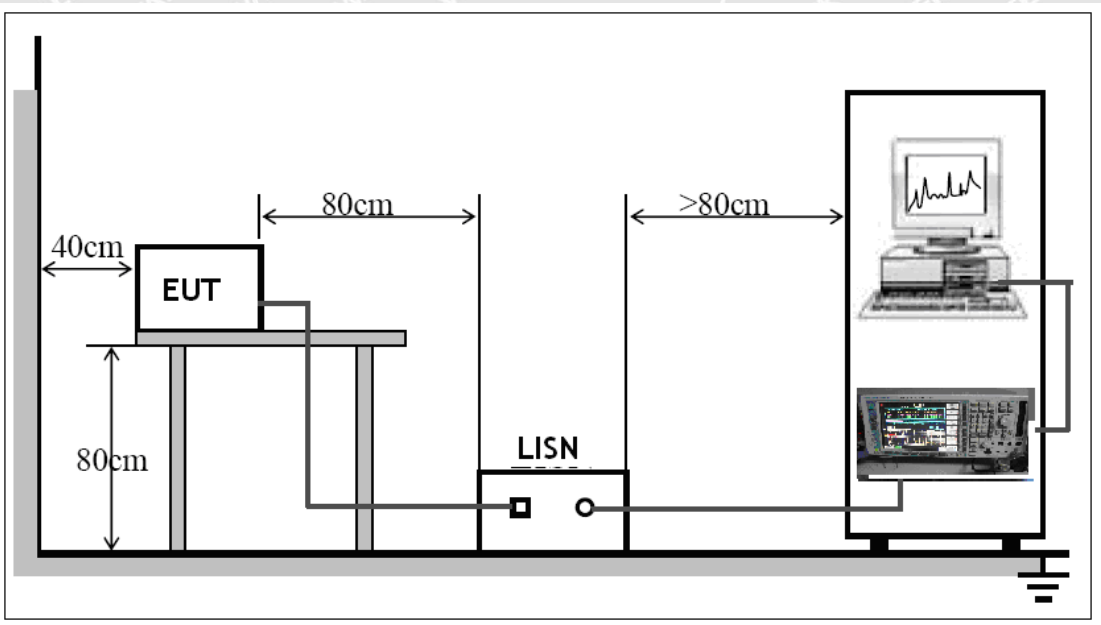
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	1012 mbar

Operation Mode and Spectrum Setup:

The EUT was tested in normal working mode. The worst data were shown as follow.

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.

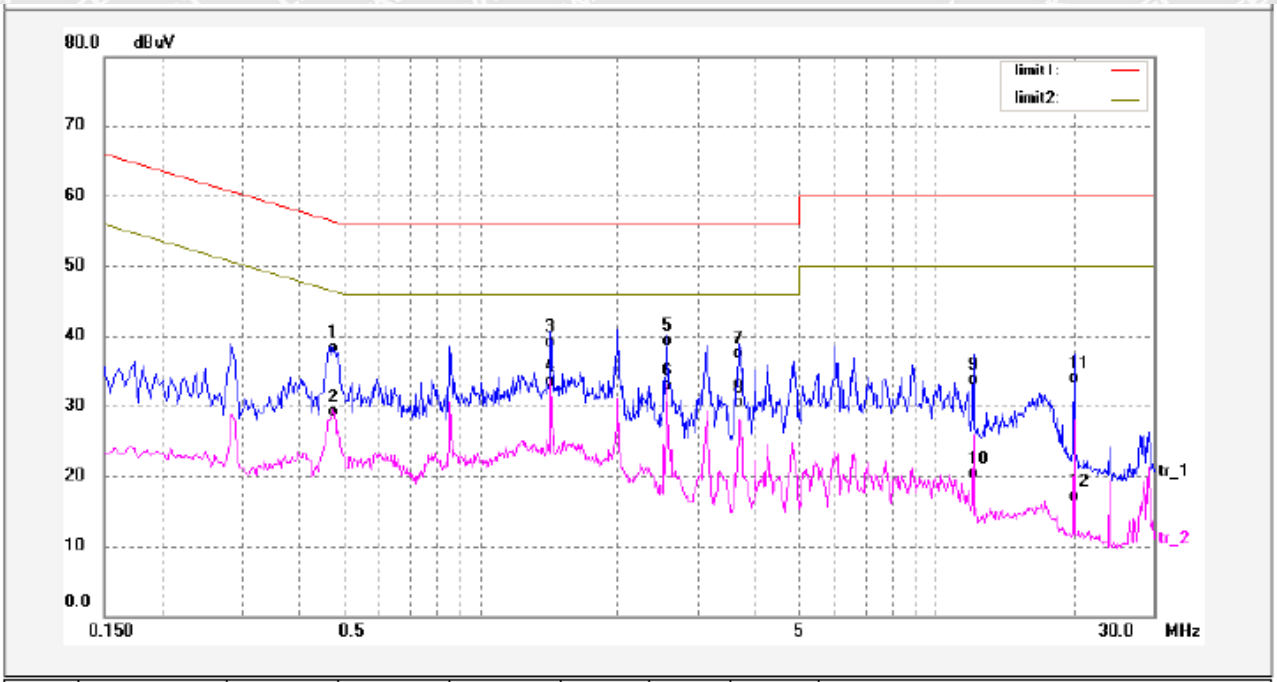


The EUT was placed on the test table in shielding room

6.3 Conducted Emission Test Result

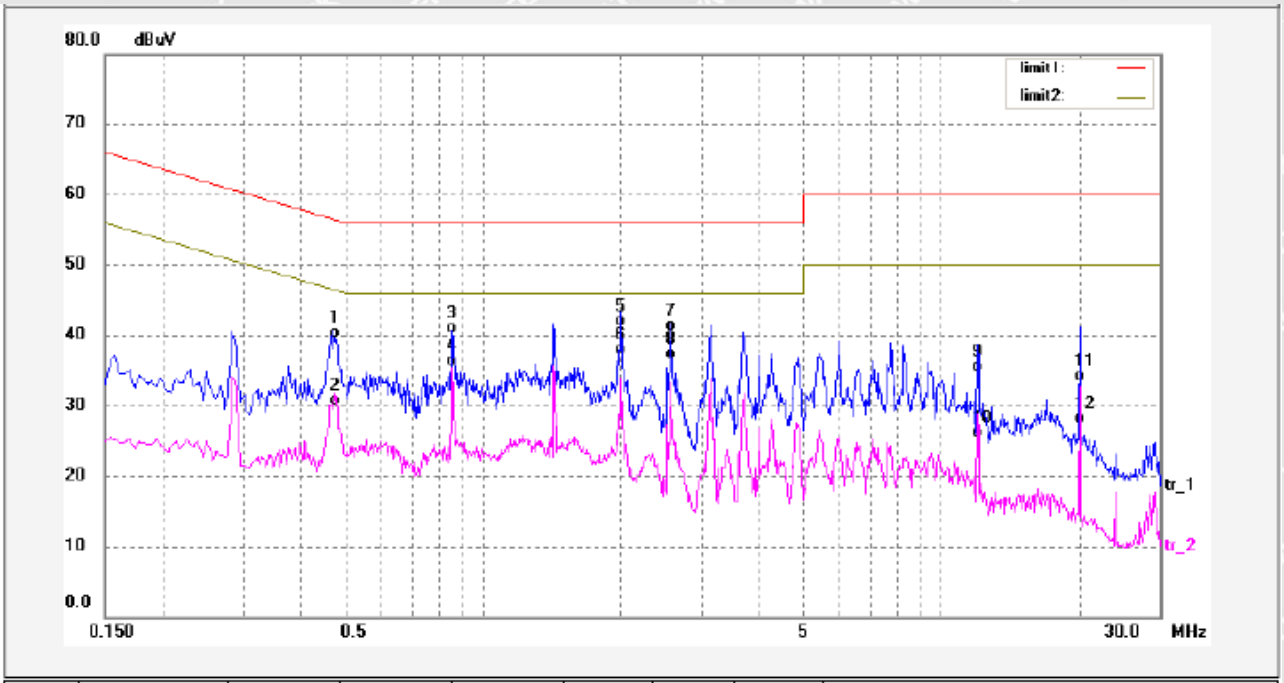
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

Test Mode: normal working
Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.4700	27.07	10.39	37.46	56.51	-19.05	QP	
2	0.4700	17.86	10.39	28.25	46.51	-18.26	AVG	
3	1.4299	27.77	10.56	38.33	56.00	-17.67	QP	
4	1.4299	22.21	10.56	32.77	46.00	-13.23	AVG	
5	2.5740	27.70	10.73	38.43	56.00	-17.57	QP	
6	2.5740	21.46	10.73	32.19	46.00	-13.81	AVG	
7	3.7180	25.91	10.79	36.70	56.00	-19.30	QP	
8	3.7180	18.88	10.79	29.67	46.00	-16.33	AVG	
9	12.0700	21.87	10.99	32.86	60.00	-27.14	QP	
10	12.0700	8.58	10.99	19.57	50.00	-30.43	AVG	
11	20.1140	22.04	11.15	33.19	60.00	-26.81	QP	
12	20.1140	5.24	11.15	16.39	50.00	-33.61	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.4700	29.19	10.39	39.58	56.51	-16.93	QP	
2	0.4700	19.46	10.39	29.85	46.51	-16.66	AVG	
3	0.8580	29.59	10.45	40.04	56.00	-15.96	QP	
4	0.8580	25.06	10.45	35.51	46.00	-10.49	AVG	
5	2.0020	30.37	10.70	41.07	56.00	-14.93	QP	
6	2.0020	26.37	10.70	37.07	46.00	-8.93	AVG	
7	2.5740	29.85	10.73	40.58	56.00	-15.42	QP	
8	2.5740	25.76	10.73	36.49	46.00	-9.51	AVG	
9	12.0580	23.79	10.99	34.78	60.00	-25.22	QP	
10	12.0580	14.24	10.99	25.23	50.00	-24.77	AVG	
11	20.0940	22.13	11.15	33.28	60.00	-26.72	QP	
12	20.0940	16.07	11.15	27.22	50.00	-22.78	AVG	

7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
Test Method: DA 00-705
Test Result: PASS
Frequency Range: 26 MHz to 25 GHz
Measurement Distance: 3m
15.209 Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.247 (d) Limit:
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

7.1 EUT Operation:

Operating Environment:

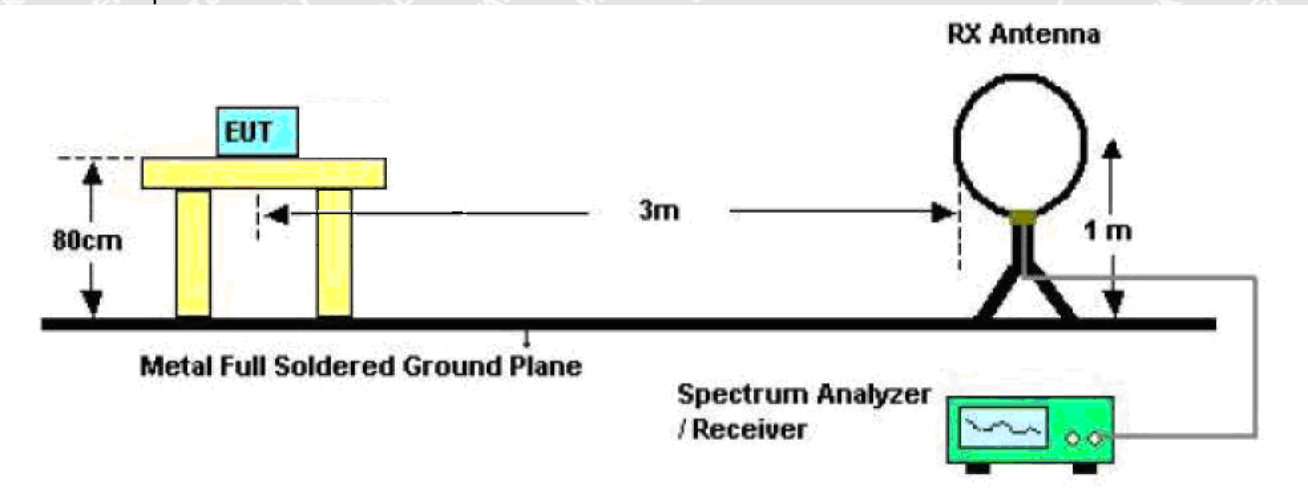
Temperature: 25.5 °C
Humidity: 51 % RH
Atmospheric Pressure: 1012 mbar

Operation Mode:

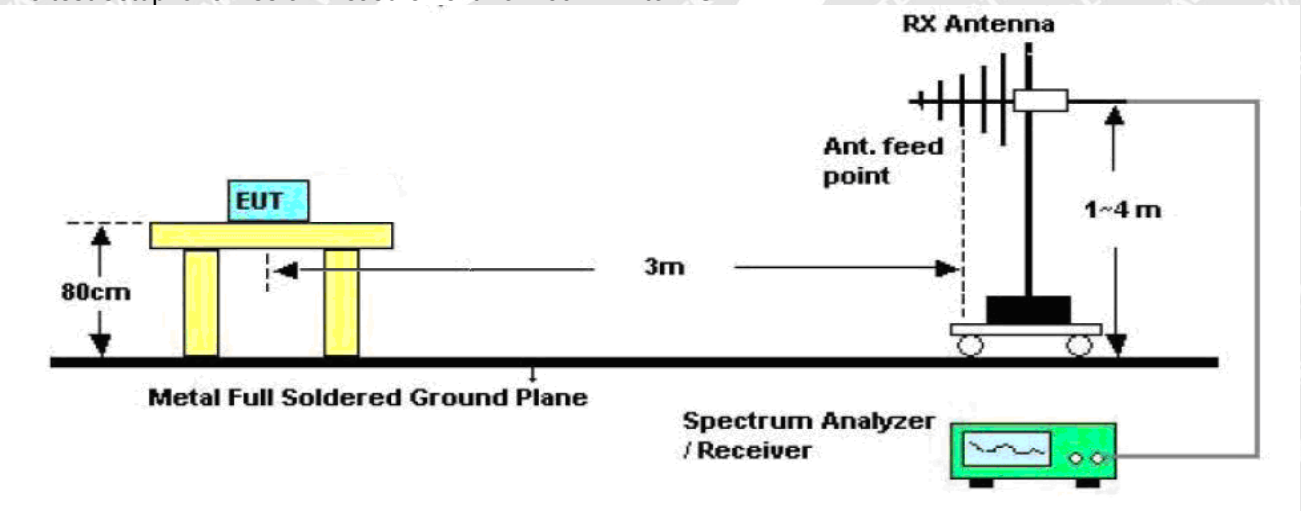
The EUT was tested in lower/middle/upper channel mode. The worst data were shown as follow.

