

FCC TEST REPORT

for

Audio Components International, Inc.

Wireless

Model Number: ES-SUB-WIRELESS-KIT

FCC ID:2AGTU-WIRELESS
IC:20907-WIRELESS

Prepared for : Audio Components International, Inc.

Address : 27520 Hawthorne Blvd., Suite 169, Rolling Hills Estates,
CA 90274, USA

Prepared by : Keyway Testing Technology Co., Ltd.

Address : Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

Tel: 86-769-8718 2258

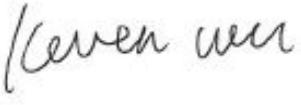
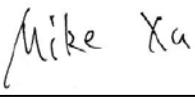
Fax: 86-769-8718 1058

Report No. : 15KWE113219F
Date of Test : Nov. 5~Dec. 4,2015
Date of Report : Dec. 5, 2015

TABLE OF CONTENTS

	Page
Test Report Declaration	1
1. TEST SUMMARY	4
2. GENERAL PRODUCT INFORMATION	4
2.1. Product Function.....	4
2.2. Description of Device (EUT).....	4
2.3. Channel List.....	4
2.4. Independent Operation Modes.....	5
2.5. Test Supporting System	5
2.6. Product Version	5
2.7. TEST SITES	5
2.8. List of Test and Measurement Instruments	6
3. TEST SET-UP AND OPERATION MODES.....	7
3.1. Principle of Configuration Selection.....	7
3.2. Block Diagram of Test Set-up.....	7
3.3. Test Operation Mode and Test Software.....	7
3.4. Special Accessories and Auxiliary Equipment.....	7
3.5. Countermeasures to Achieve EMC Compliance	7
4. EMISSION TEST RESULTS.....	8
4.1. Conducted Emission at the Mains Terminals Test.....	8
4.2. Radiated Emission Test.....	13
5. BAND EDGE COMPLIANCE TEST.....	20
5.1. Limits	20
5.2. Test setup	20
6. BANDWIDTH TEST	24
6.1. Limits	24
6.2. TEST PROCEDURE	24
7. OUTPUT POWER TEST	28
7.1. Limits	28
7.2. Test setup	28
7.3. Test result	28
8. POWER SPECTRAL DENSITY TEST.....	29
8.1. Limits	29
8.2. Test setup	29
8.3. Test result	29
9. ANTENNA REQUIREMENTS	33
9.1. Limits	33
9.2. Result	33
10. PHOTOGRAPHS OF TEST SET-UP	34
11. PHOTOGRAPHS OF THE EUT	36

Keyway Testing Technology Co., Ltd.

Applicant:	Audio Components International, Inc. 27520 Hawthorne Blvd., Suite 169, Rolling Hills Estates, CA 90274, USA		
Manufacturer:	GREEN TECH(DONG GUAN)CO., LTD. 3 RD FL, BLDG I, NO 7 NanSi Street, XianMangXi Road, QingXi Town, DongGuan City, Guang Dong Province, China 523660		
E.U.T:	Wireless		
Model Number:	ES-SUB-WIRELESS-KIT		
Trade Name:	Episode	Serial No.:	-----
Date of Receipt:	Nov. 4 , 2015	Date of Test:	Nov. 5~Dec.4,2015
Test Specification:	FCC Part 15, Subpart 15.247: Oct. 1, 2014 ANSI C63.10:2013 KDB558074 D01 DTS Meas Guidance v03r03 RSS-247 Issue 1 May 2015 RSS-Gen Issue 4 November 2014		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: Dec. 5, 2015			
Tested by:	Reviewed by:	Approved by:	
		 Andy Gao	
Keven Wu / Engineer	Mike Xu / Supervisor	Andy Gao / Supervisor	
Other Aspects:	None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.			

1.TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207 &RSS-Gen §8.8	PASS
Radiated Emissions	15.205(a)/15.209/15.247(d) &RSS-Gen §6.13	PASS
6dB&99% Bandwidth	15.247(a)(2)& RSS-247 §5.2(1) &RSS-Gen§6.6	PASS
Power density	15.247(e) &RSS-247 §5.2 (2)	PASS
Maximum Peak Output Power	15.247(b)(3)& RSS-247 §5.4&RSS-Gen§6.12	PASS
Emissions from out of band	15.247(d) & RSS-247 §5.5	PASS
Antenna Requirement	15.203&RSS-Gen§8.3	PASS

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Wireless
Model No.:	ES-SUB-WIRELESS-KIT
Operation Frequency:	2412MHz~2464MHz
Modulation technology:	QPSK (DSSS)
Antenna Type:	PCB ANT
Antenna gain:	ANT A:2.408dBi ANT B:2.408dBi
Power supply:	DC 5V from adapter
Adapter:	Mode: GQ05-050050-CU Input: 100-240V~, 50/60Hz, 0.3A Max Output: 5V--, 500mA

2.3. Channel List

Channel	Frequency (MHz)
01	2412
02	2438
03	2464

2.4. Independent Operation Modes

The basic operation modes are:

2.4.1. EUT work TX mode, and frequency as below:

Channel	Frequency
Low	2412MHz
Middle	2438MHz
High	2464MHz

Remark: According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup"

2.5. Test Supporting System

Antenna A/ B are transmitting, two antennas simultaneously transmit. And the data is recorded for radiated emission and band edge.

For MIMO mode , Directional gain=GANT +10log(N)dbi =5.42dbi

The EUT has MIMO mode.

2.6. Product Version

Product SW version	100X-D1
Product HW version	100X-D1
Radio SW version	DWLC84-L2
Radio HW version	DWLC84-L2

Note: SW means software, HW means hardware.

2.7. TEST SITES

2.7.1. Test Facilities

Lab Qualifications : Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

2.8. List of Test and Measurement Instruments

2.8.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,15	Apr. 27,16
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,15	Apr. 27,16
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,15	Apr. 27,16

2.8.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
System Simulator	Agilent	E5515C	GB43130245	Apr. 27,15	Apr. 27,16
Power Splitter	Weinschel	1506A	NW425	Apr. 27,15	Apr. 27,16
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	R&S	FSV40	132.1.3008K39-100967	Apr. 27,15	Apr. 27,16
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,15	Apr. 27,16
Signal Amplifier	SONOMA	310	187016	Apr. 27,15	Apr. 27,16
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,15	Apr. 27,16
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 27,15	Apr. 27,16
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,15	Apr. 27,16
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,15	Apr. 27,16
High Pass filter	Micro	HPM50111	324216	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 27,15	Apr. 27,16
DC Power Supply	LongWei	PS-305D	010964729	Apr. 27,15	Apr. 27,16
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 27,15	Apr. 27,16
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	Apr. 27,15	Apr. 27,16
Splitter	Agilent	11636B	0025164	Apr. 27,15	Apr. 27,16
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 22,15	Apr. 22,16
Power Meter	R&S	NRVS	100696	Apr. 24,15	Apr. 24,16
Power Sensor	R&S	URV5-Z4	395.1619.05	Apr. 24,15	Apr. 24,16

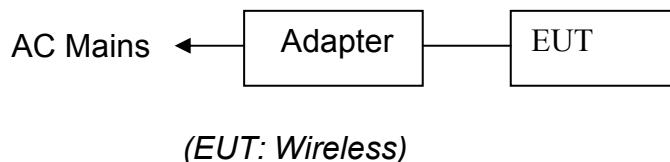
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Conducted Emission at the Mains Terminals Test

4.1.1. Limit 15.209 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

4.1.2. Test Setup

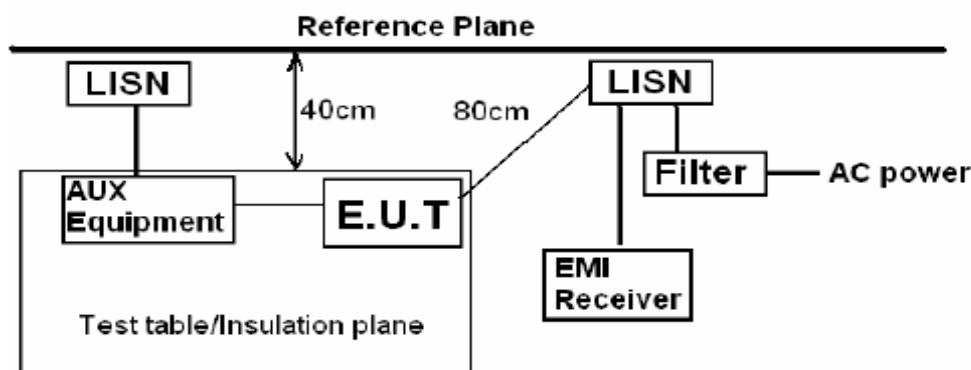
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



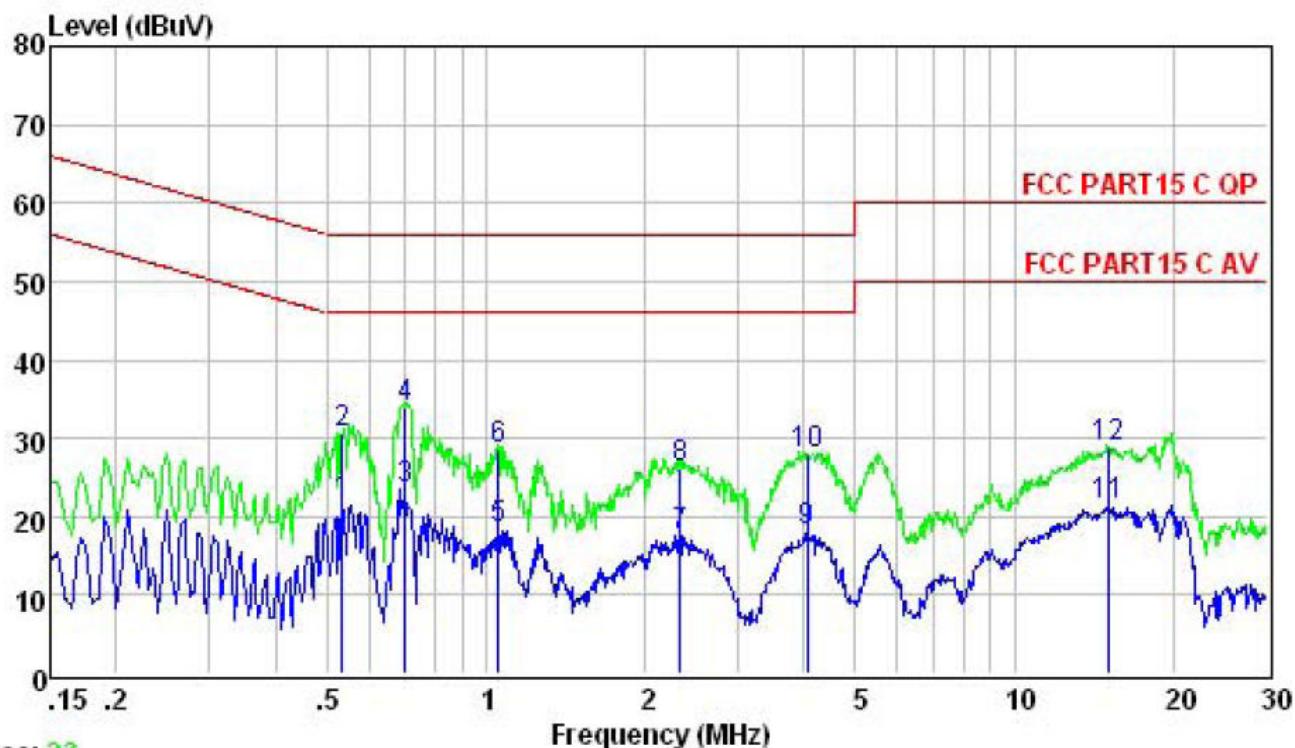
Remark:

