



Report No.SH14040015R03

FCC RF TEST REPORT

Issued to

Waysion Technology (Xiamen) Co., LTD

For

7" Mobile Data Terminal

Model Name : X7
Trade Name : WAYSION
Brand Name : WAYSION
Standard : 47 CFR Part 15, Subpart C
RSS-GEN
RSS-210
Test date : Apr.22,2014 to Apr.25,2014
Issue date : Apr.25,2014
FCC ID : 2ACHTWSP01

by
ShenzhenMORLAB Communication Technology Co., Ltd.

Tested by

Zhang Jie

Zhang Jie

Approved by

Wei Bei

Wei Bei

Review by

Mu Wenping

Mu Wenping



CTIA Authorized Test Lab

LAB CODE 20081223-00

IEEE 1725

OTA

OFTA

電訊管理局



GCF

Official Observer of
Global Certification Forum

Bluetooth

BQTF

FCC

Reg.
No.741109

The report refers only to the sample tested and does not apply to the bulk. This report is issued in confidence to the client and it will be strictly treated as such by the Shenzhen MORLAB Communication Technology Co., Ltd. It may not be reproduced in its entirety or in part and it may not be used for advertising. The client to whom the report is issued may, however, show or send it or a certified copy thereof prepared by the Shenzhen MORLAB Telecommunication Co., Ltd to his customer. Supplier or others persons directly concerned. Shenzhen MORLAB Telecommunication Co., Ltd will not, without the consent of the client enter into any discussion of correspondence with any third party concerning the contents of the report. In the event of the improper use of the report, Shenzhen MORLAB Telecommunication Co., Ltd reserves the rights to withdraw it and to adopt any other remedies which may be appropriate.

DIRECTORY

1.	General Information	4
1.1	Applicant	4
1.2	Manufacturer	4
1.3	Description of EUT	4
2.	Facilities and Accreditations	5
2.1	Test Facility	5
2.2	Environmental Conditions	5
2.3	Measurement Uncertainty	5
2.4	List of Equipments Used	5
3.	Test Standards and Results	6
4.	47 CFR Part 15C and RSS-210 requirements	7
4.1	Antenna requirement	7
5.	Test Result.....	8
5.1	Peak Output Power.....	8
5.2	Average Power	10
5.3	6dB & 20dB(99%) Bandwidth.....	11
5.4	Conducted Spurious Emissions and Band Edge	15
5.5	Power Spectral Density(PSD)	18
5.6	Restricted Frequency Bands.....	20
5.7	Conducted Emission	24
5.8	Radiated Emission.....	25

Change History

Issue	Date	Reason for change
1.0	Apr.25,2014	First edition

1. General Information

1.1 Applicant

Waysion Technology (Xiamen) Co., LTD

3E, Rihua Building, No. 8, Xinfeng 2nd Road, Torch High-Tech Zone, Xiamen, Fujian, China

1.2 Manufacturer

Waysion Technology (Xiamen) Co., LTD

3E, Rihua Building, No. 8, Xinfeng 2nd Road, Torch High-Tech Zone, Xiamen, Fujian, China

1.3 Description of EUT

EUT Name : 7" Mobile Data Terminal
Model Name..... : WAYSION
Brand Name : WAYSION
Trade Name : X7
Hardware Version..... : V1.0
Software Version : V1.0
Modulation Type : GFSK DTS
Frequency Range..... : 2402MHz~2480MHz(at intervals of 2MHz)
Number of Channels : 40
Antenna Type : integrated
Antenna Gain : 2.0dBi

*NOTE 1: The EUT contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is $F(\text{MHz})=2402+2*n$ ($0 \leq n \leq 39$). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 19 (2440MHz) and 39 (2480MHz).*

NOTE 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.

2. Facilities and Accreditations

2.1 Test Facility

ShenzhenMorlab Communications Technology Co., Ltd. Morlab Laboratory is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572. A 9*6*6(m) fully anechoic chamber was used for the radiated spurious emissions test.