7.2 Test Setup

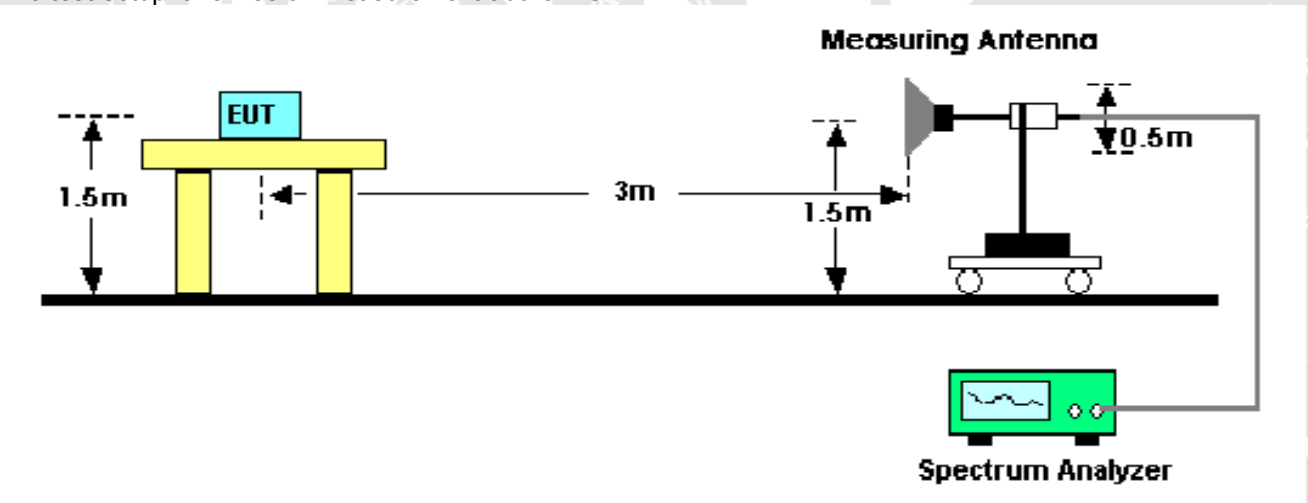
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.
The test setup for emission measurement below 30MHz.



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

According to FCC Part15 Rules, the system was tested from 26 MHz to 25 GHz.

Below 30MHz

Sweep Speed	Auto
IF Bandwidth	10KHz
Video Bandwidth	10KHz
Resolution Bandwidth	10KHz

30MHz ~ 1GHz

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

Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth	3MHz
Quasi-Peak Adapter Bandwidth	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	1MHz

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 tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand). After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

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:
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

7.6 Summary of Test Results

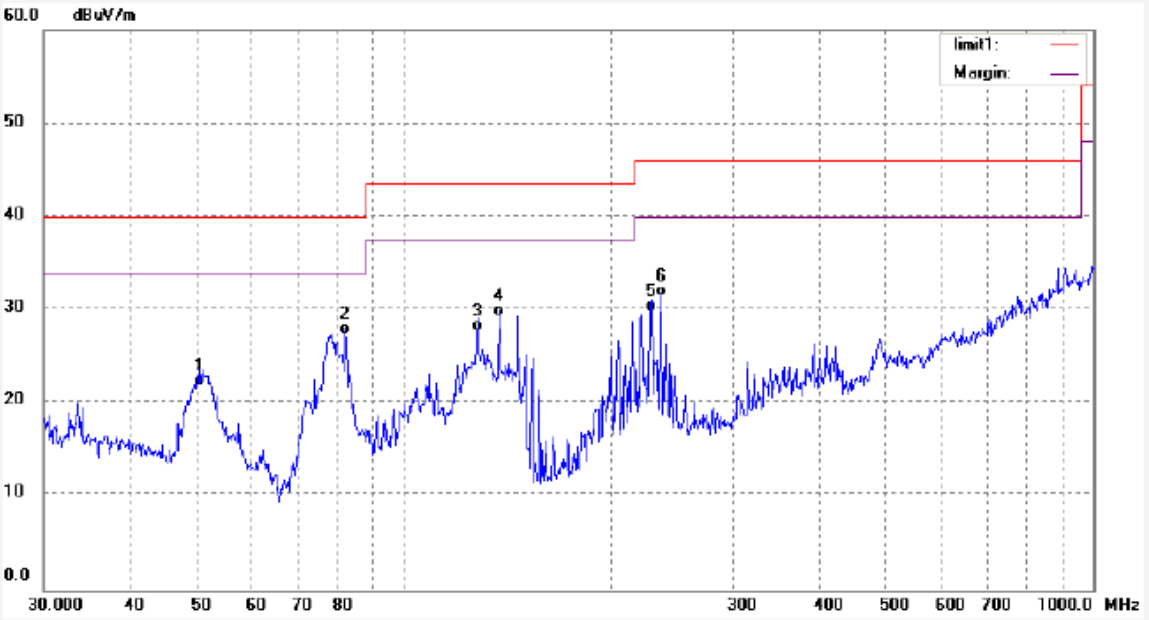
Test mode 1a: continuous receiving mode

Remark: the EUT were pretested at the upper, middle and lower channels, and the worst case was the middle Channel mode, so the data show was the middle channel mode 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	50.4614	7.29	14.56	21.85	40.00	-18.15	QP	
2	82.2363	17.80	9.53	27.33	40.00	-12.67	QP	
3	128.0356	15.88	11.81	27.69	43.50	-15.81	QP	
4	137.3565	17.45	11.90	29.35	43.50	-14.15	QP	
5	228.6173	13.57	16.25	29.82	46.00	-16.18	QP	
6	235.9622	15.74	15.70	31.44	46.00	-14.56	QP	

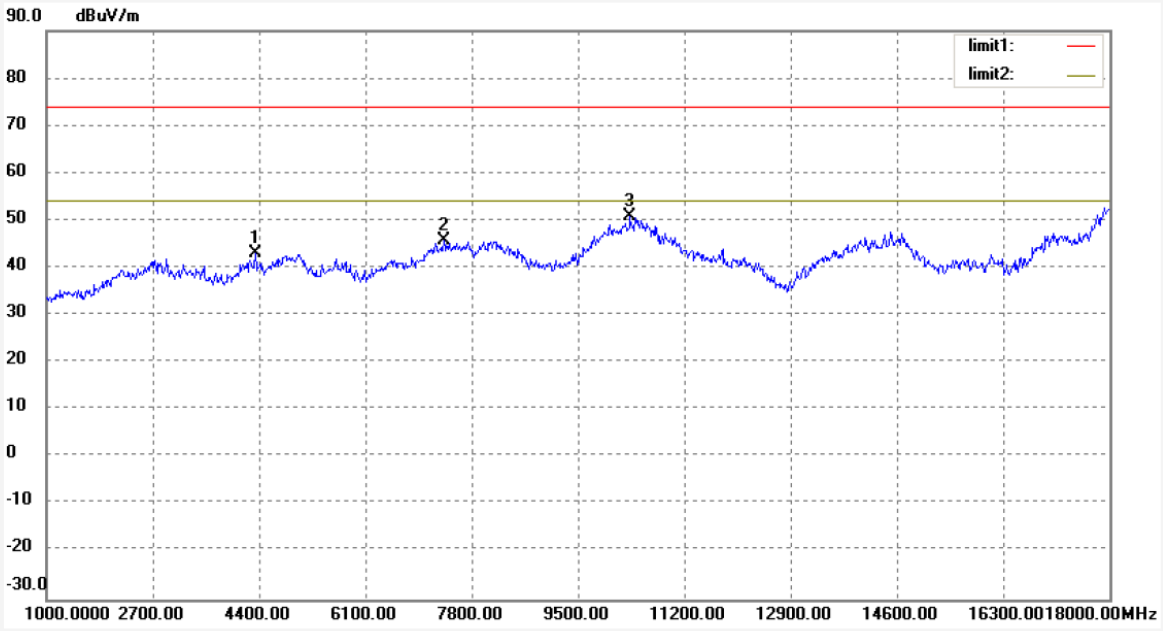
Antenna polarization: Horizontal

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.0000	16.75	16.15	32.90	40.00	-7.10	QP	
2	32.9854	13.26	16.57	29.83	40.00	-10.17	QP	
3	52.0826	10.05	14.48	24.53	40.00	-15.47	QP	
4	74.2696	17.82	9.29	27.11	40.00	-12.89	QP	
5	107.4074	16.50	14.01	30.51	43.50	-12.99	QP	
6	128.4861	18.61	11.85	30.46	43.50	-13.04	QP	

Test Frequency: Above 1GHz radiation test data:

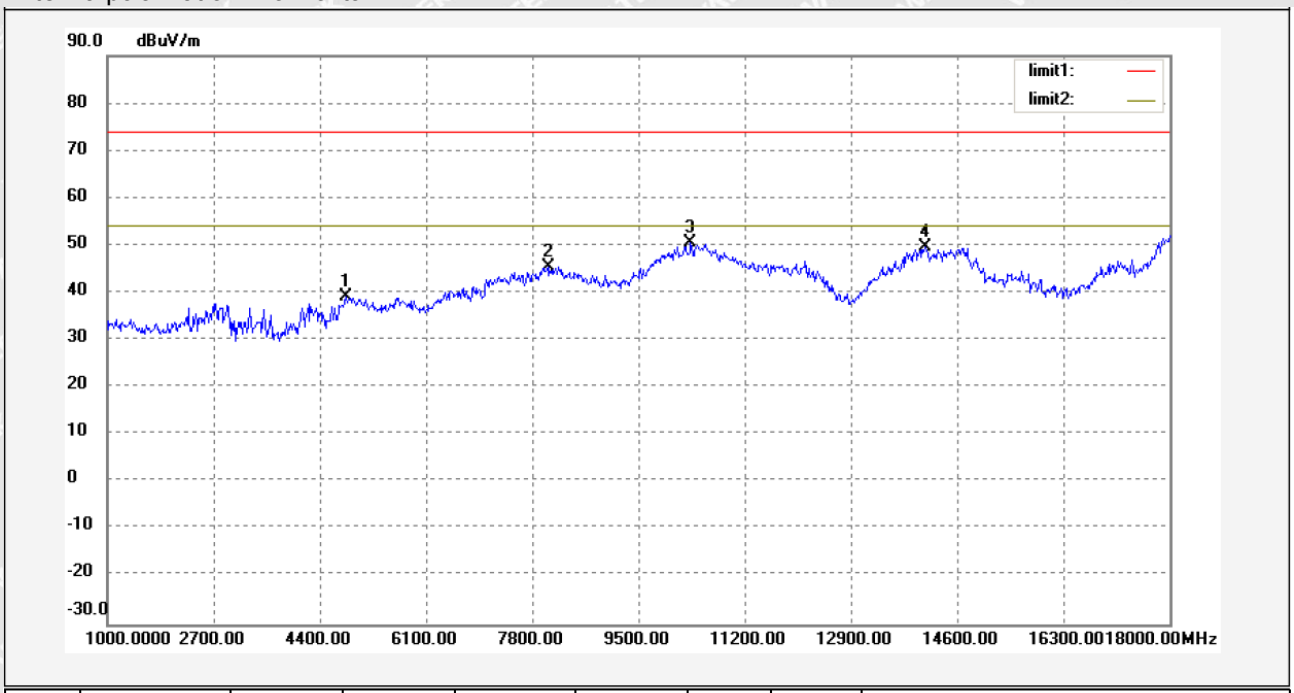
Remark: No any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz did not record.