E.U.T: Equipment Under Test

LISN: Line Impedance Stabilization Network

Test table height=0.8m

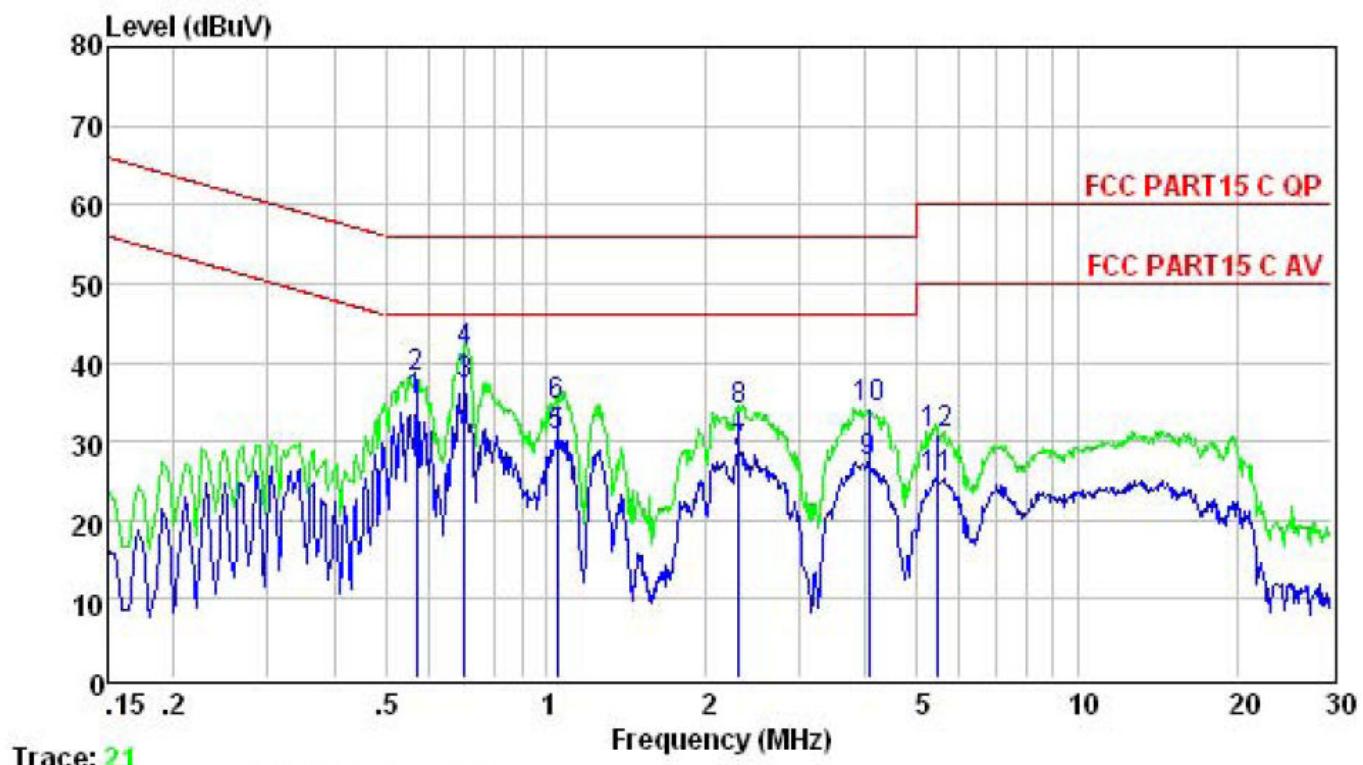
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 5.0V form Adapter AC 120V/60Hz		



Trace: 23

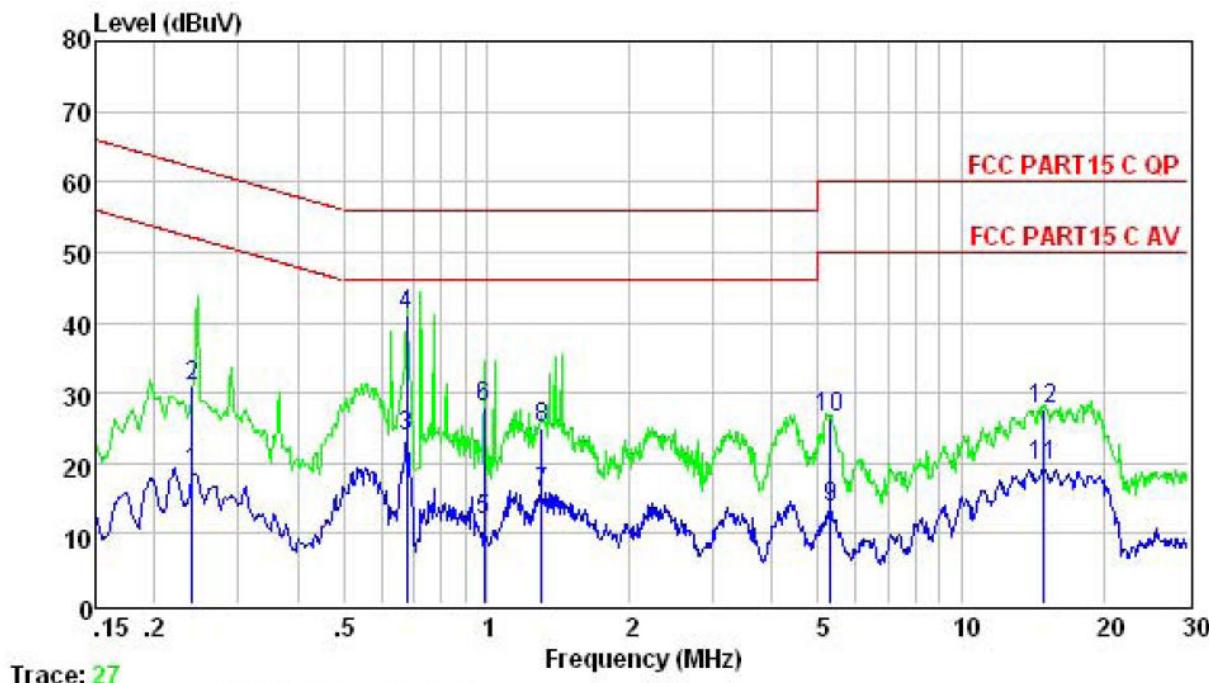
Freq	Level	Limit	Over	Remark
		Line	Limit	
MHz	dBuV	dBuV	dB	
1	0.535	21.66	56.00	-34.34 Average
2	0.535	30.59	56.00	-25.41 QP
3	0.705	23.47	56.00	-32.53 Average
4	0.705	34.03	56.00	-21.97 QP
5	1.054	18.44	56.00	-37.56 Average
6	1.054	28.69	56.00	-27.31 QP
7	2.334	17.61	56.00	-38.39 Average
8	2.334	26.19	56.00	-29.81 QP
9	4.049	18.04	56.00	-37.96 Average
10	4.049	28.09	56.00	-27.91 QP
11	15.066	21.49	60.00	-38.51 Average
12	15.066	28.94	60.00	-31.06 QP

EUT :	Wireless	Model Name :	ES-SUB-WIRELESS-KIT
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 5.0V form Adapter AC 120V/60Hz		



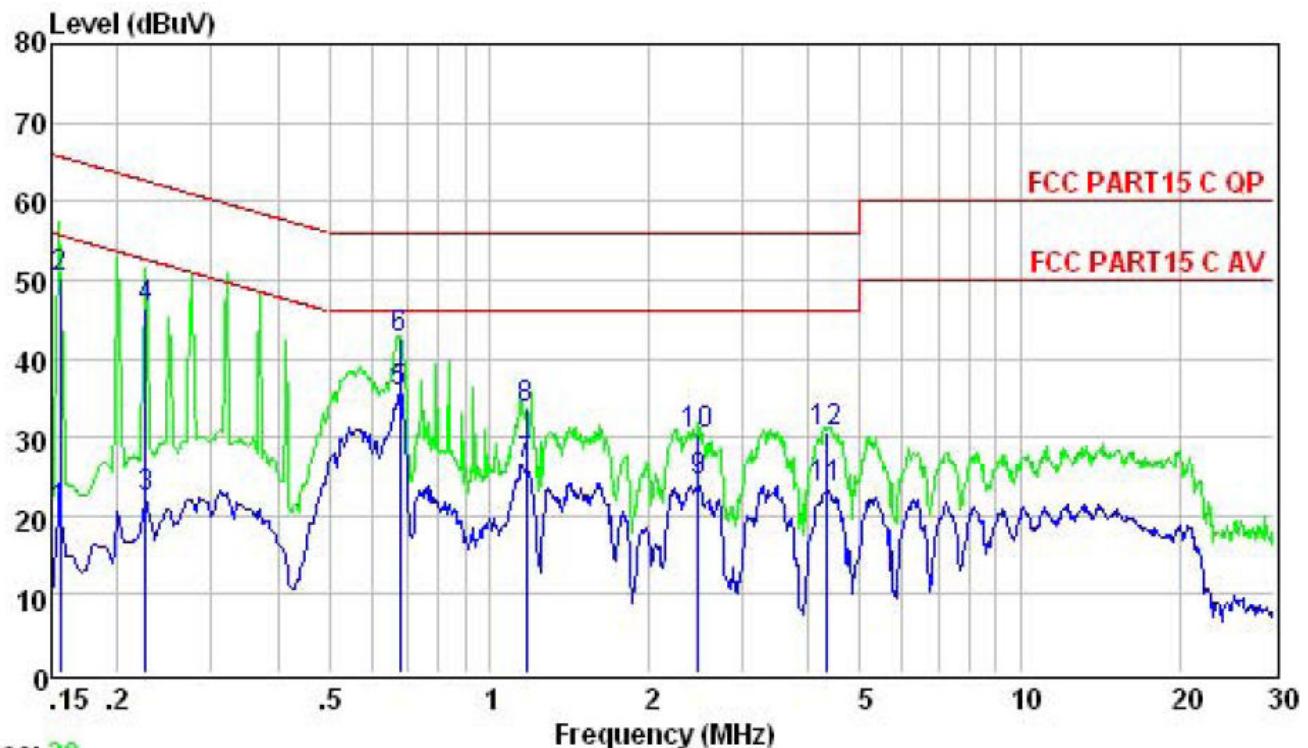
Freq	Level	Limit		Over Limit	Remark
		MHz	dBuV	dBuV	dB
1	0.570	35.03	56.00	-20.97	Average
2	0.570	38.02	56.00	-17.98	QP
3	0.705	37.22	56.00	-18.78	Average
4	0.705	41.26	56.00	-14.74	QP
5	1.049	30.50	56.00	-25.50	Average
6	1.049	34.52	56.00	-21.48	QP
7	2.309	28.53	56.00	-27.47	Average
8	2.309	34.03	56.00	-21.97	QP
9	4.049	27.49	56.00	-28.51	Average
10	4.049	34.19	56.00	-21.81	QP
11	5.447	25.37	60.00	-34.63	Average
12	5.447	31.06	60.00	-28.94	QP

EUT :	Wireless	Model Name :	ES-SUB-WIRELESS-KIT
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 5.0V form Adapter AC 240V/60Hz		



Freq	Level	Limit		Over	Remark
		Line	Limit		
MHz	dBuV	dBuV	dB		
1	0.240	18.65	62.08	-43.43	Average
2	0.240	30.96	62.08	-31.12	QP
3	0.679	23.81	56.00	-32.19	Average
4	0.679	41.09	56.00	-14.91	QP
5	0.989	11.78	56.00	-44.22	Average
6	0.989	28.03	56.00	-27.97	QP
7	1.310	15.78	56.00	-40.22	Average
8	1.310	24.96	56.00	-31.04	QP
9	5.305	13.58	60.00	-46.42	Average
10	5.305	26.42	60.00	-33.58	QP
11	14.907	19.52	60.00	-40.48	Average
12	14.907	27.53	60.00	-32.47	QP

EUT :	Wireless	Model Name :	ES-SUB-WIRELESS-KIT
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 5.0V form Adapter AC 240V/60Hz		