2.2 Environmental Conditions

Ambient temperature: 20~25°C

Relative humidity: 40~60%

Atmosphere pressure: 86-106kPa

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission: $\pm 1.76\text{dB}$

Uncertainty of Radiated Emission: $\pm 3.16\text{dB}$

2.4 List of Equipments Used

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal. Due
Service Simulator	Anritsu	MT8852A	6K00002788	2013.9.2	1year
Spectrum Analyzer	R&S	FSP30	101020	2013.6.12	1year
Spectrum Analyzer	Agilent	E4440A	MY46187763	2013.7.26	1year
Spectrum Analyzer	R&S	FSU26	200880	2013.6.18	1year
RF Power Meter	Giga-tronics	6542C	41-1838372	2013.9.27	1year
Power Splitter	Weinschel	1506A	NW521	(n.a.)	(n.a.)
Power Splitter	Mini-Circuits	ZFRSC-183-S+	765001016	(n.a.)	(n.a.)
Attenuator 1	Resnet	10dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	10dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 3	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)
Receiver	Rohde&Schwarz	ESCI3	100666	2013.6.15	1year
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2013.5.8	2year
Antenna	Schwarzbeck	BBHA 9120C	9120C-384	2013.7.23	1year
Antenna	R&S	HL562	100385	2013.6.18	1year
Antenna	R&S	HF906	100565	2013.6.18	1year
LISN	Rohde&Schwarz	ENV216	812744	2013.9.2	1year
Personal Computer	HP	(n.a.)	(n.a.)	(n.a.)	(n.a.)
Test Antenna-Horn	Schwarzbeck	BBHA9170	BBHA91970171	2013.7.22	1year
Test Antenna-Loop	Rohde&Schwarz	HFH2-Z2	860004/001	2013.9.2	1year

NOTE:

Equipments listed above have been calibrated and are in the period of validation.

3. Test Standards and Results

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC Part 15 Subpart C §15.247

ANSI C63.4-2009

RSS-GEN/RSS-210

NOTE:

(1) All test items were verified and recorded according to the standards and without any deviation during the test.

(2) This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart C and RSS-210 (Bluetooth, 2.4GHz ISM band radiators), recorded in a separate test report.

Test items and the results are as follows:

No	FCC Rules	Description	Section in RSS-GEN, RSS-210	Result
1	15.203	Antenna Requirement	7.1.4	PASS
2	15.247(b)	Peak Output Power	A8.4(2)	PASS
3	15.247(b)	Average Power	A8.4(2)	PASS
4	15.247(a)	6dB Bandwidth	A8.2(a)	PASS
5	15.247(a)	20dB(99%) Bandwidth	A8.2(a)	PASS
6	15.247(d)	Conducted Spurious Emission	A8.5	PASS
7	15.247(d)	Restricted Frequency Bands	A8.5	PASS
8	15.207	Conducted Emission	7.2.4	PASS
9	15.247(d) 15.209	Radiated Emission	A8.5	PASS
10	15.247(e)	Power Spectral Density(PSD)	A8.2(b)	PASS

4. 47 CFR Part 15C and RSS-210 requirements

4.1 Antenna requirement

4.1.1 Applicable standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by 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.

4.1.2 Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

5. Test Result

5.1 Peak Output Power

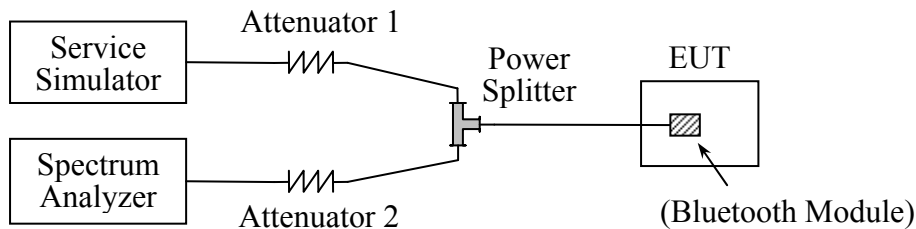
5.1.1 Requirement

According to FCC section 15.247(b)(3) and RSS-210 A8.4(2), For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

5.1.2 Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

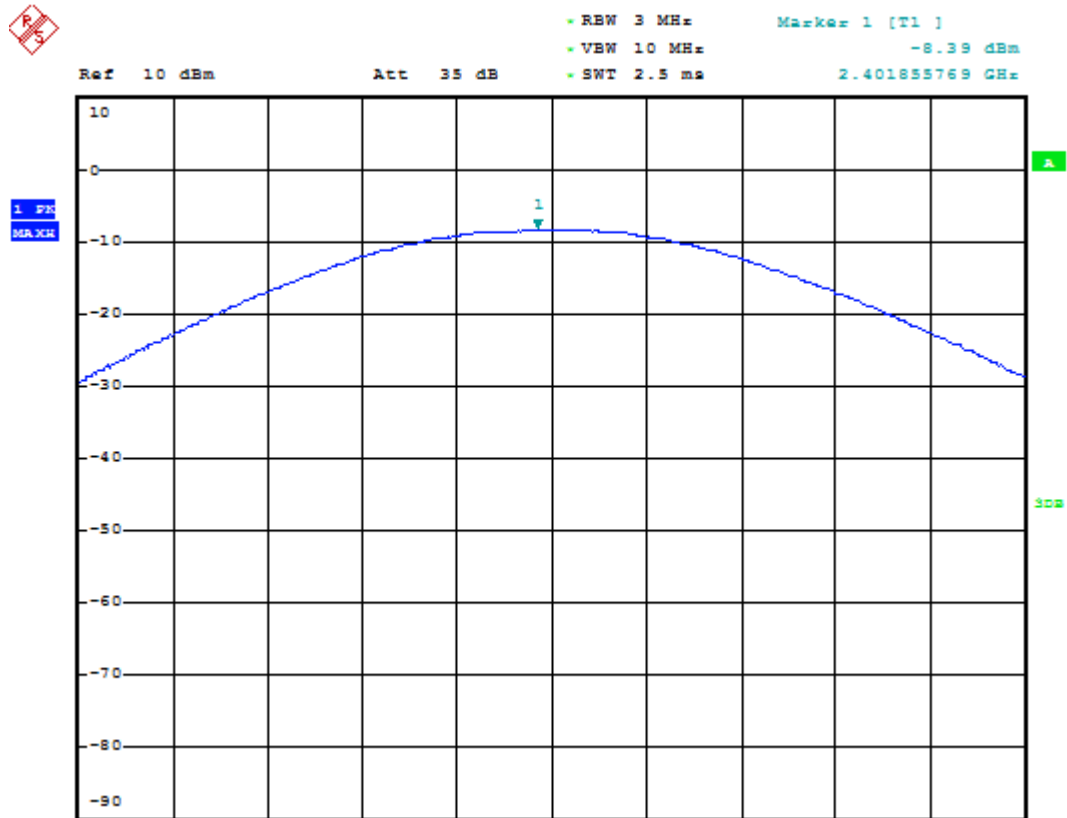
5.1.3 Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