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4338.677	35.84	7.16	43.00	74.00	-31.00	peak	
2	7353.707	29.64	16.06	45.70	74.00	-28.30	peak	
3	10334.669	30.10	20.72	50.82	74.00	-23.18	peak	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4815.631	34.38	4.77	39.15	74.00	-34.85	peak	
2	8052.104	30.68	14.91	45.59	74.00	-28.41	peak	
3	10334.669	32.56	18.05	50.61	74.00	-23.39	peak	
4	14082.164	26.66	23.01	49.67	74.00	-24.33	peak	

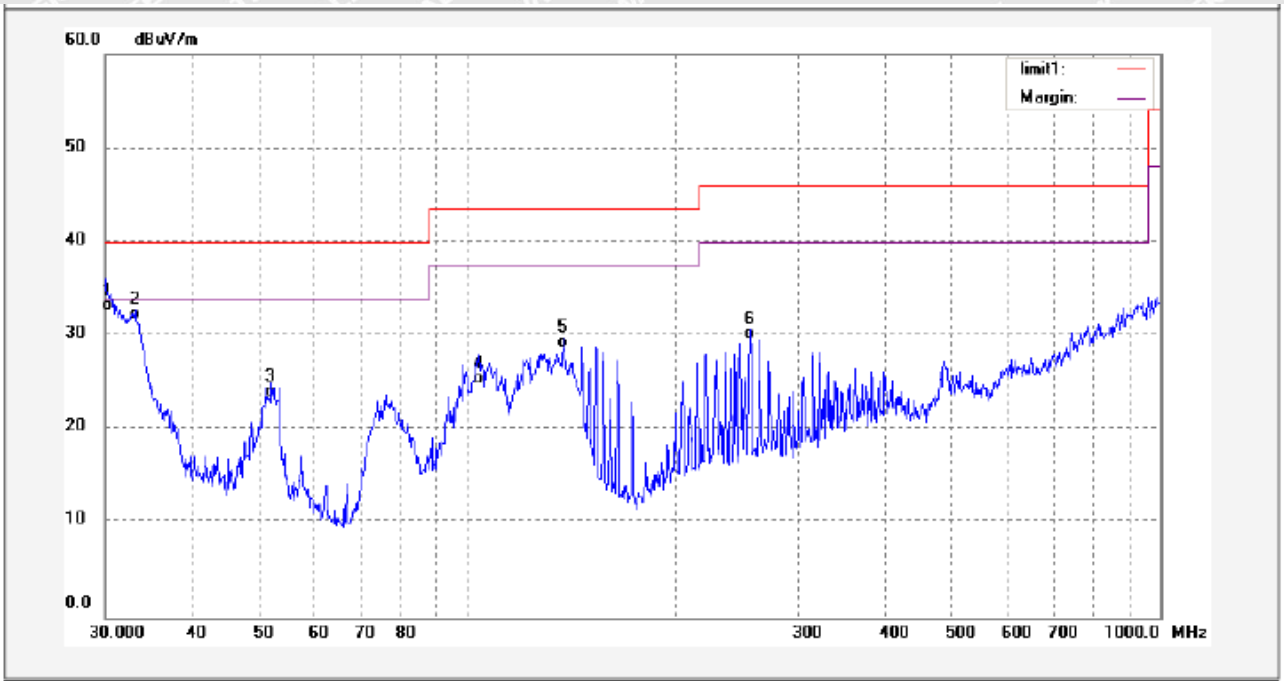
Test mode 1b: continuous transmitting mode

Remark: The pre-test were performed at the upper, middle and lower channels. And the worst case was the middle Channel mode, so the data show was the middle channel mode only.

Because the emissions below 30MHz are more than 20dB below the limit, the data is not shown in the report.

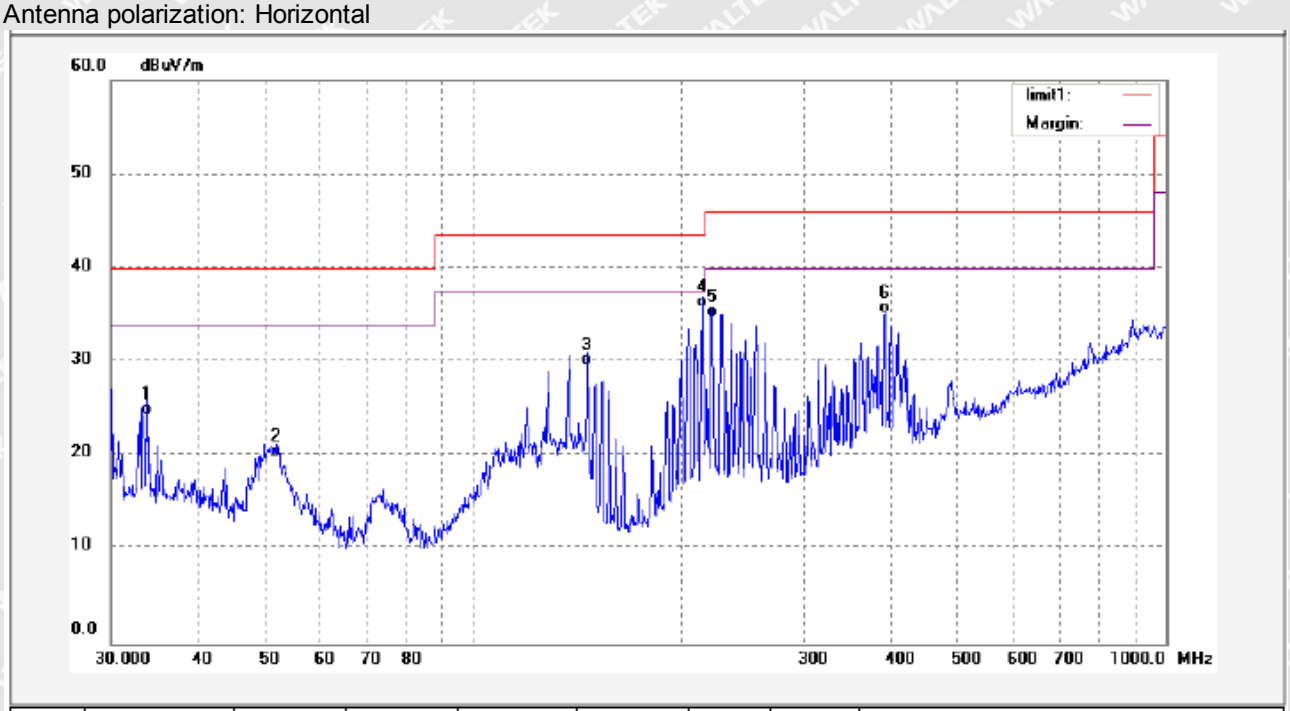
Test Frequency: 30MHz ~ 1000MHz

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.0000	16.50	16.15	32.65	40.00	-7.35	QP	
2	33.1015	15.10	16.56	31.66	40.00	-8.34	QP	
3	52.0826	8.97	14.48	23.45	40.00	-16.55	QP	
4	103.6990	10.57	14.19	24.76	43.50	-18.74	QP	
5	137.3565	16.87	11.90	28.77	43.50	-14.73	QP	
6	255.8226	13.54	16.03	29.57	46.00	-16.43	QP	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	33.8067	7.86	16.54	24.40	40.00	-15.60	QP	
2	51.8998	5.35	14.50	19.85	40.00	-20.15	QP	
3	146.3241	18.40	11.24	29.64	43.50	-13.86	QP	
4	213.8535	20.80	15.03	35.83	43.50	-7.67	QP	
5	221.5010	18.60	16.20	34.80	46.00	-11.20	QP	
6	392.7376	14.58	20.66	35.24	46.00	-10.76	QP	

Test Frequency: 1GHz ~ 25GHz radiation test data
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 (°)
Lower frequency							
2402.00	AV	Vertical	96.52	N/A	(Fund.)	1.1	110
4804.00	AV	Vertical	41.02	54.00	13.98	1.4	140
7206.00	AV	Vertical	35.23	54.00	19.73	1.6	170
9608.00	AV	Vertical	32.52	54.00	21.48	1.4	130
12010.00	AV	Vertical	31.25	54.00	22.75	1.8	185
14412.00	AV	Vertical	31.01	54.00	22.99	1.2	195
16814.00	AV	Vertical	30.02	54.00	23.98	1.9	160
19216.00	AV	Vertical	30.67	54.00	23.33	1.4	140
21618.00	AV	Vertical	29.63	54.00	24.34	1.4	30
24020.00	AV	Vertical	29.01	54.00	24.99	1.1	145
2402.00	AV	Horizontal	92.23	N/A	(Fund.)	1.7	70
4804.00	AV	Horizontal	41.12	54.00	12.88	1.2	180
7206.00	AV	Horizontal	36.21	54.00	17.79	1.4	100
9608.00	AV	Horizontal	34.25	54.00	19.75	1.4	195
12010.00	AV	Horizontal	33.21	54.00	20.79	1.6	110
14412.00	AV	Horizontal	31.25	54.00	22.75	1.2	190
16814.00	AV	Horizontal	30.74	54.00	23.26	1.7	150
19216.00	AV	Horizontal	32.01	54.00	21.99	1.6	175
21618.00	AV	Horizontal	31.53	54.00	22.47	1.4	160
24020.00	AV	Horizontal	30.01	54.00	23.99	1.4	90
2402.00	PK	Vertical	106.41	N/A	(Fund.)	1.3	30
4804.00	PK	Vertical	45.21	74.00	29.64	1.7	145
7206.00	PK	Vertical	40.01	74.00	33.99	2.1	160
9608.00	PK	Vertical	37.42	74.00	36.58	1.2	240
12010.00	PK	Vertical	36.21	74.00	37.79	1.1	100
14412.00	PK	Vertical	32.01	74.00	41.99	1.4	155
16814.00	PK	Vertical	33.21	74.00	40.79	1.5	185
19216.00	PK	Vertical	30.10	74.00	43.90	1.1	190
21618.00	PK	Vertical	29.01	74.00	44.99	1.9	110
24020.00	PK	Vertical	29.01	74.00	44.99	1.2	165
2402.00	PK	Horizontal	102.32	N/A	(Fund.)	2.0	120
4804.00	PK	Horizontal	41.24	74.00	32.76	1.7	170
7206.00	PK	Horizontal	38.25	74.00	35.75	1.6	90
9608.00	PK	Horizontal	36.98	74.00	37.02	1.1	85
12010.00	PK	Horizontal	35.69	74.00	38.31	1.7	205
14412.00	PK	Horizontal	35.62	74.00	38.38	1.0	60
16814.00	PK	Horizontal	33.35	74.00	40.65	1.7	220
19216.00	PK	Horizontal	33.01	74.00	40.99	1.7	155

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
21618.00	PK	Horizontal	30.21	74.00	43.79	1.3	170
24020.00	PK	Horizontal	30.01	74.00	43.99	1.5	140
Middle frequency							
2441.00	AV	Vertical	92.21	N/A	(Fund.)	1.7	70
4882.00	AV	Vertical	39.02	54.00	14.98	1.4	185
7323.00	AV	Vertical	35.21	54.00	18.71	1.1	140
9764.00	AV	Vertical	33.33	54.00	20.67	1.5	70
12205.00	AV	Vertical	32.02	54.00	21.98	1.7	50
14646.00	AV	Vertical	32.01	54.00	21.99	1.4	225
17087.00	AV	Vertical	30.26	54.00	23.74	1.6	60
19528.00	AV	Vertical	30.01	54.00	23.99	1.5	80
21969.00	AV	Vertical	29.02	54.00	24.98	1.9	210
24410.00	AV	Vertical	28.23	54.00	25.77	1.7	175
2441.00	AV	Horizontal	92.96	N/A	(Fund.)	1.5	190
4882.00	AV	Horizontal	35.69	54.00	18.31	1.7	150
7323.00	AV	Horizontal	34.25	54.00	19.75	1.7	310
9764.00	AV	Horizontal	33.52	54.00	20.48	1.0	215
12205.00	AV	Horizontal	31.21	54.00	22.79	1.2	200
14646.00	AV	Horizontal	30.25	54.00	23.75	1.7	250
17087.00	AV	Horizontal	29.25	54.00	24.75	2.1	185
19528.00	AV	Horizontal	28.36	54.00	25.64	1.3	165
21969.00	AV	Horizontal	28.02	54.00	25.98	1.3	210
24410.00	AV	Horizontal	28.02	54.00	25.98	1.7	200
2441.00	PK	Vertical	107.52	N/A	(Fund.)	1.3	30
4882.00	PK	Vertical	44.21	74.00	29.79	1.7	175
7323.00	PK	Vertical	38.25	74.00	35.75	1.8	170
9764.00	PK	Vertical	37.94	74.00	36.06	1.4	180
12205.00	PK	Vertical	37.87	74.00	36.13	1.9	220
14646.00	PK	Vertical	36.10	74.00	38.90	1.0	95
17087.00	PK	Vertical	32.03	74.00	41.97	1.4	50
19528.00	PK	Vertical	30.21	74.00	43.79	1.9	190
21969.00	PK	Vertical	28.30	74.00	45.70	2.0	185
24410.00	PK	Vertical	28.30	74.00	45.70	1.4	195
2441.00	PK	Horizontal	103.45	N/A	(Fund.)	1.7	60
4882.00	PK	Horizontal	43.56	74.00	30.44	1.7	125
7323.00	PK	Horizontal	41.51	74.00	32.49	1.7	120
9764.00	PK	Horizontal	40.14	74.00	33.86	1.7	145
12205.00	PK	Horizontal	39.36	74.00	34.64	1.8	220
14646.00	PK	Horizontal	37.44	74.00	36.56	1.1	210
17087.00	PK	Horizontal	34.21	74.00	39.79	1.3	160