Freq	Level	Limit		Over	Remark
		MHz	dBuV	dBuV	dB
1	0.156	20.45	65.69	-45.24	Average
2	0.156	50.35	65.69	-15.34	QP
3	0.226	22.21	62.61	-40.40	Average
4	0.226	46.39	62.61	-16.22	QP
5	0.679	35.72	56.00	-20.28	Average
6	0.679	42.59	56.00	-13.41	QP
7	1.172	26.56	56.00	-29.44	Average
8	1.172	33.47	56.00	-22.53	QP
9	2.474	24.31	56.00	-31.69	Average
10	2.474	30.26	56.00	-25.74	Peak
11	4.338	23.37	56.00	-32.63	Average
12	4.338	30.65	56.00	-25.35	QP

4.2. Radiated Emission Test

4.2.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		µV/m	dB(µV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(µV)/m (Peak) 54.0 dB(µV)/m (Average)	

4.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m(above 1GHz, the high was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

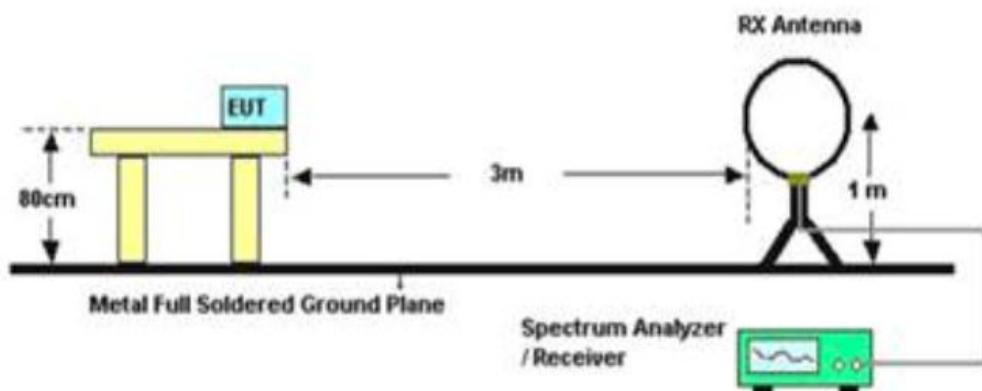
The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

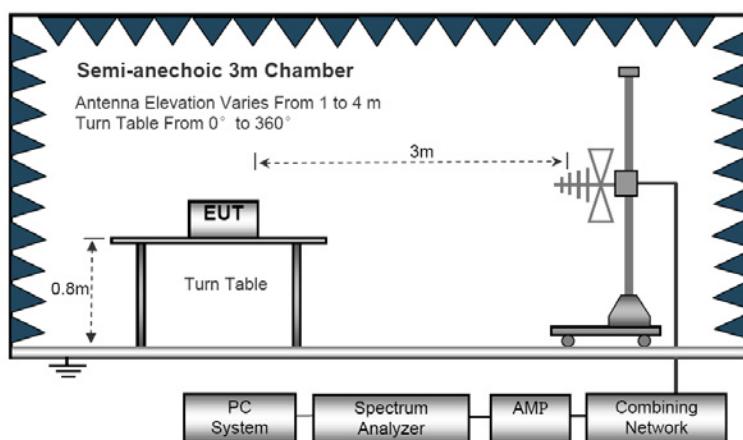
The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

- Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading+Preamp Factor.
 2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.
 3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
 4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
 5. For Both PK and AV value above 1GHz, PK detector is used.
 6. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

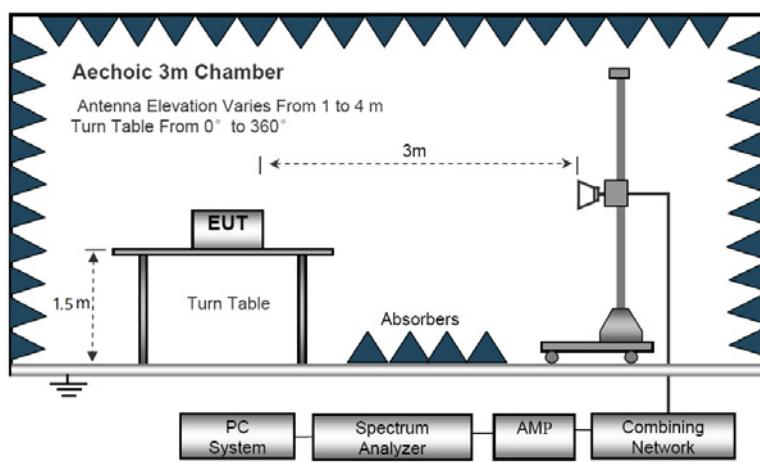
Radiated Emission Test-Up Frequency Below 30MHz



30MHz- 1GHz



Above 1GHz



Below 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

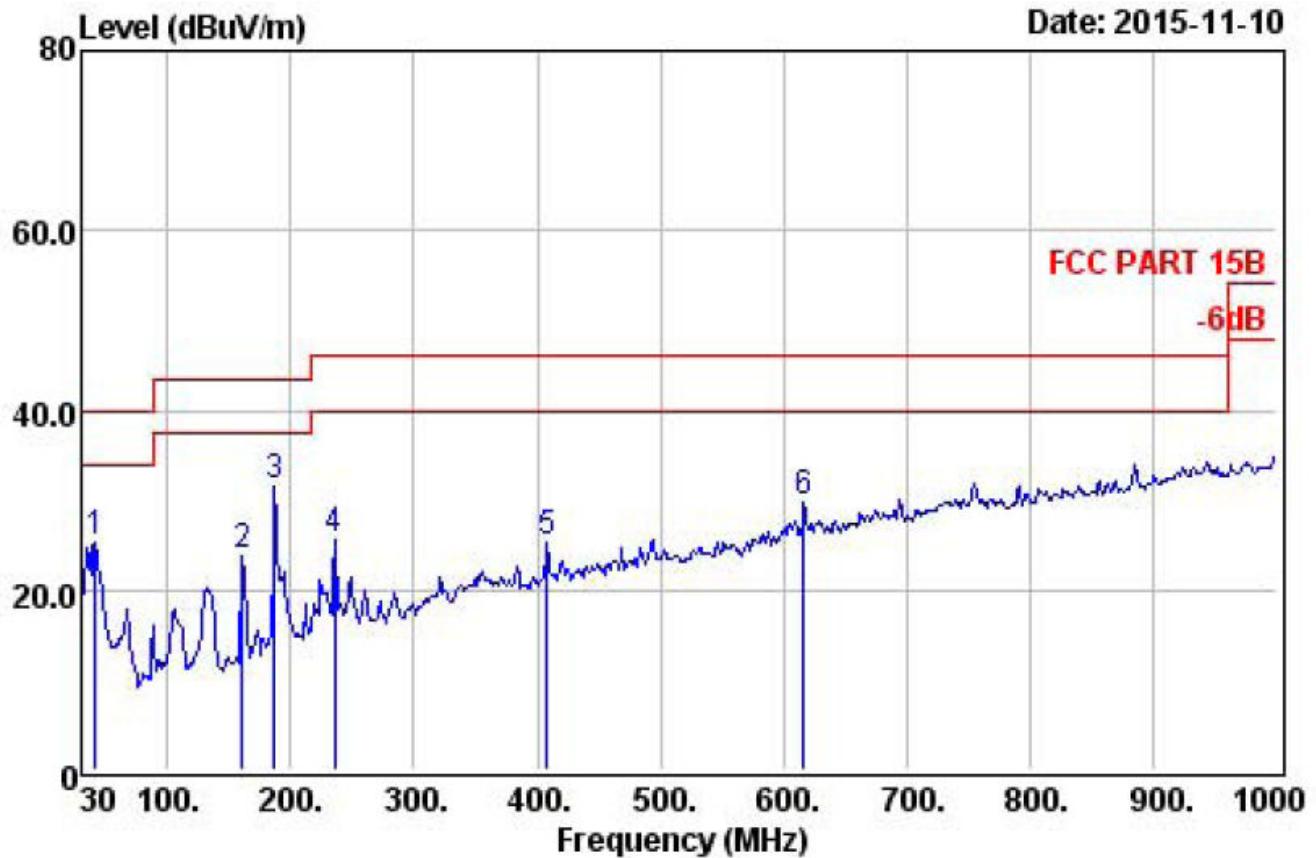
Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

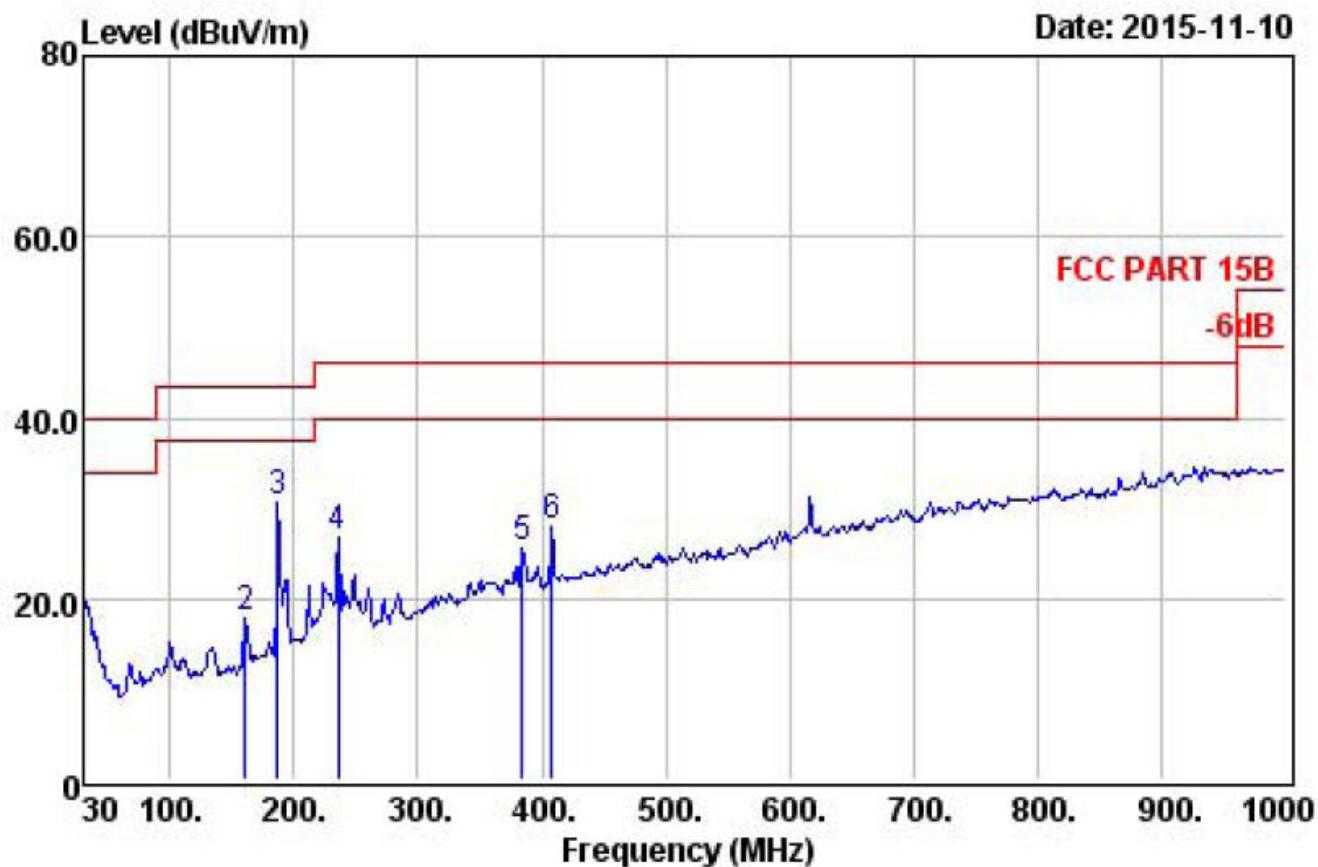
Below 1GHz

Vertical



Freq	Preamp Factor	Read Level	Cable Loss	Line Level	Limit Line	Over Limit	Over Remark	
							dB	
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m		
1	41.64	31.38	43.90	0.56	25.31	40.00	-14.69	QP
2	160.95	31.22	44.31	1.30	23.68	43.50	-19.82	QP
3	187.14	31.13	51.04	1.39	31.49	43.50	-12.01	QP
4	235.64	30.94	42.41	1.61	25.58	46.00	-20.42	QP
5	408.30	30.63	36.87	2.48	25.29	46.00	-20.71	QP
6	616.85	30.64	35.94	3.38	29.75	46.00	-16.25	QP

Horizontal



Preamp Freq	Factor	Read	Cable	Limit Line	Over Limit	Remark
		Level	Loss			
MHz	dB	dBuV	dB	dBuV/m	dBuV/m	
1	30.00	31.41	33.12	0.56	21.07	40.00 -18.93 QP
2	160.95	31.22	38.55	1.30	17.92	43.50 -25.58 QP
3	187.14	31.13	50.18	1.39	30.63	43.50 -12.87 QP
4	235.64	30.94	43.65	1.61	26.82	46.00 -19.18 QP
5	384.05	30.62	37.66	2.27	25.54	46.00 -20.46 QP
6	408.30	30.63	39.56	2.48	27.98	46.00 -18.02 QP

Above 1GHz

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low Channel (2412 MHz)-Above 1G							
Vertical	4824.012	47.87	10.44	58.31	74	-15.69	Pk
Vertical	4824.012	38.11	10.44	48.55	54	-5.45	AV
Vertical	7236.000	39.12	12.39	51.51	74	-22.49	pk
Horizontal	4824.012	45.74	10.44	56.18	74	-17.82	pk
Horizontal	4824.012	37.54	10.44	47.98	54	-6.02	AV
Horizontal	7236.000	30.54	12.39	42.93	74	-31.07	pk
Mid Channel (2438 MHz)-Above 1G							
Vertical	4876.000	47.19	10.40	57.59	74	-16.41	pk
Vertical	4876.000	37.76	10.40	48.16	54	-5.84	AV
Vertical	7314.000	36.87	12.75	49.62	74	-24.38	Pk
Horizontal	4876.000	47.31	10.40	57.71	74	-16.29	Pk
Horizontal	4876.000	38.11	10.40	48.51	54	-5.49	AVk
Horizontal	7314.000	30.23	12.75	42.98	74	-31.02	Pk
High Channel (2464 MHz)- Above 1G							
Vertical	4928.000	49.12	10.39	59.51	74	-14.49	pk
Vertical	4928.000	37.99	10.39	48.38	54	-5.62	AV
Vertical	7392.000	39.13	12.68	51.81	74	-22.19	pk
Horizontal	4928.000	47.15	10.39	57.54	74	-16.46	Pk
Horizontal	4928.000	35.42	10.39	45.81	54	-8.19	AV
Horizontal	7392.000	31.56	12.68	44.24	74	-29.76	pk

Note: When PK value is lower than the Average value limit, average didn't record.

Margin= Emission Level- Limits

Emission Level= Meter Reading+ Factor

5. BAND EDGE COMPLIANCE TEST

5.1. Limits

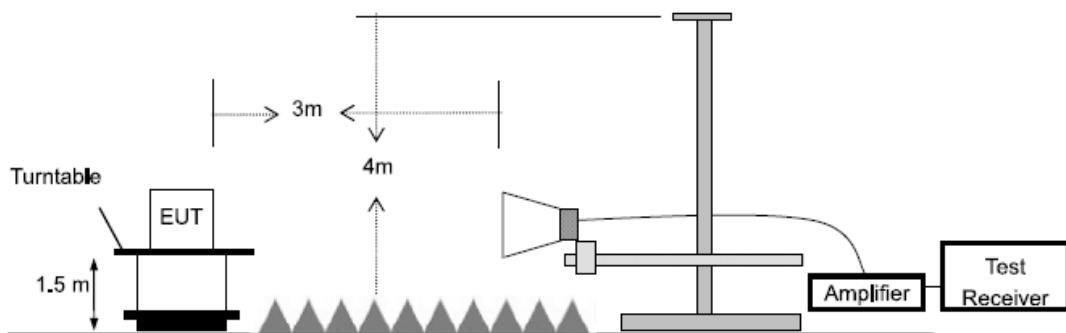
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

5.2. Test setup

For Conducted Test



For Radiated emission Test



5.3.TEST Procedure

For Conducted Test

1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

For Radiated emission Test

The EUT was placed on a styrofoam table which is 1.5m above ground plane.

The measurement procedure at the ban edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maximum peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limit for the emissions in the unrestricted band. A maximum-peak-detector marks the highest emission in the unrestricted band next to the band edge.

The measurements were performed at the lower end of the 2.4GHz band.

Use the following spectrum analyzer settings:

For Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

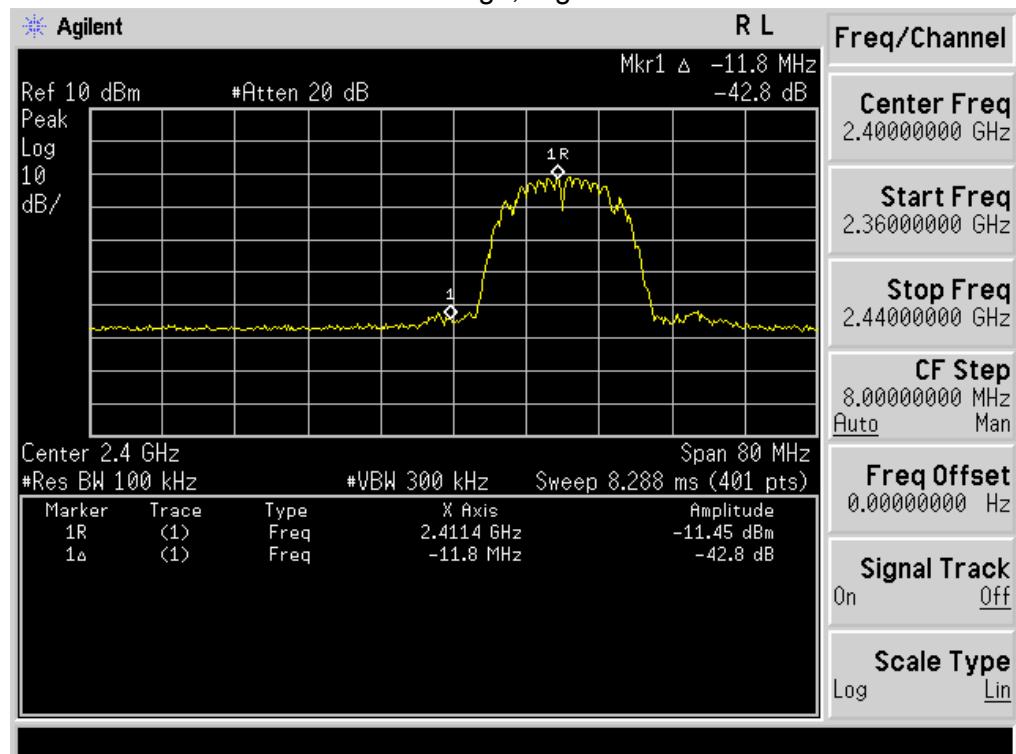
Radiated band edge:

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
		PK	PK	AV	
2390	H	50.31	74.00	54.00	Pass
2390	V	49.23	74.00	54.00	Pass
2483.5	H	50.64	74.00	54.00	Pass
2483.5	V	49.21	74.00	54.00	Pass

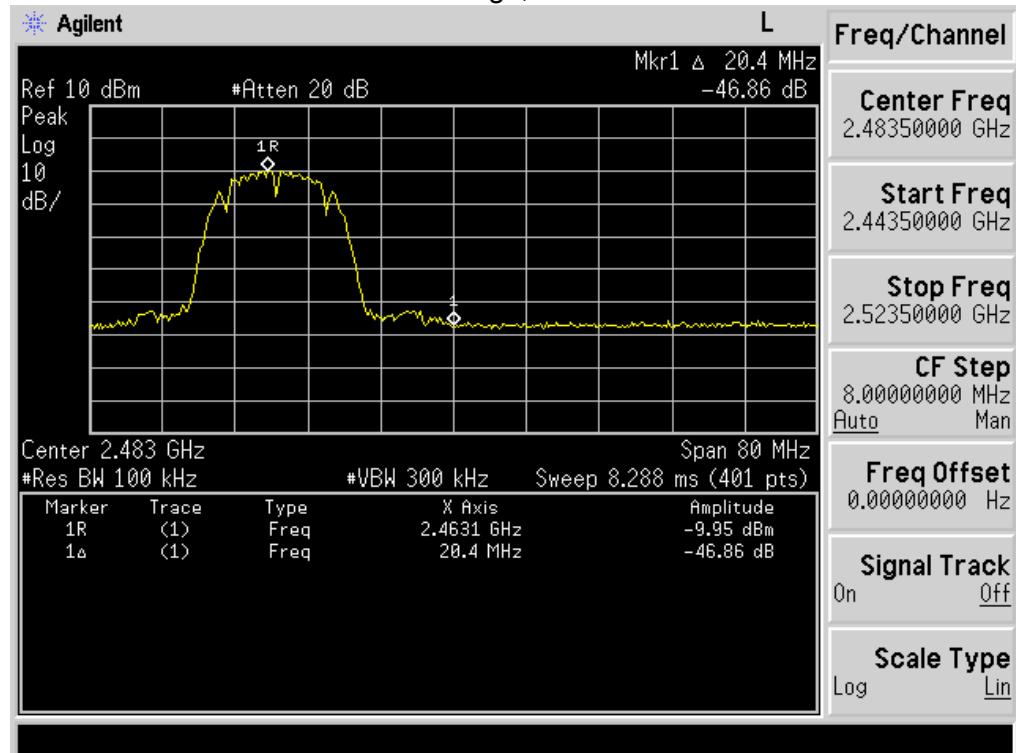
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit

Frequency Band MHz	Delta Peak to band emission (dBc)	>Limit (dBc)	Result
Left-band	42.80	20	Pass
Right-band	46.86	20	Pass

Band Edge, Right Side



Band Edge, Left Side



6. BANDWIDTH TEST

6.1. Limits

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

6.2. TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

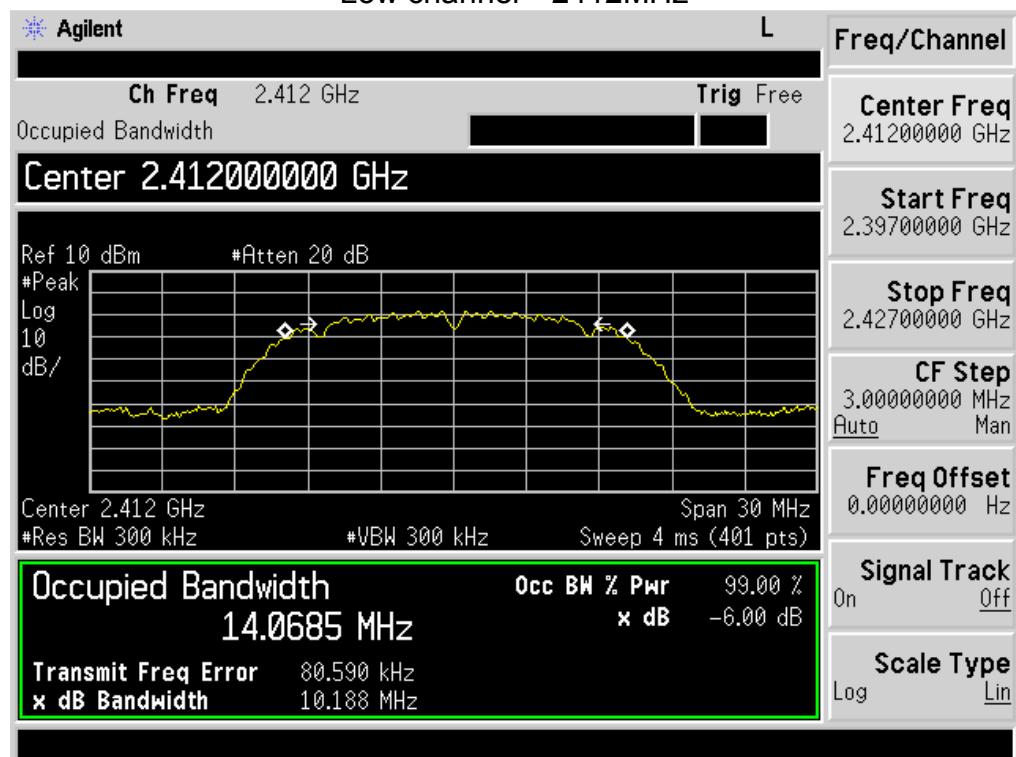
Test data:

Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
2412	10.091	14.069	>0.5	Pass
2438	9.846	14.077	>0.5	Pass
2464	9.847	14.076	>0.5	Pass

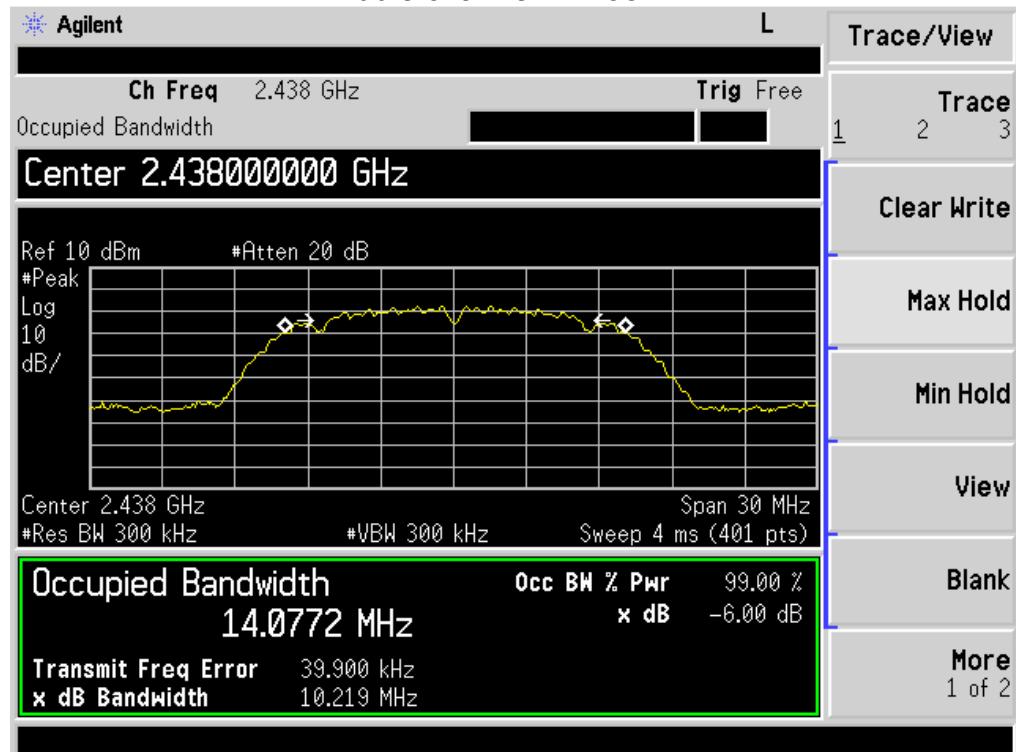
Test plot as follows:

99% bandwith

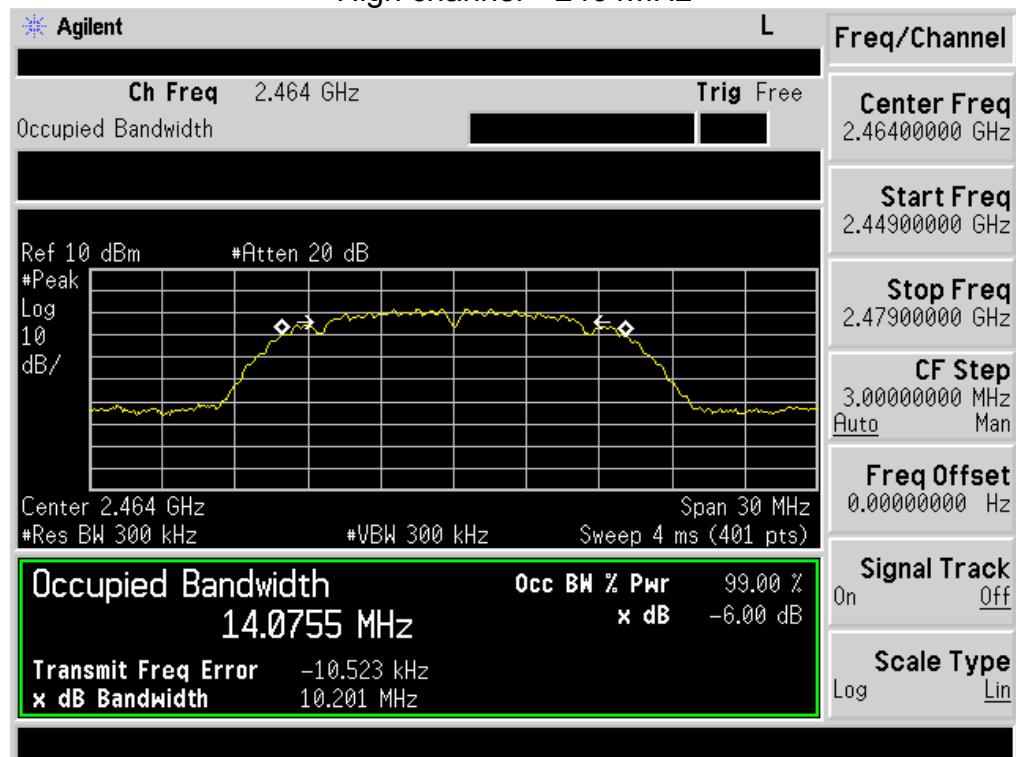
Low channel 2412MHz



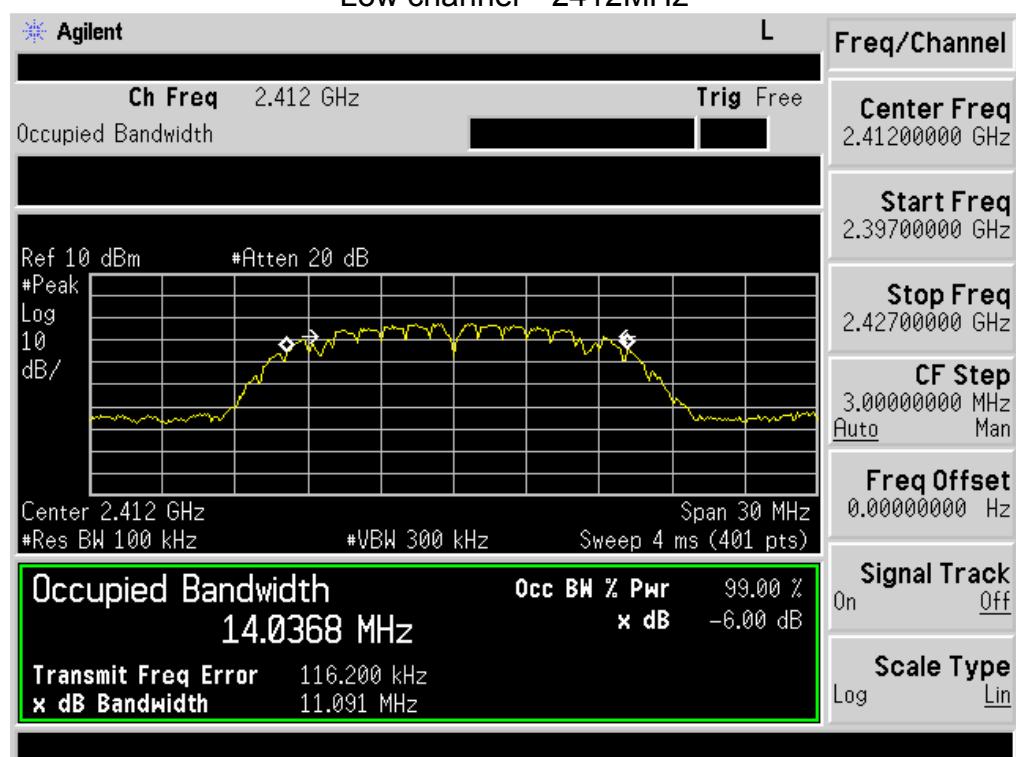
Middle channel 2438MHz



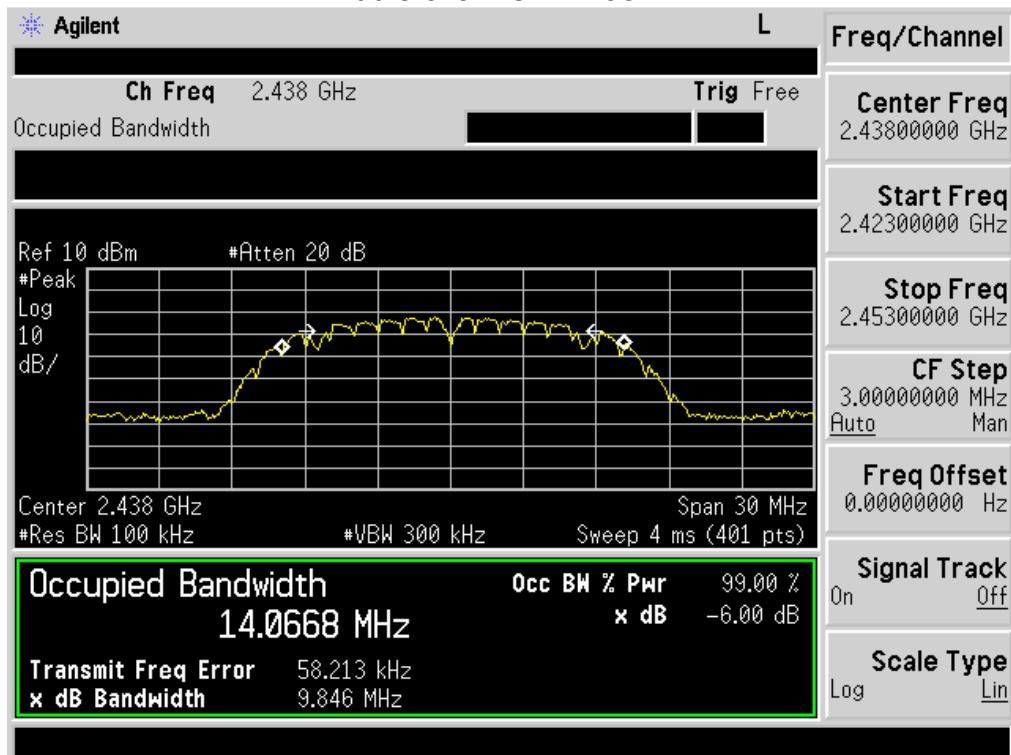
High channel 2464MHz



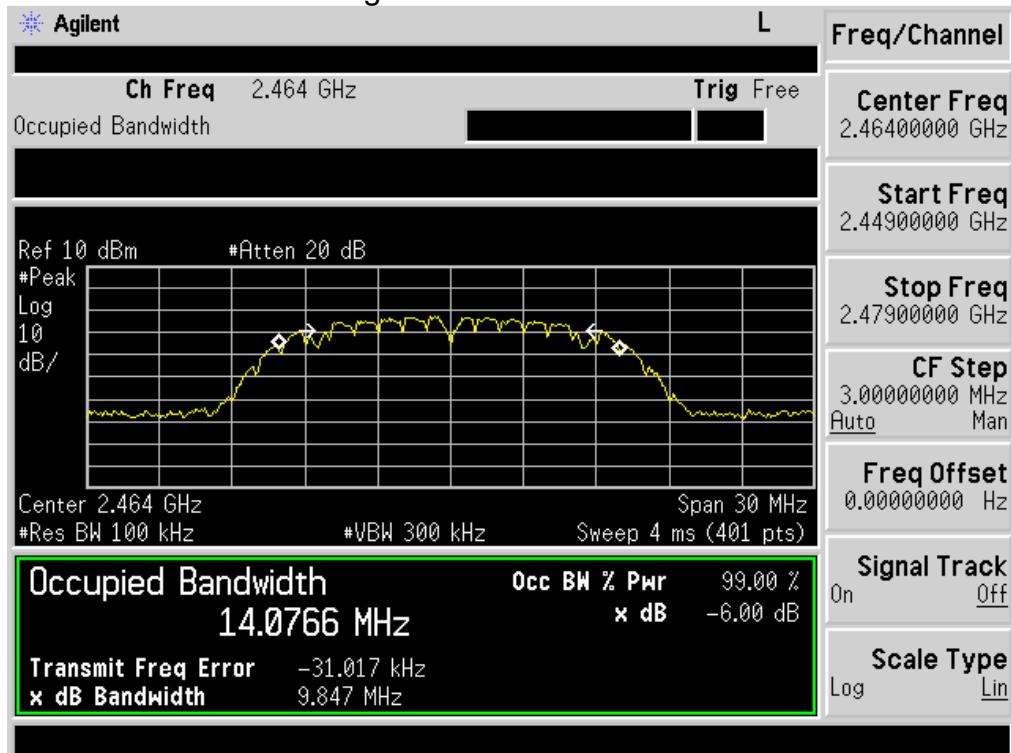
Low channel 2412MHz



Middle channel 2438MHz



High channel 2464MHz



7. OUTPUT POWER TEST

7.1. Limits

For systems using digital modulation in the 2400~2483.5MHz, The out put Power shall not exceed 1W (30dBm)