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
19528.00	PK	Horizontal	38.86	74.00	35.14	1.3	245
21969.00	PK	Horizontal	34.21	74.00	39.79	1.1	50
24410.00	PK	Horizontal	33.33	74.00	40.67	1.3	215
Upper frequency							
2480.00	AV	Vertical	93.42	N/A	(Fund.)	1.2	220
4960.00	AV	Vertical	36.25	54.00	17.75	1.4	95
7440.00	AV	Vertical	32.25	54.00	21.75	1.3	170
9920.00	AV	Vertical	30.26	54.00	23.74	1.1	130
12400.00	AV	Vertical	30.55	54.00	23.45	2.0	140
14880.00	AV	Vertical	30.34	54.00	23.66	1.5	195
17360.00	AV	Vertical	30.62	54.00	23.38	1.2	160
19840.00	AV	Vertical	30.13	54.00	23.87	1.1	260
22320.00	AV	Vertical	30.27	54.00	23.73	1.5	150
24800.00	AV	Vertical	28.25	54.00	25.75	1.0	220
2480.00	AV	Horizontal	92.51	N/A	(Fund.)	1.5	190
4960.00	AV	Horizontal	34.56	54.00	19.44	2.3	210
7440.00	AV	Horizontal	30.35	54.00	23.65	1.4	160
9920.00	AV	Horizontal	31.47	54.00	22.53	1.3	275
12400.00	AV	Horizontal	31.89	54.00	22.11	1.2	185
14880.00	AV	Horizontal	32.42	54.00	21.58	1.5	190
17360.00	AV	Horizontal	31.17	54.00	22.83	1.9	230
19840.00	AV	Horizontal	32.55	54.00	21.45	1.5	135
22320.00	AV	Horizontal	32.86	54.00	21.14	1.4	150
24800.00	AV	Horizontal	30.25	54.00	22.75	2.4	170
2480.00	PK	Vertical	107.53	N/A	(Fund.)	1.3	210
4960.00	PK	Vertical	44.21	74.00	29.79	1.0	115
7440.00	PK	Vertical	35.62	74.00	38.38	2.5	180
9920.00	PK	Vertical	35.35	74.00	38.65	1.1	160
12400.00	PK	Vertical	35.56	74.00	38.44	1.6	130
14880.00	PK	Vertical	34.21	74.00	39.79	1.0	155
17360.00	PK	Vertical	33.54	74.00	40.46	1.2	140
19840.00	PK	Vertical	36.26	74.00	37.74	1.6	190
22320.00	PK	Vertical	36.73	74.00	37.27	2.1	170
24800.00	PK	Vertical	30.21	74.00	43.99	1.0	210
2480.00	PK	Horizontal	93.64	N/A	(Fund.)	1.8	240
4960.00	PK	Horizontal	42.58	74.00	31.42	1.4	140
7440.00	PK	Horizontal	38.64	74.00	35.36	1.6	150
9920.00	PK	Horizontal	35.37	74.00	38.63	1.5	265
12400.00	PK	Horizontal	35.52	74.00	38.48	1.6	160
14880.00	PK	Horizontal	35.26	74.00	38.74	1.6	150

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
17360.00	PK	Horizontal	36.41	74.00	37.59	2.1	190
19840.00	PK	Horizontal	32.41	74.00	41.59	1.3	245
22320.00	PK	Horizontal	31.11	74.00	42.89	1.9	170
24800.00	PK	Horizontal	28.21	74.00	45.79	1.6	260

8 Band Edge Measurements

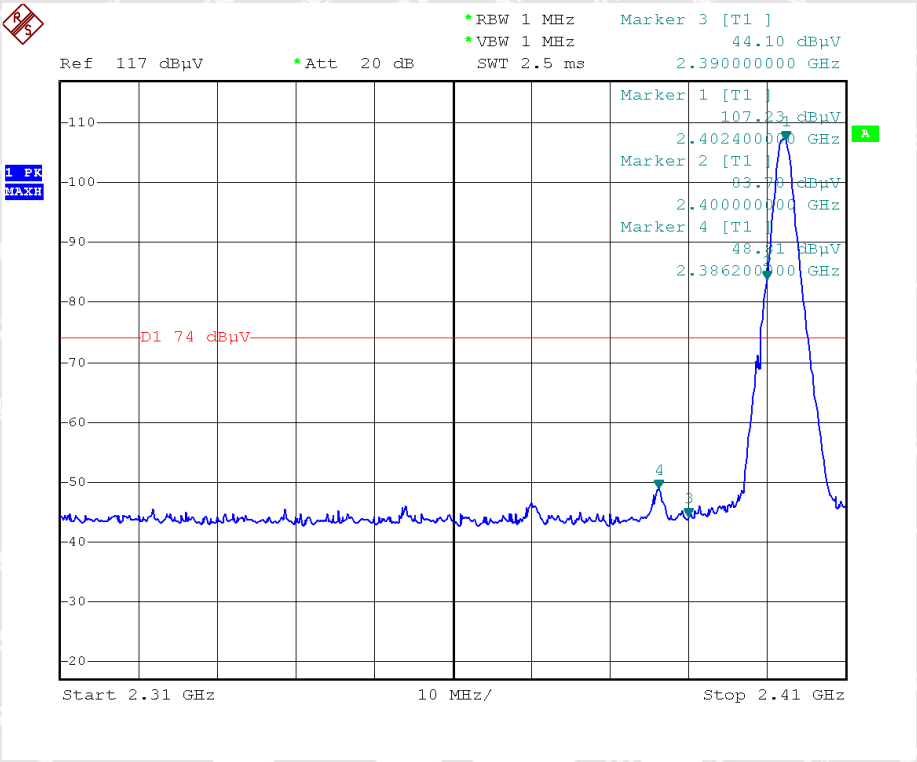
Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. As defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Measurement Distance:	3m
Limit:	40.0 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

8.1 Test Procedure:

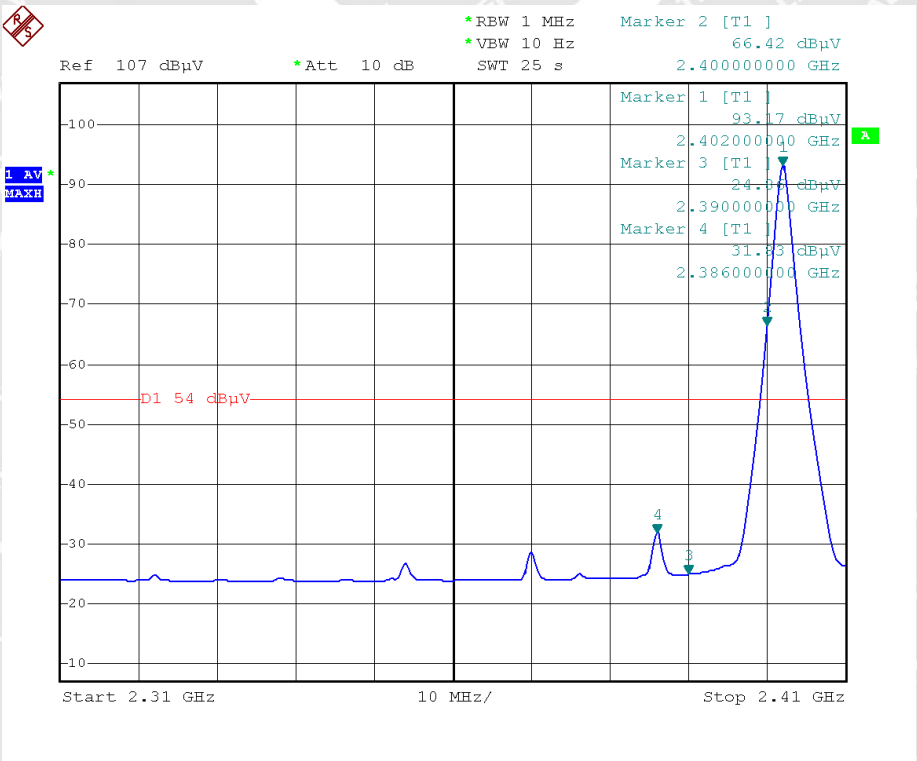
Detector:	For Peak value: RBW = 1 MHz for f ≥ 1 GHz VBW ≥ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for f ≥ 1 GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold
Test mode:	Test in fixing operating frequency at lower and upper channel.

8.2 Test Result:

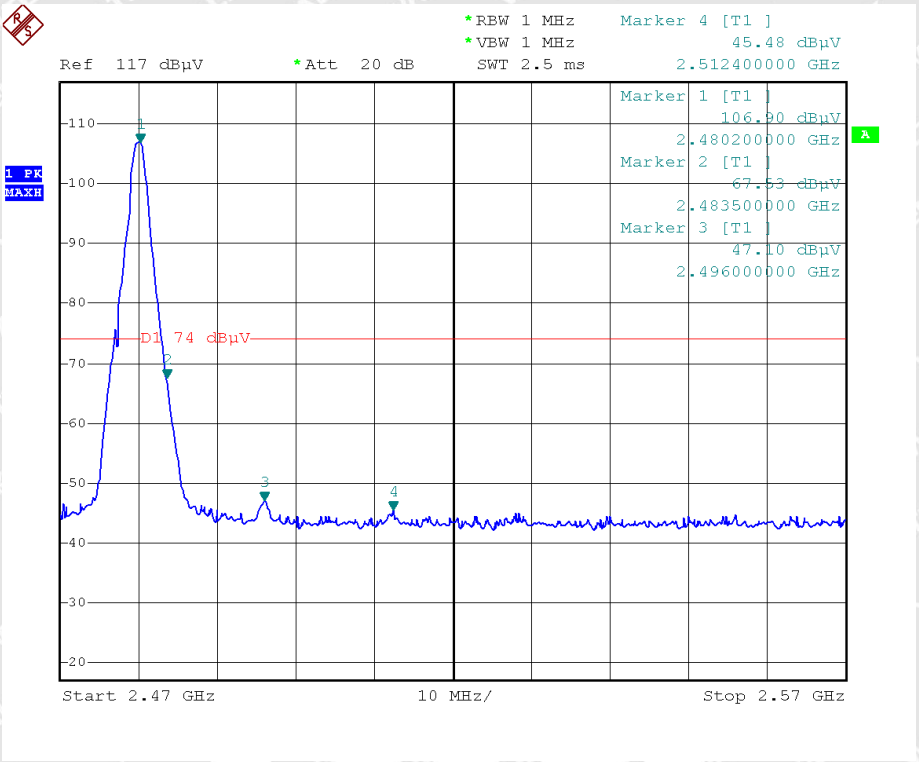
Lower Channel – Peak



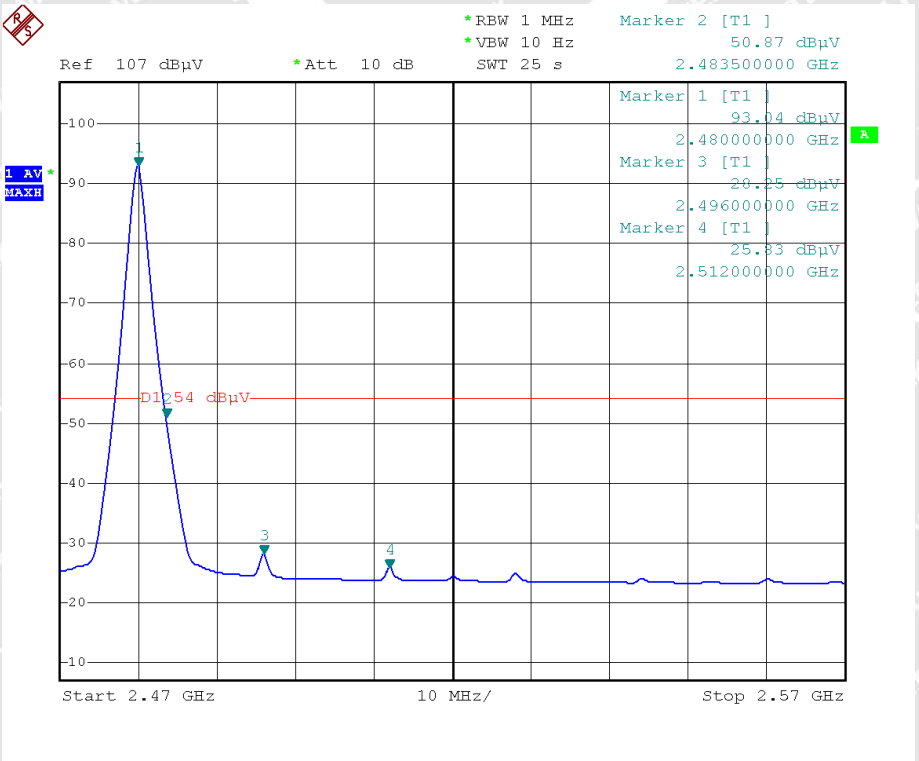
Lower Channel – AV



Upper Channel – Peak



Upper Channel – AV



9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: DA 00-705
Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