7.2. Test setup

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

7.3. Test result

Test Channel	Frequency	Maximum output power. Antenna port				Total Power		LIMIT
		(PK) (dBm)		(AV) (dBm)		(PK)	(AV)	
		(MHz)	ANT A	ANT B	ANT A	ANT B	dBm	dBm
Low	2412	8.93	8.47	5.68	5.34	11.72	8.52	30
Middle	2438	8.57	8.13	5.21	5.05	11.37	8.14	30
High	2464	8.76	8.31	5.42	5.28	11.55	8.36	30

8. POWER SPECTRAL DENSITY TEST

8.1. Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

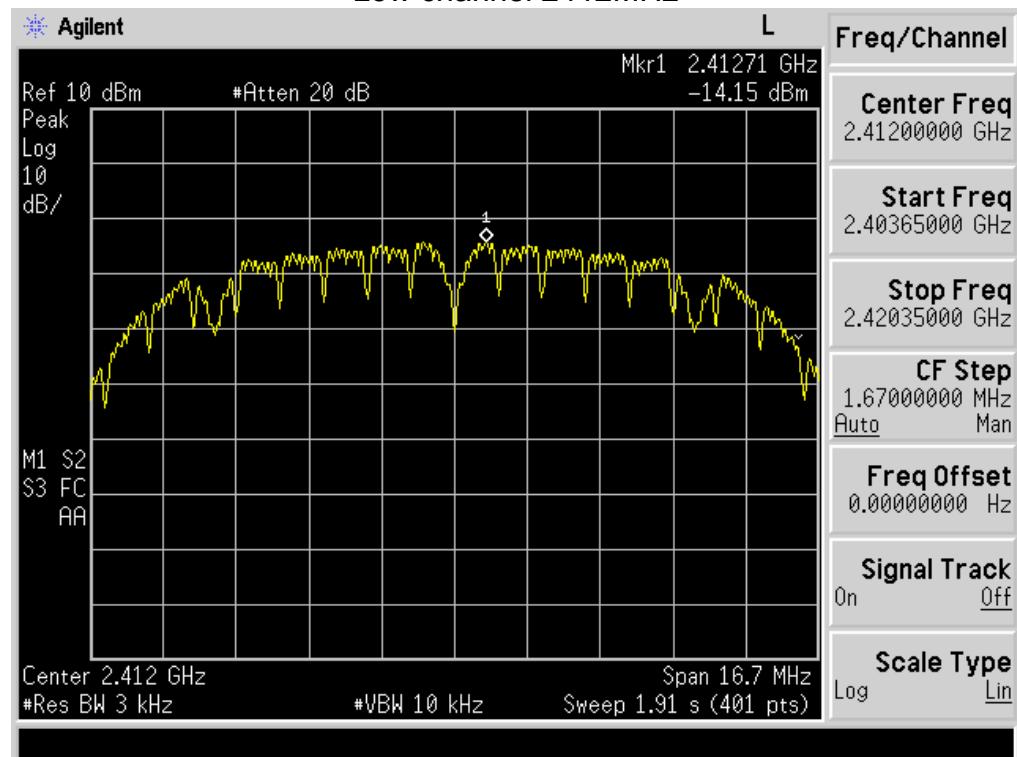
8.2. Test setup

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW =3kHz.
4. Set the VBW ≥ 3 times RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

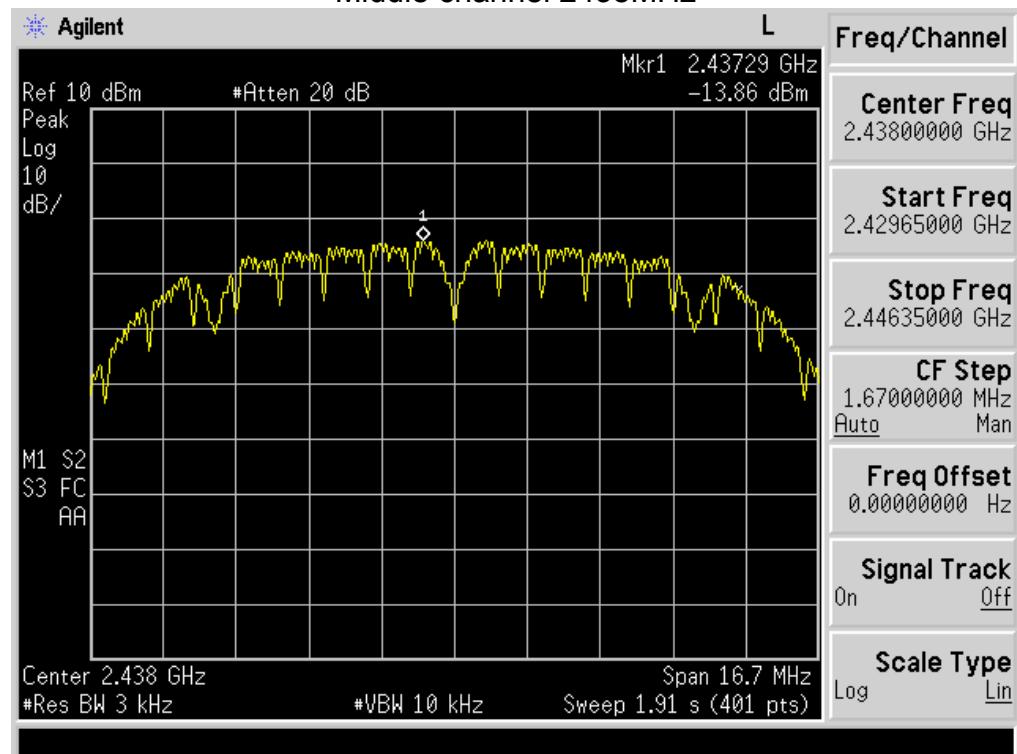
8.3. Test result

Frequency	Power Density A (dBm)	Power Density B (dBm)	total power density (dBm)	Limit (dBm)	Result
2412 MHz	-14.15	-13.26	-10.67	8	PASS
2438 MHz	-13.86	-12.02	-9.83	8	PASS
2464 MHz	-15.29	-12.01	-10.34	8	PASS