9.1 Test Procedure:

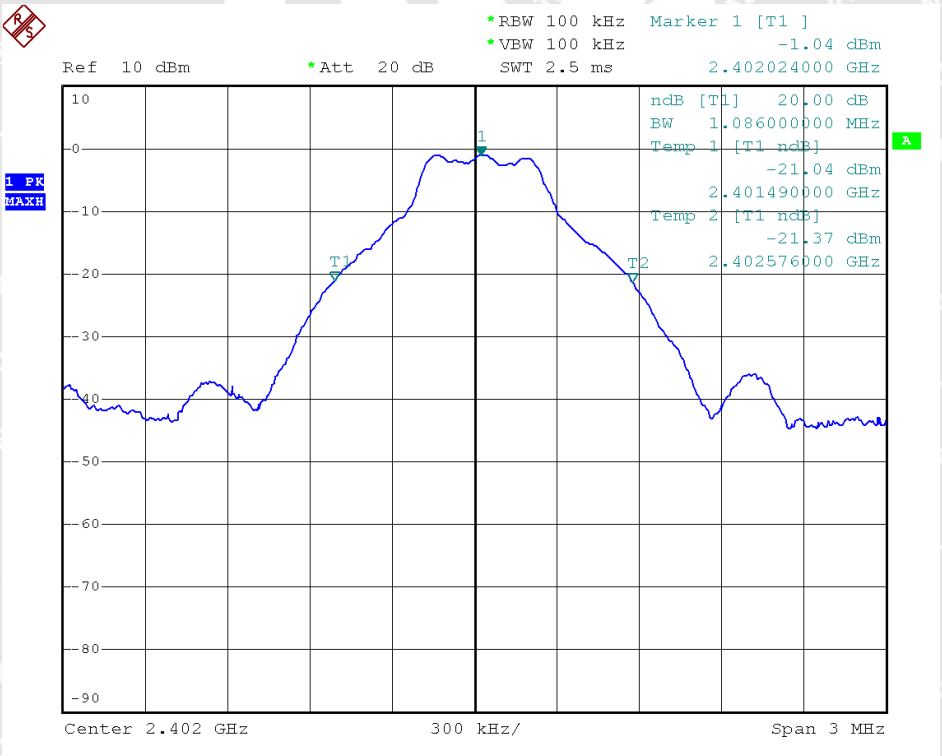
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1MHz, VBW = 1MHz

9.2 Test Result:

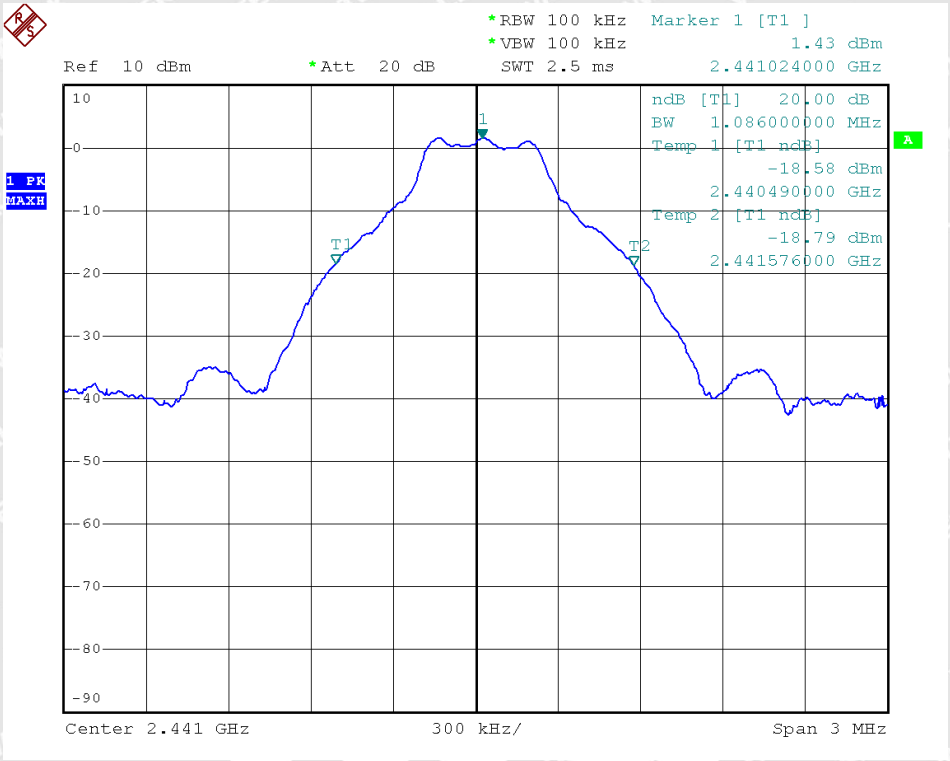
Test Channel	Bandwidth
Lower	1.086MHz
Middle	1.086MHz
Upper	1.116MHz

Test result plot as follows:

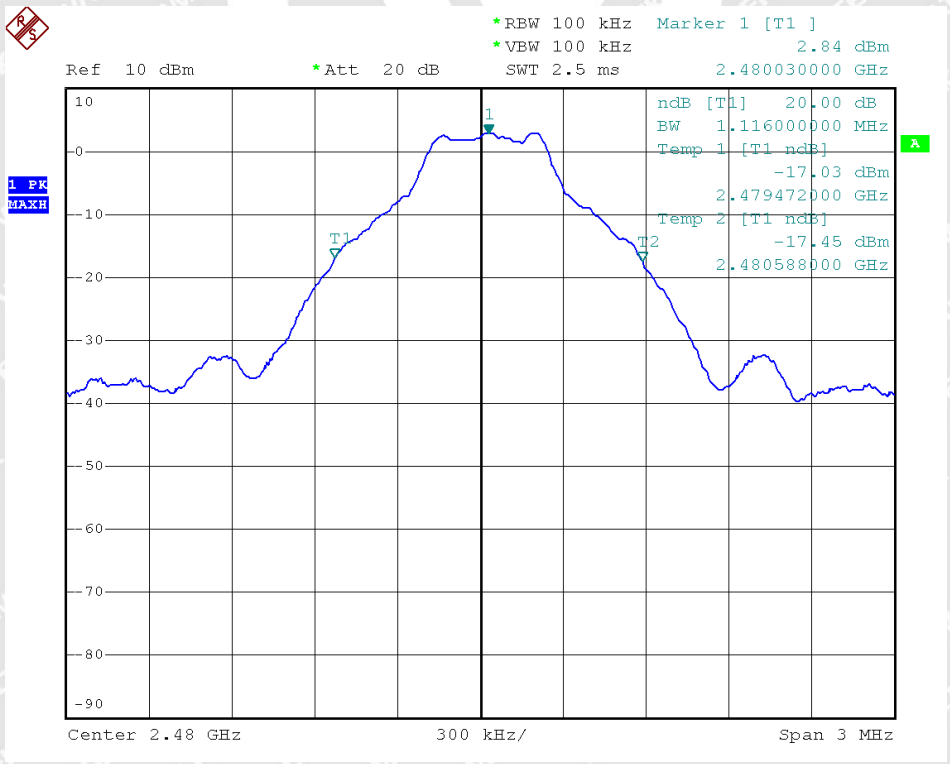
Lower Channel



Middle Channel



Upper Channel



10 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: 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 1watts (30 dBm) limit applies.
Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

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 = 3 MHz. VBW = 10 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)
Lower	3.15	30
Middle	3.26	30
upper	3.31	30

11 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: 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 125 mW.
Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

11.1 Test Procedure:

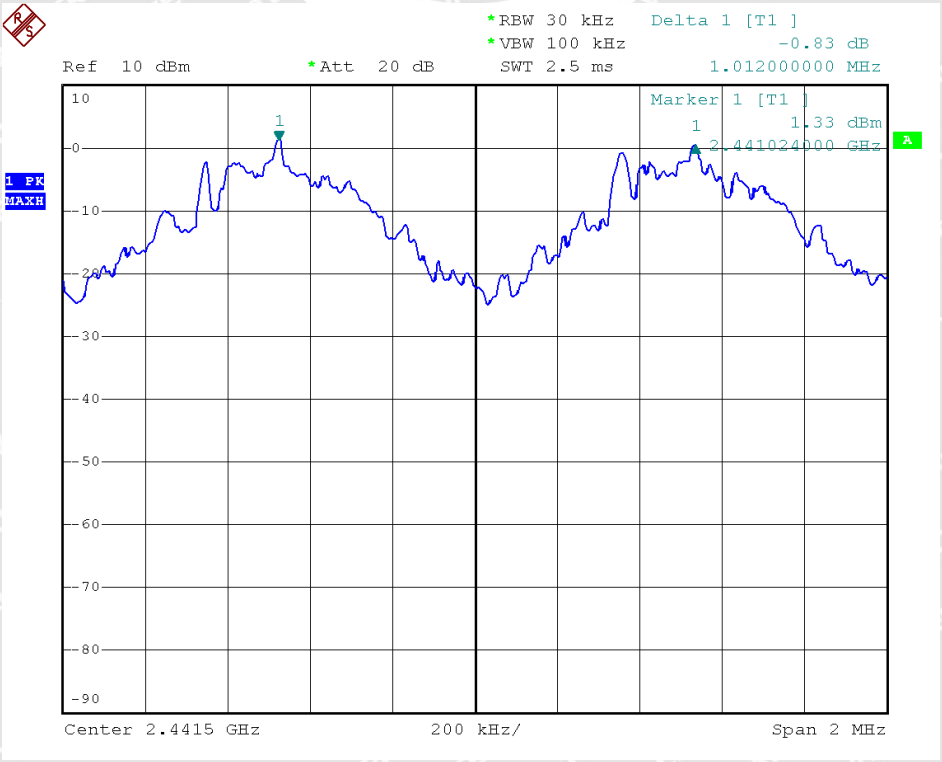
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz, Span = 2MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine 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
Lower	1.002	PASS
Middle	1.001	PASS
Upper	1.003	PASS

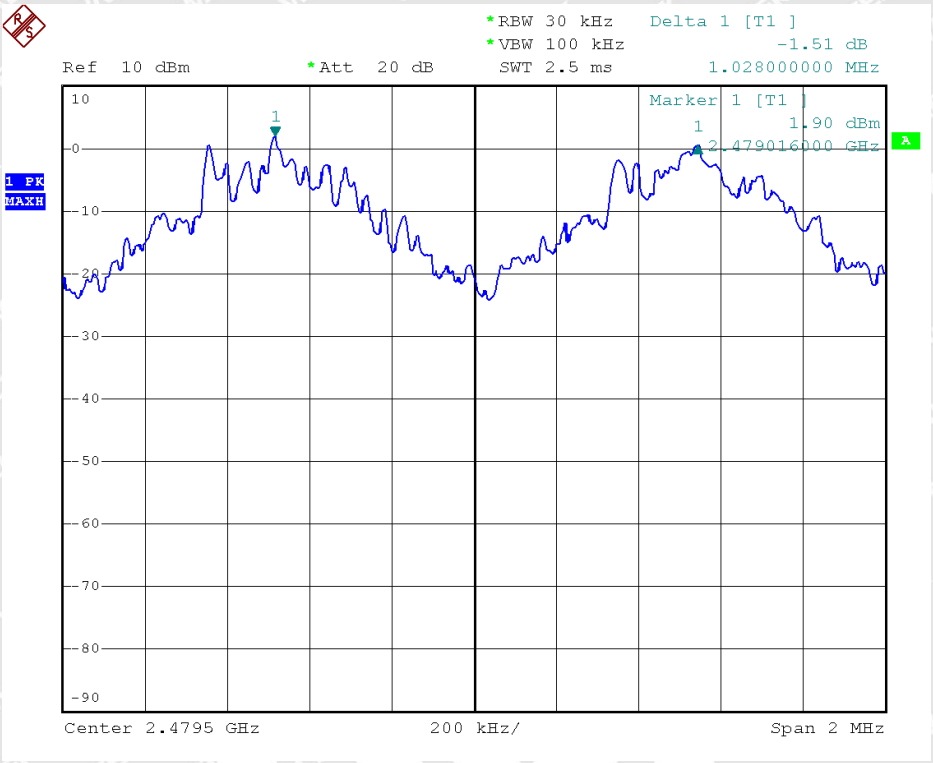
Test result plot as follows:
Lower Channel:

Middle Channel



Report No.: WT12074810-S-S-F

Upper Channel



12 Number of Hopping Frequency

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 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.

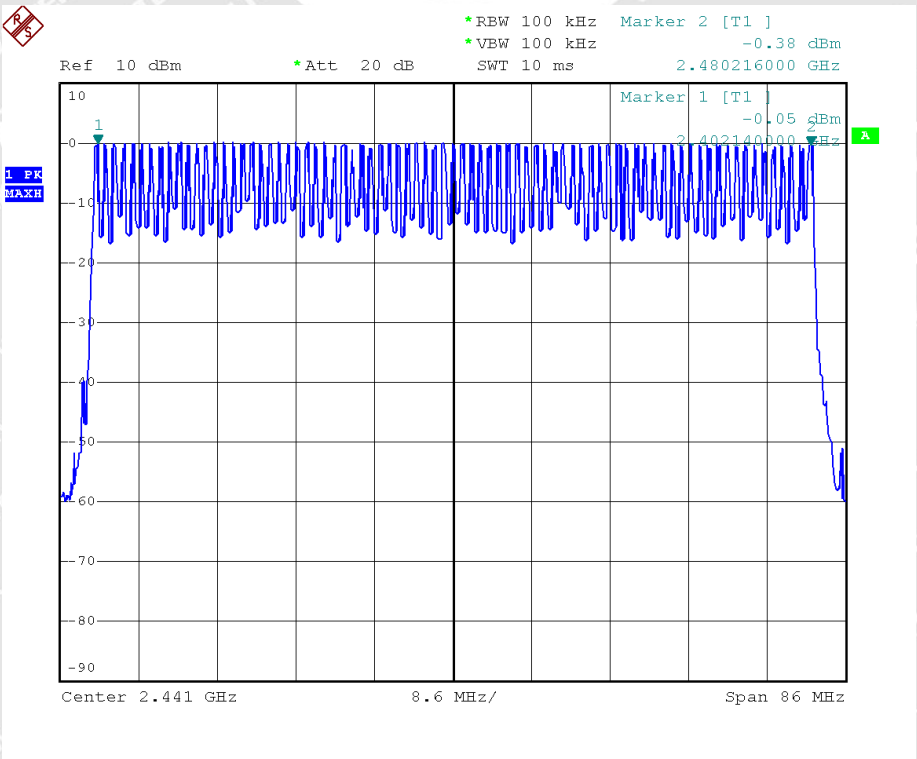
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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 79 Channels



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	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.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

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) * 79 = 31.6 (s)
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).
DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).
DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

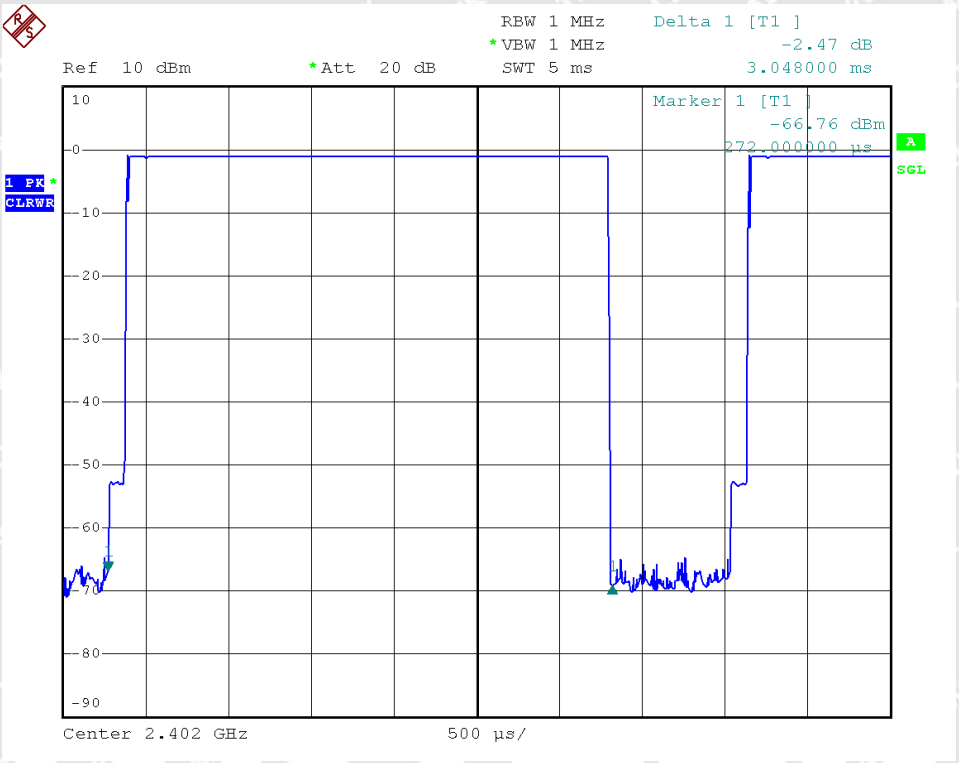
Data Packet	Dwell Time(s)
DH5	1600/79/6*31.6*(MkrDelta)/1000
DH3	1600/79/4*31.6*(MkrDelta)/1000
DH1	1600/79/2*31.6*(MkrDelta)/1000

Note: Mkr Delta is once pulse time.

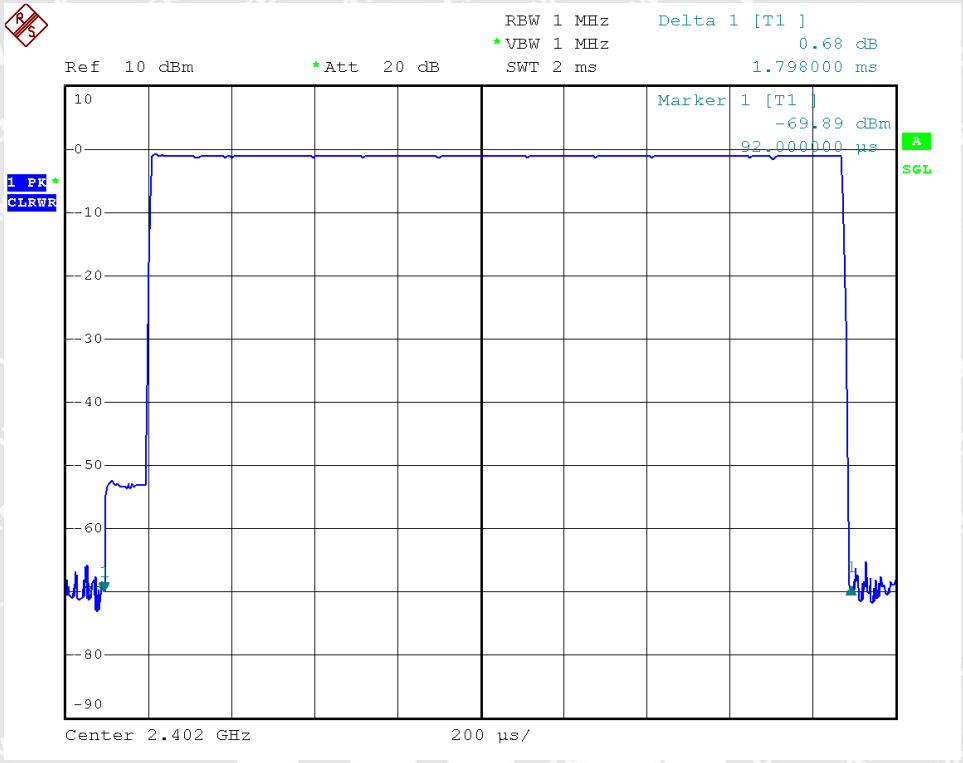
Dwell time of each occupation in this channel as follows:

Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Lower	3.048	0.325	0.400	Pass
DH3	Lower	1.798	0.288	0.400	Pass
DH1	Lower	0.530	0.170	0.400	Pass

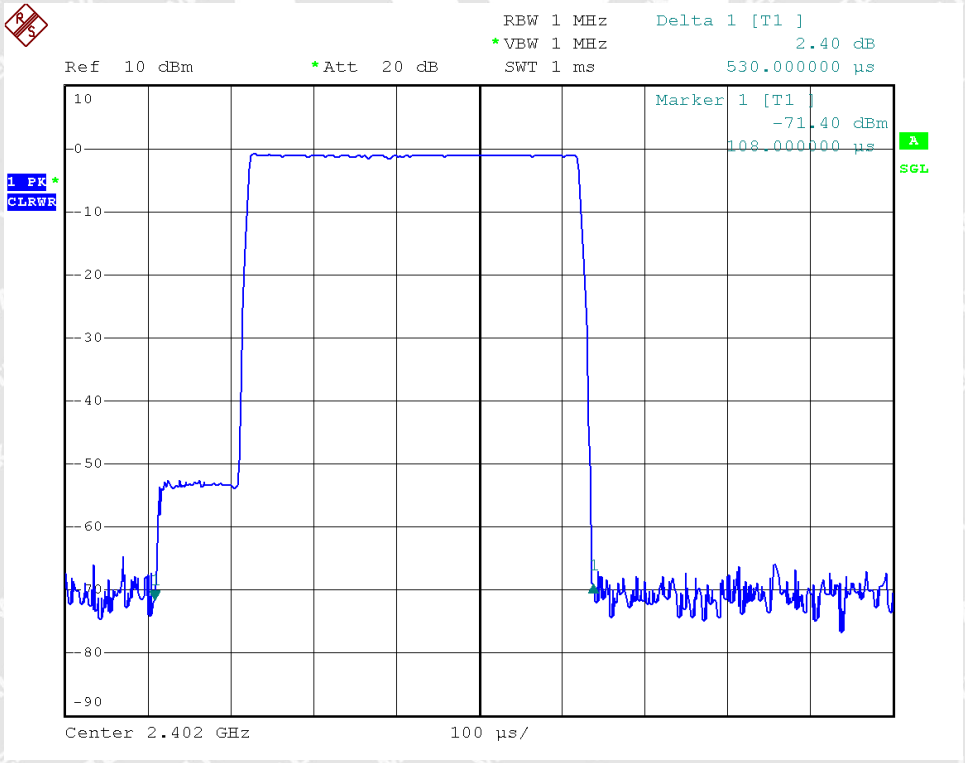
Mode: DH5



Mode: DH3

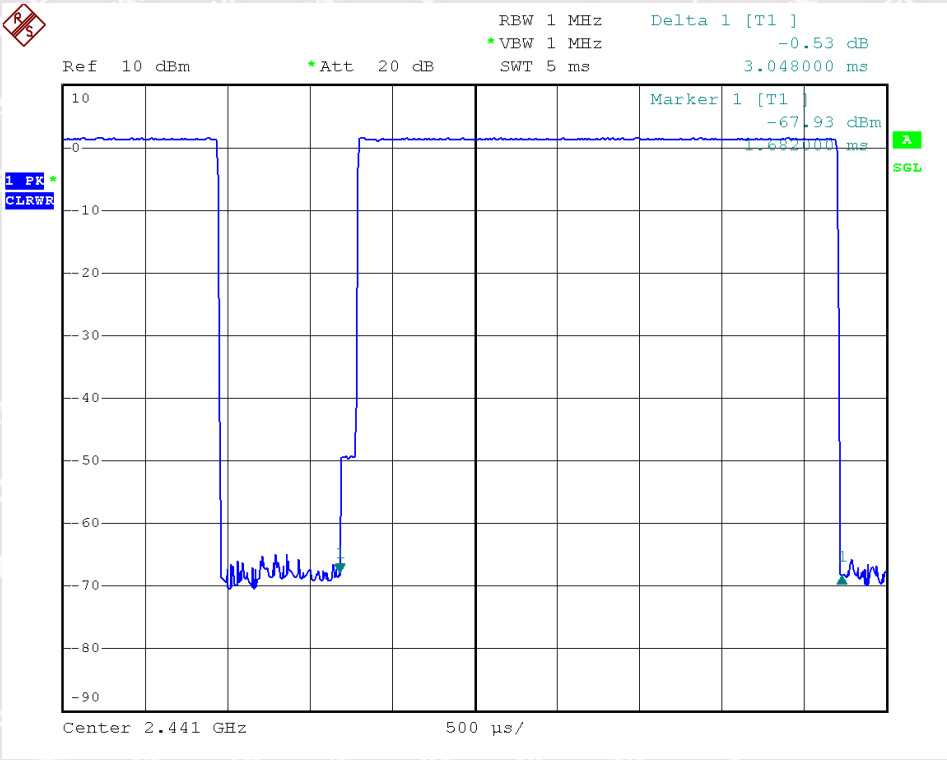


Mode: DH1

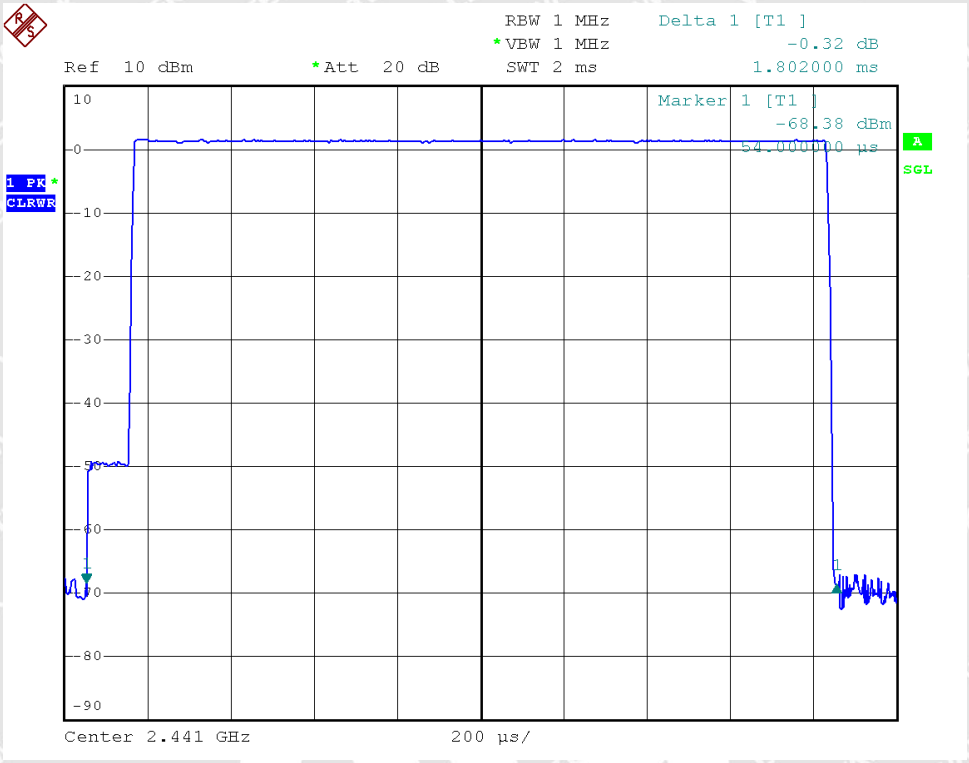


Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Middle	3.048	0.325	0.400	Pass
DH3	Middle	1.802	0.288	0.400	Pass
DH1	Middle	0.532	0.170	0.400	Pass