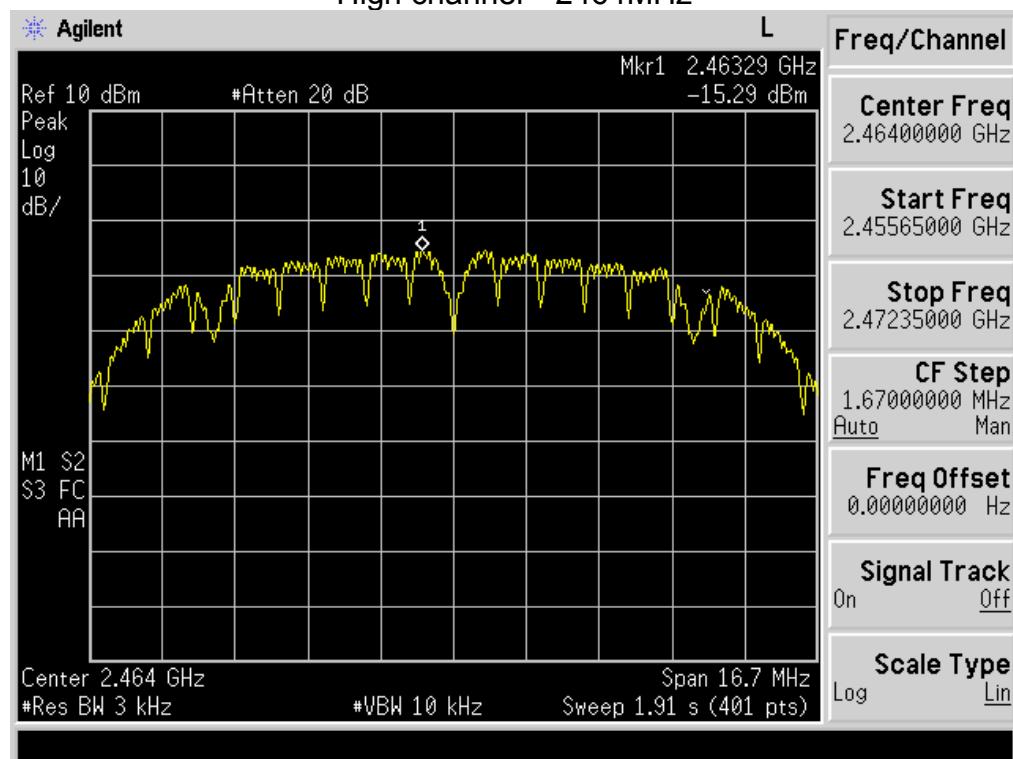
ANT A
Low channel 2412MHz



Middle channel 2438MHz

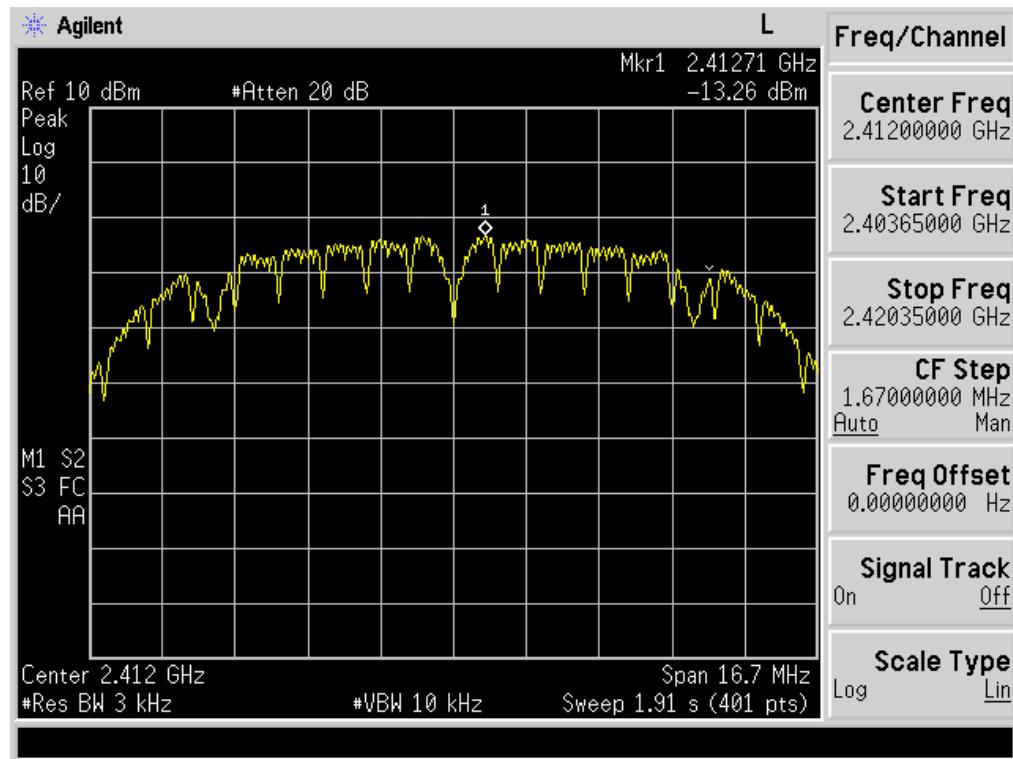


High channel 2464MHz

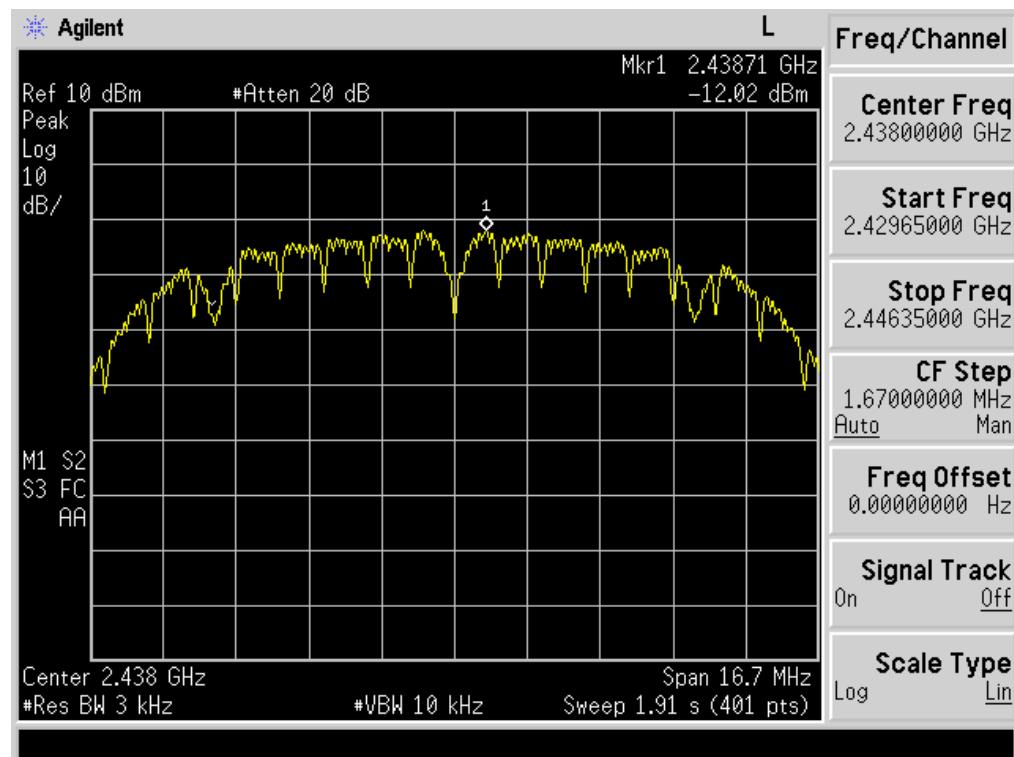


ANT B

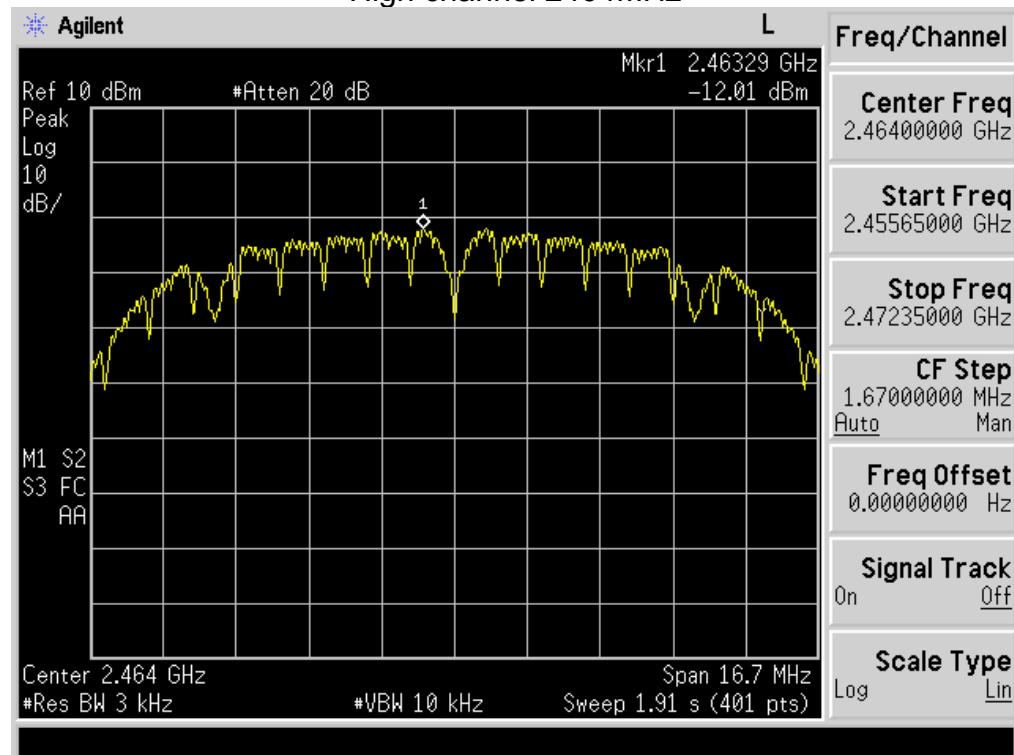
Low channel 2412MHz



Middle channel 2438MHz



High channel 2464MHz



9. ANTENNA REQUIREMENTS

9.1. Limits

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2. Result

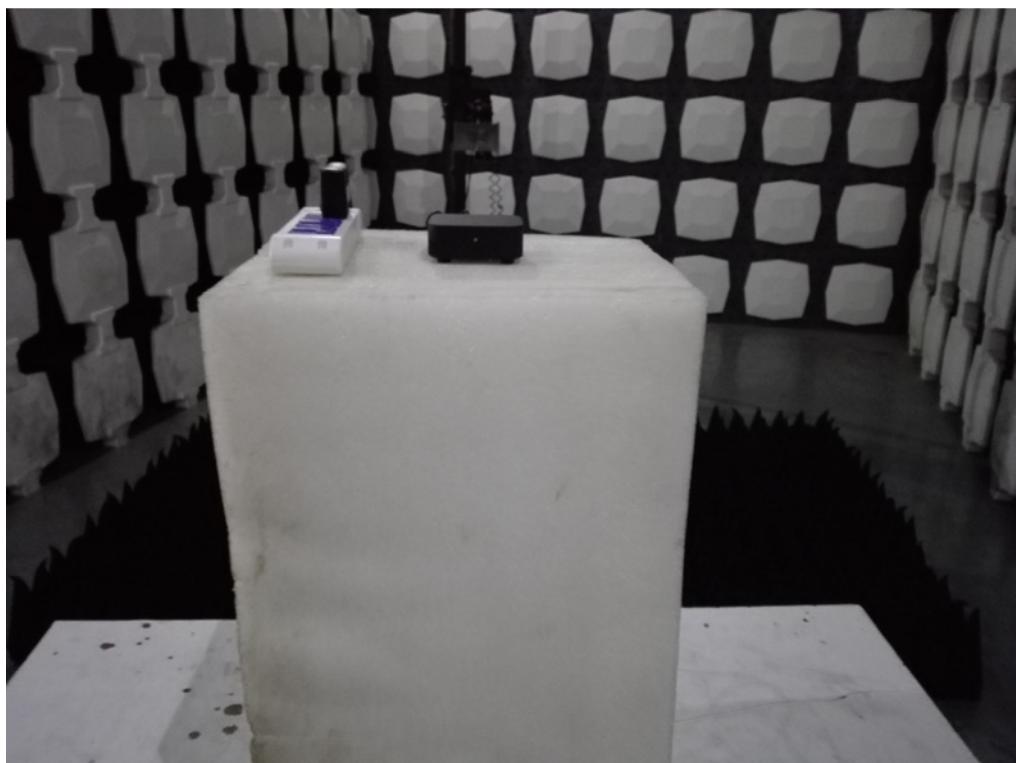
The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.408dBi.