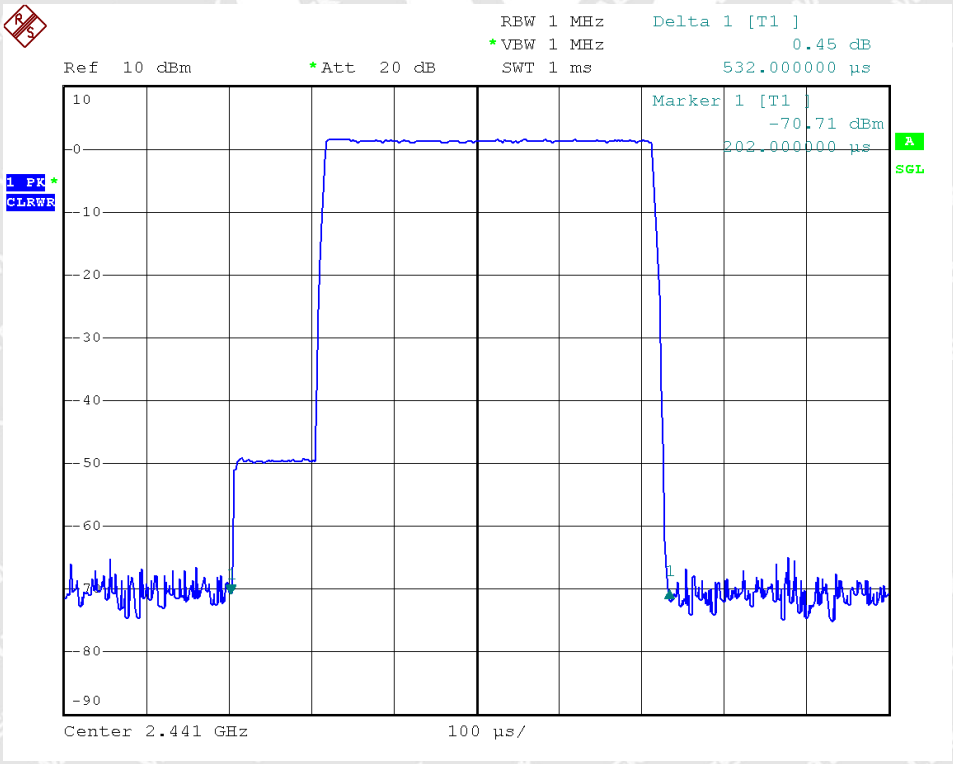
Mode: DH5



Mode: DH3

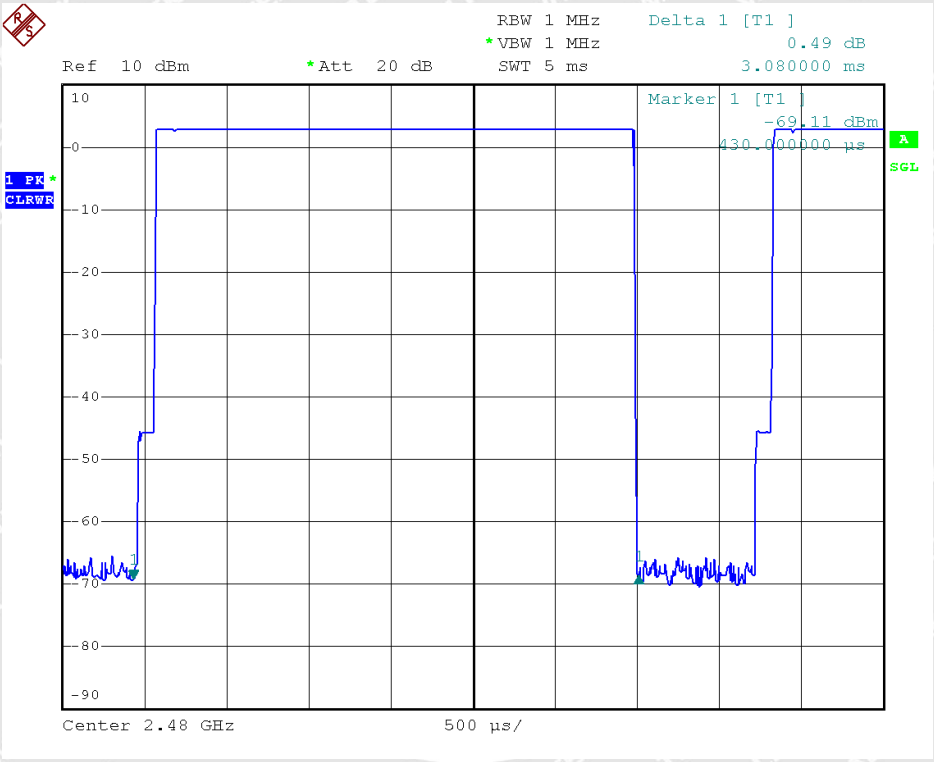


Mode: DH 1

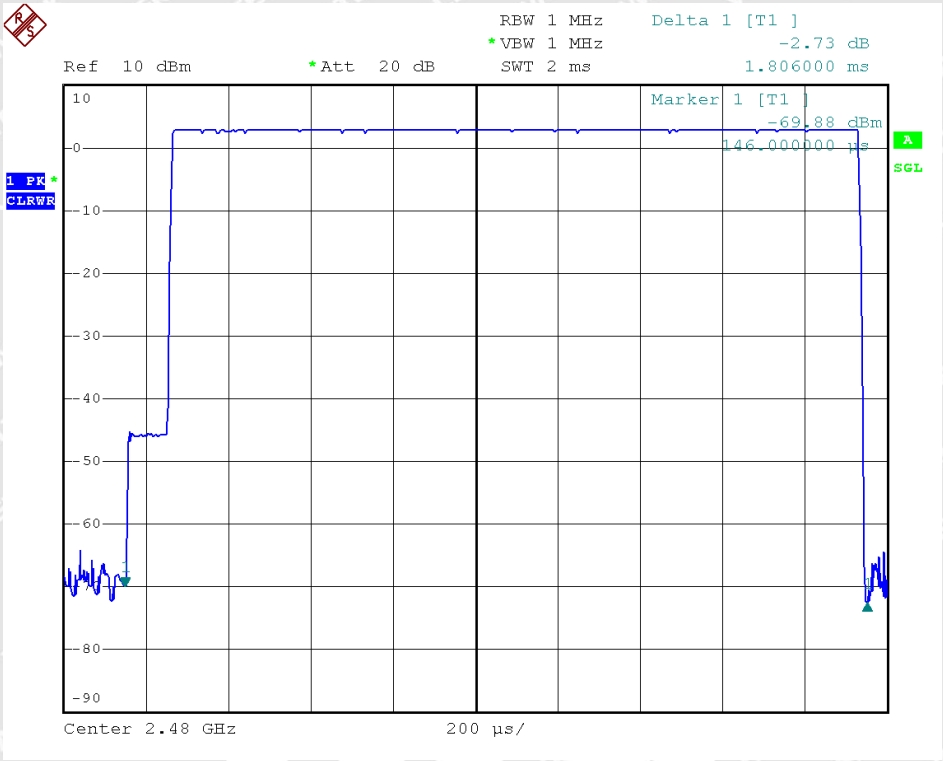


Data Packet	Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
DH5	Upper	3.080	0.329	DH5	Pass
DH3	Upper	1.806	0.289	DH3	Pass
DH1	Upper	0.528	0.169	DH1	Pass

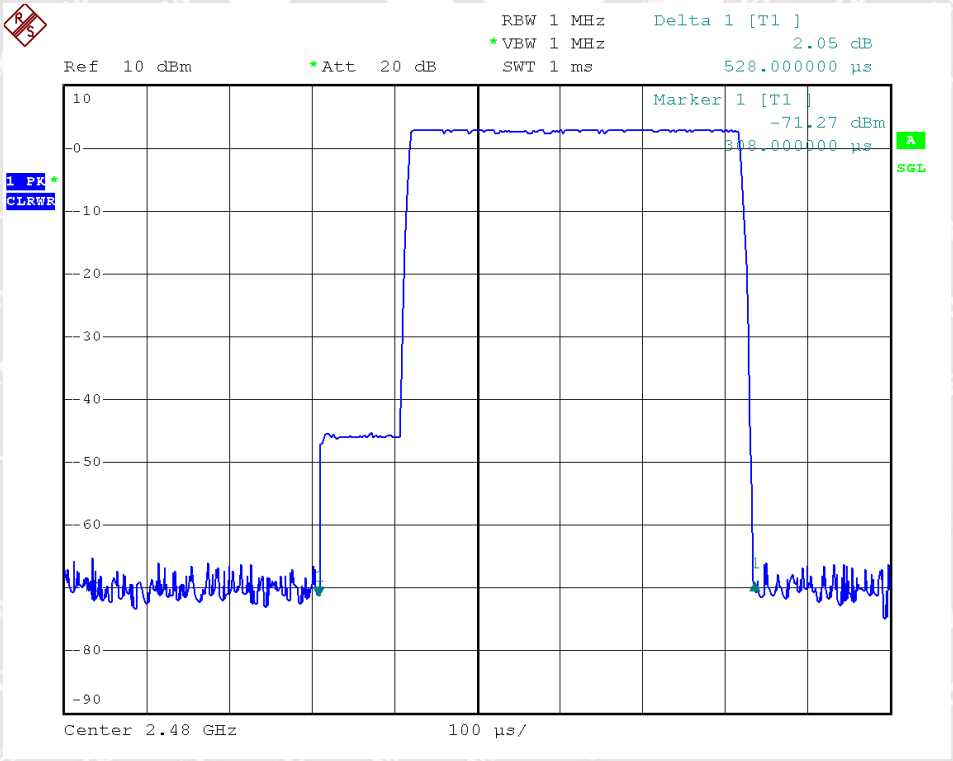
Mode: DH5



Mode: DH3



Mode: DH1



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 PCB printed antenna, fulfil the requirement of this section.

15 RF Exposure

15.1 Requirements:

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.

15.2 Measurement Result:

Channel	Antenna Gain (dBi)	Antenna Gain (numeric)	Conducted Power (dBm)	Conducted Power (mW)
Lower	0	1	3.15	2.07
Middle	0	1	3.26	2.12
Upper	0	1	3.31	2.14

Formula: dBm=10lg(mw), $Gain_{numeric}=10^{(dBi/10)}$

The EUT works on the 2.4GHz ISM band, and the max output power (conducted) of which is 2.14mW lower than low threshold 60/f (GHz) mW (25mW), d < 2.5cm in general population category.

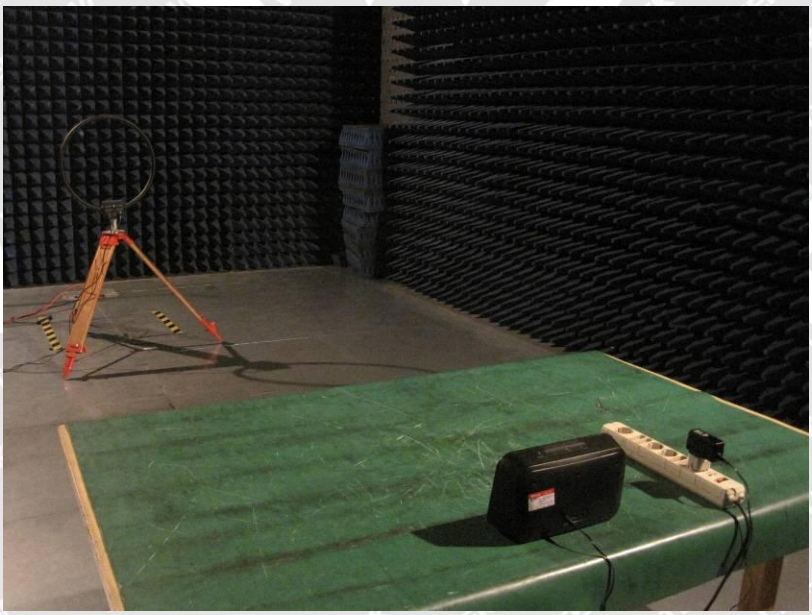
The SAR evaluation is not required.

16 Photographs –Test Setup

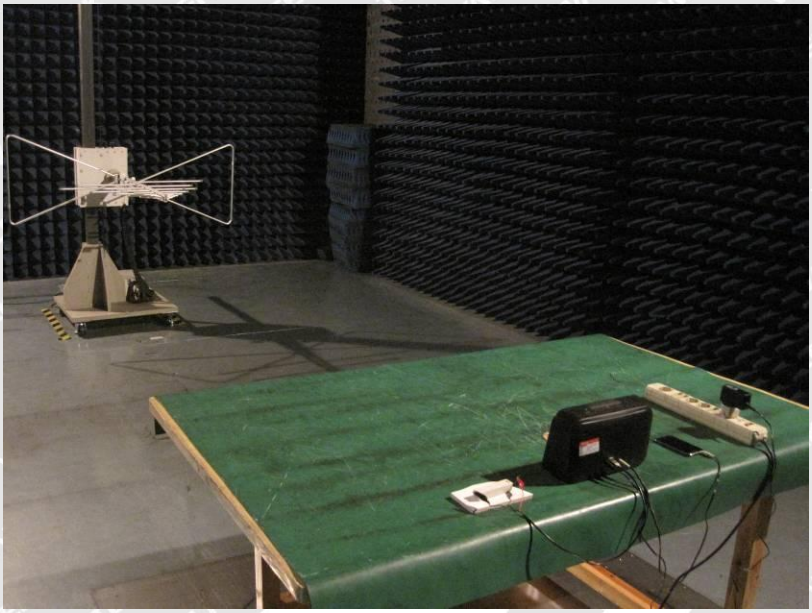
16.1 Conduction Emission

16.2 Radiation Spurious Emission

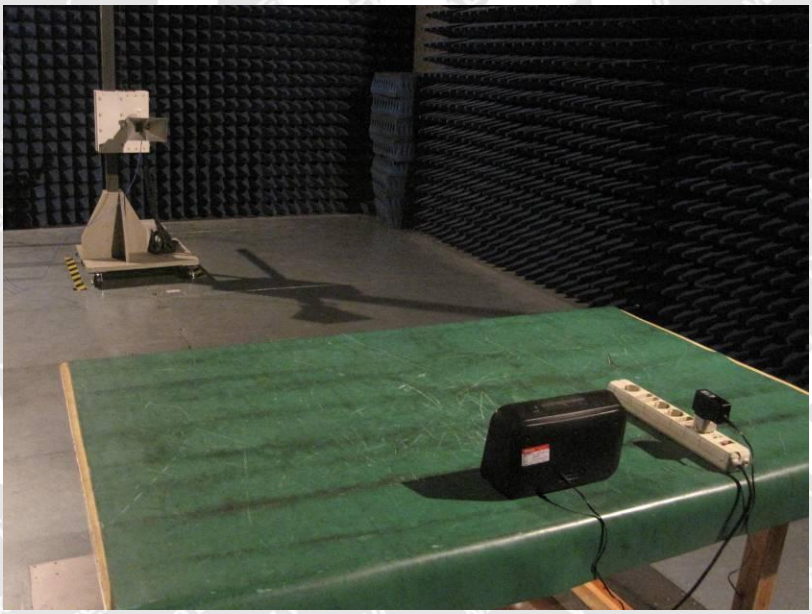
Below 30MHz



From 30-1000MHz



Above 1GHz

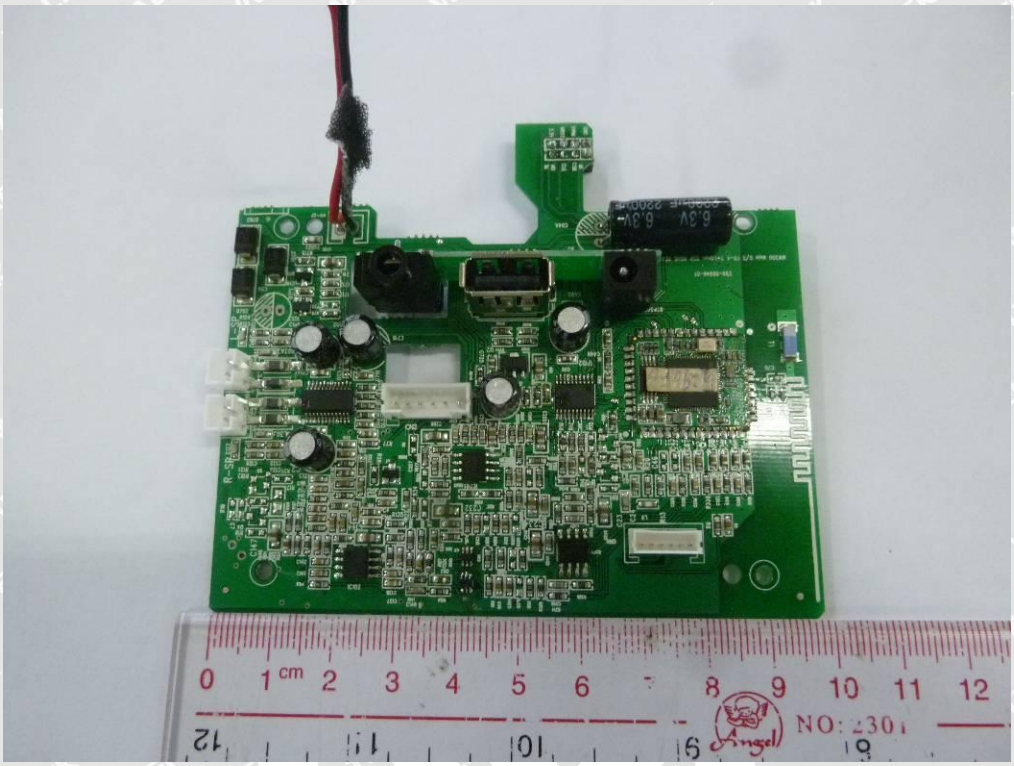


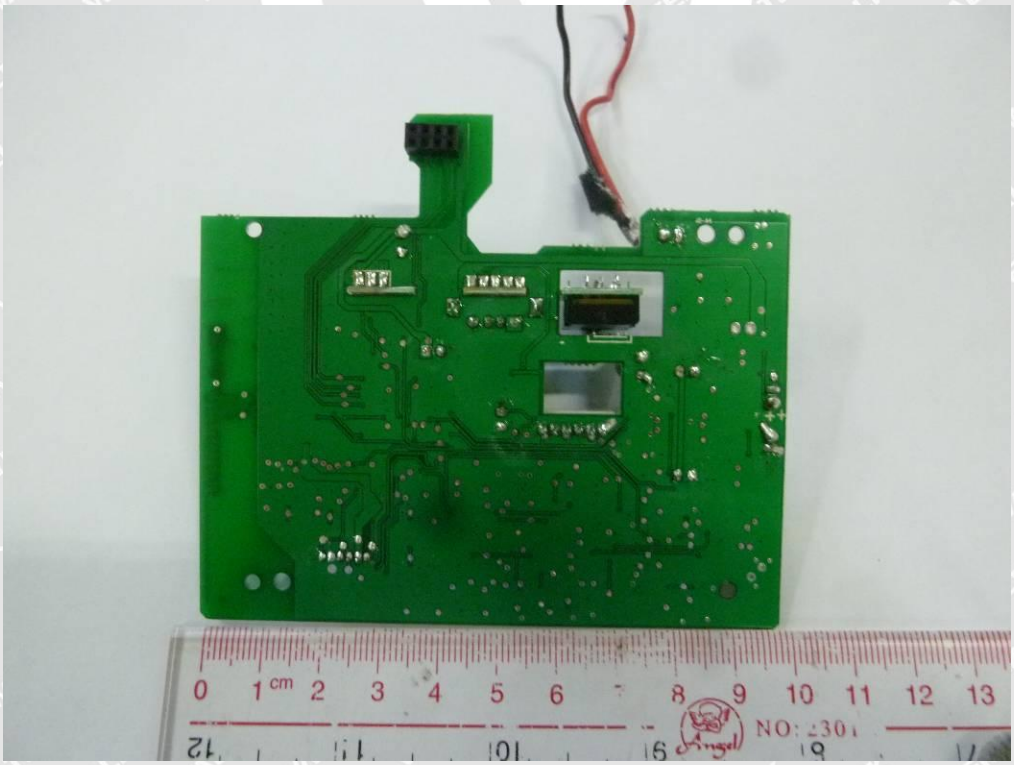
17 Photographs - Constructional Details

17.1 EUT – Appearance View

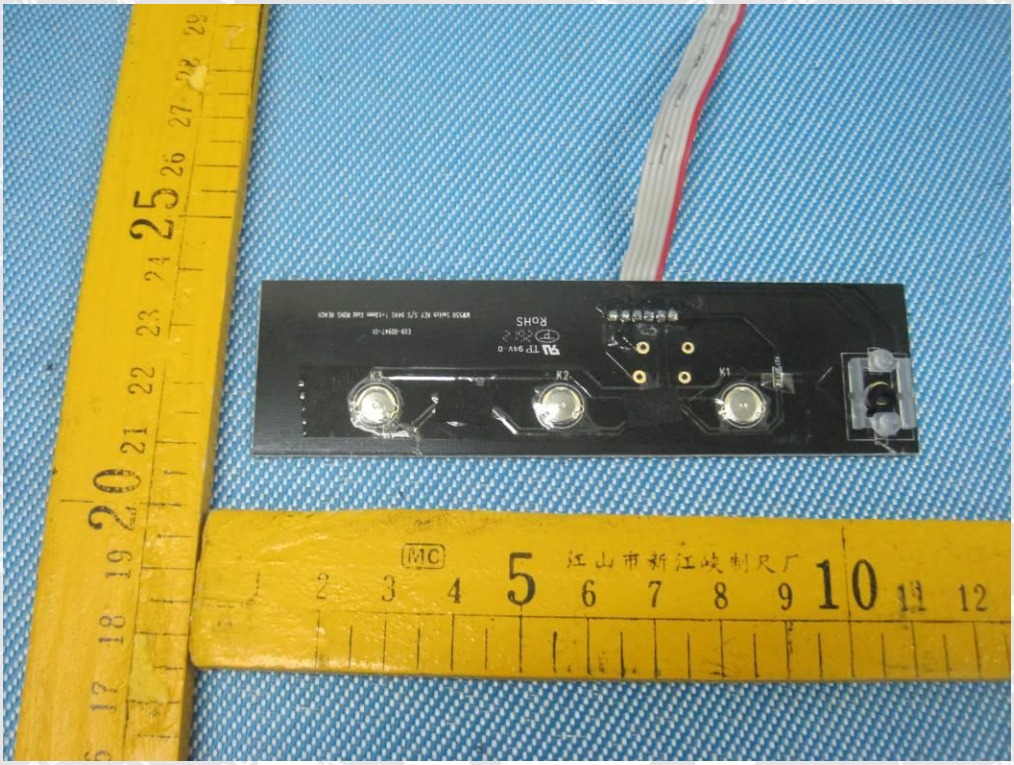
17.2 EUT- Open View

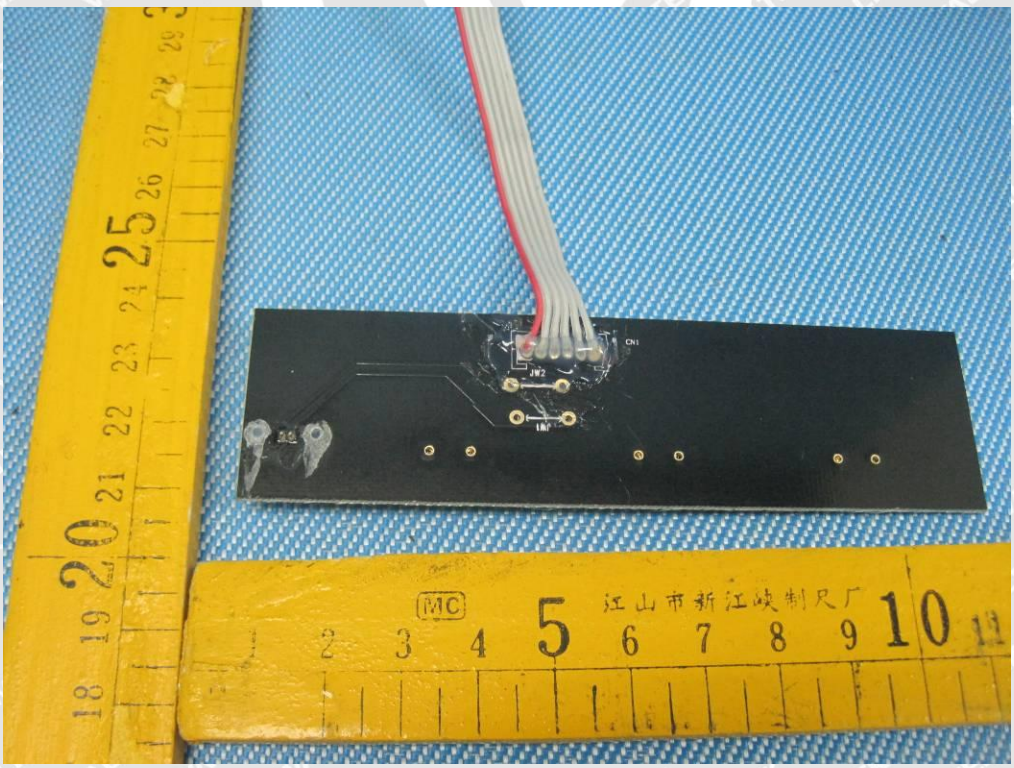
17.3 EUT – PCB1 View





17.4 EUT – PCB2 View





18 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 harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
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 Back View/ proposed FCC Label Location