10. PHOTOGRAPHS OF TEST SET-UP

Conducted Emission



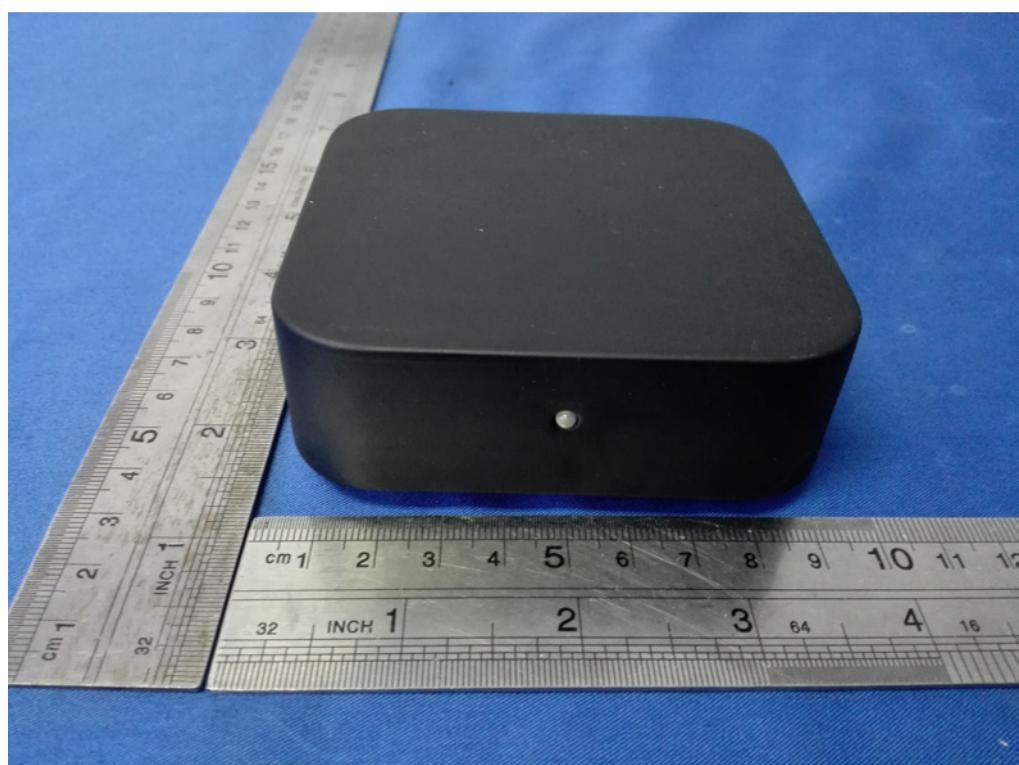
Radiated Emission Test



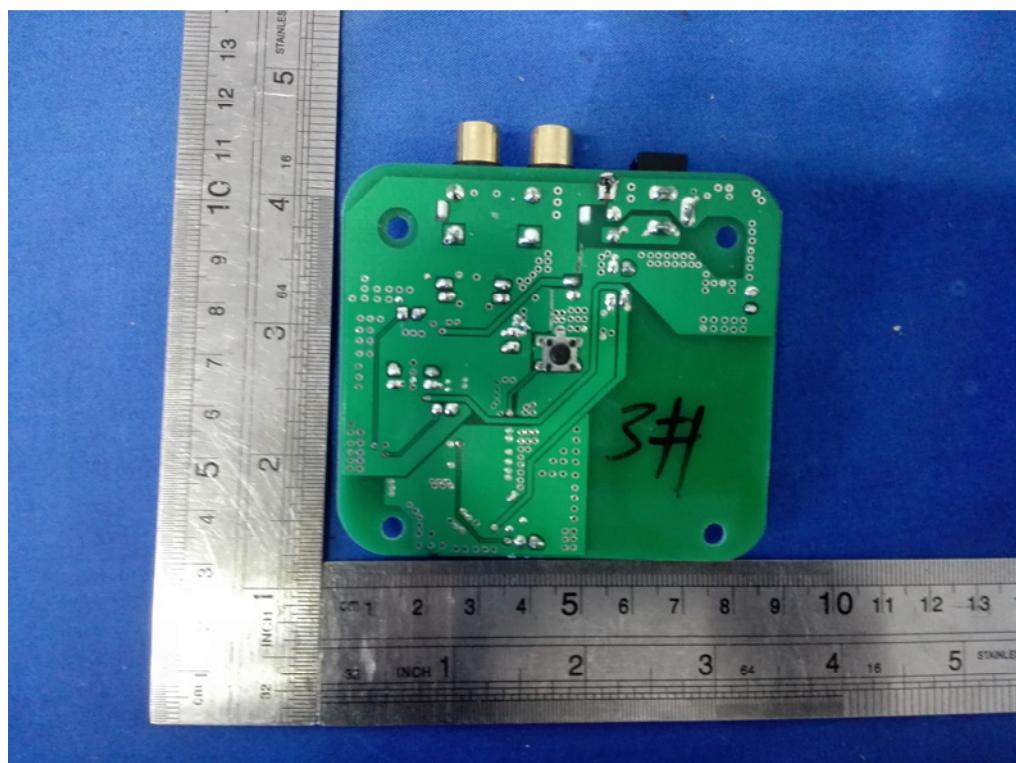
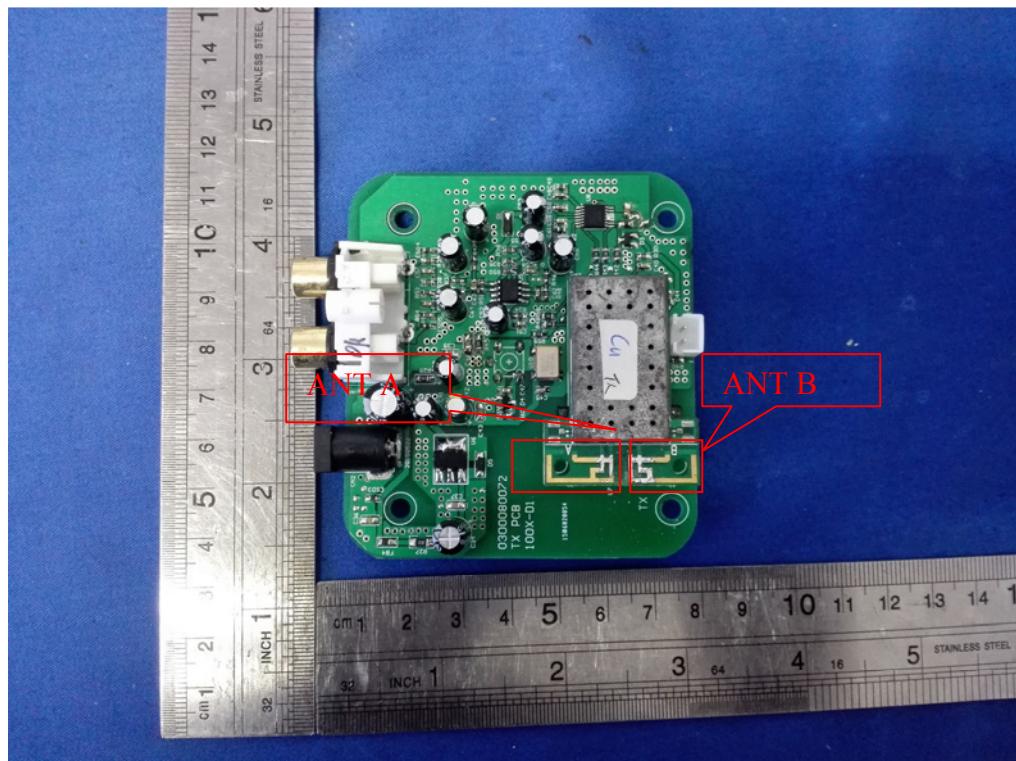
11. PHOTOGRAPHS OF THE EUT

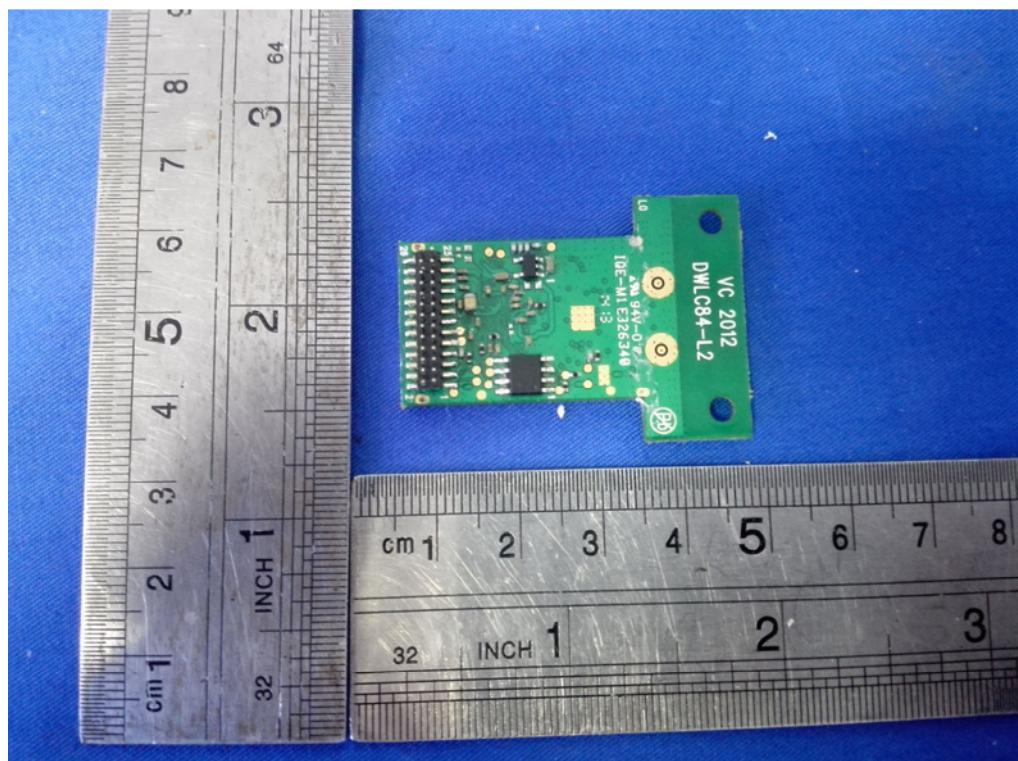
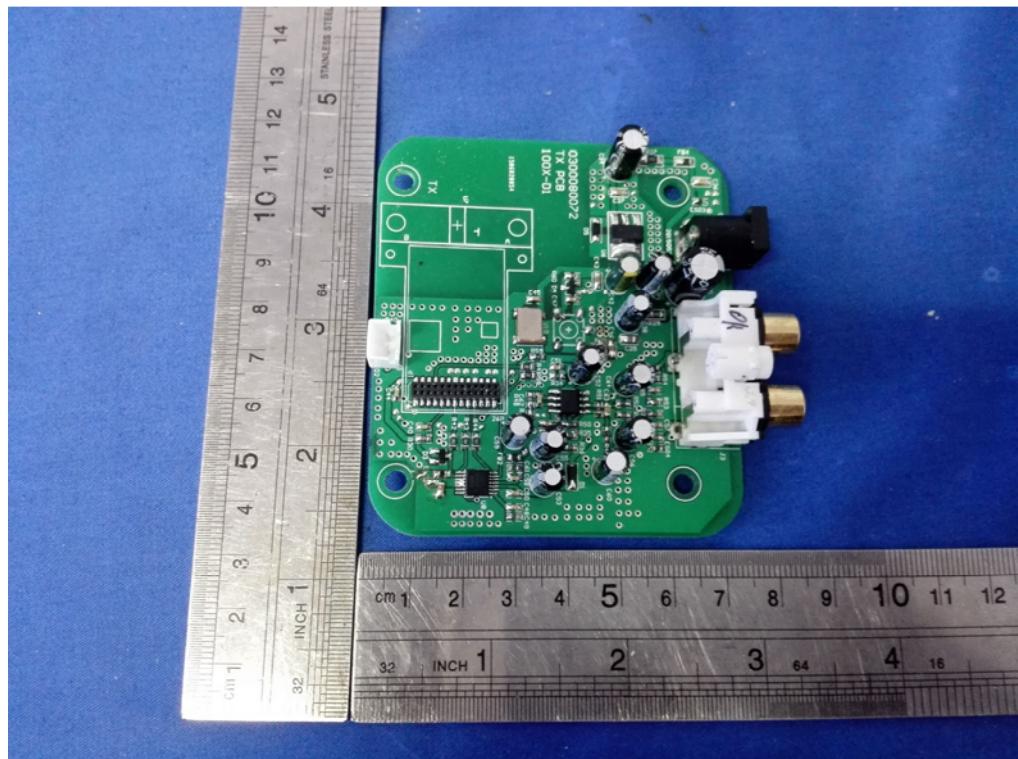


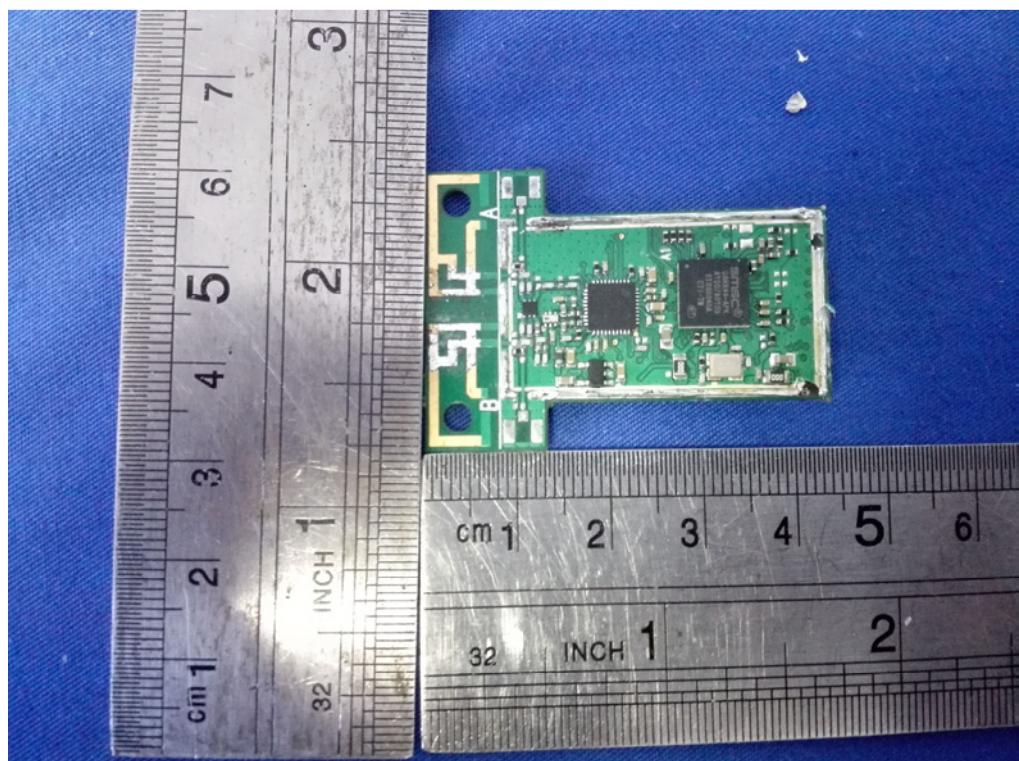












-----END-----