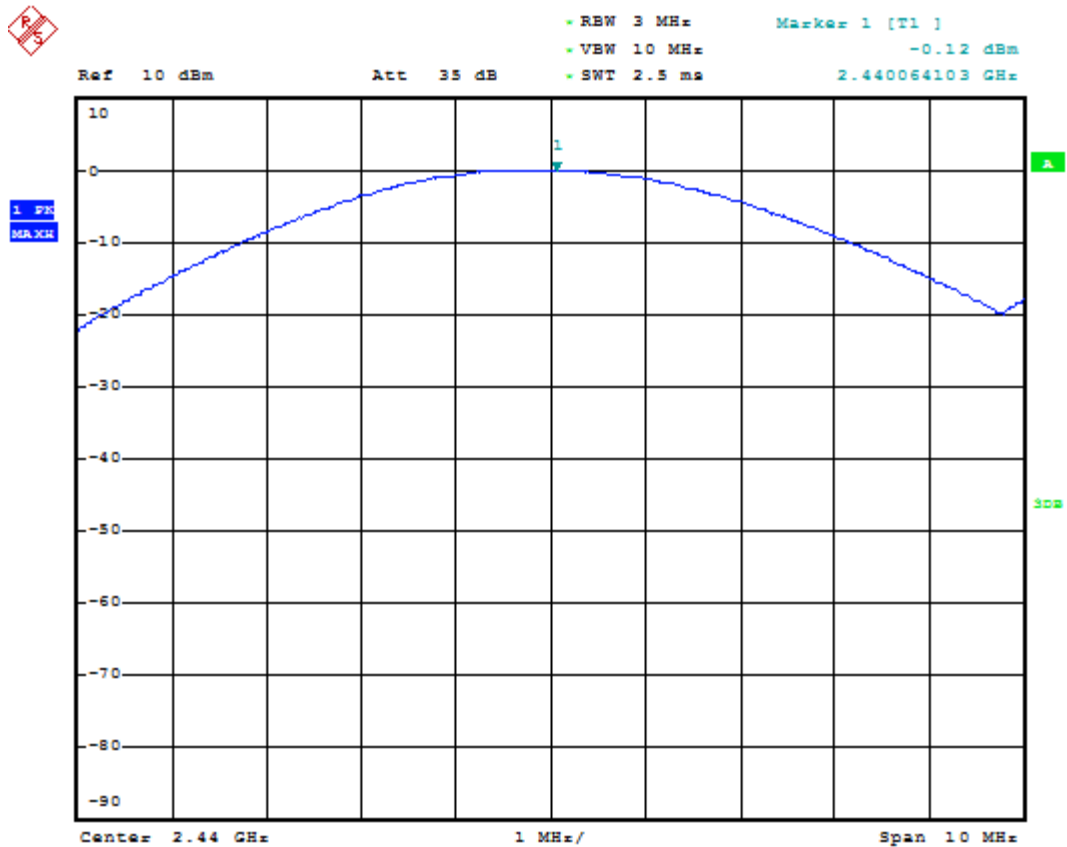
A. Test Verdict:

Channel	Frequency	Measured Output Peak Power		Refer to Plot	Limit		Verdict
		dBm	W		dBm	W	
0	2402	-8.39	0.000144877	Plot A	30	1	Pass
19	2440	-0.12	0.000972747	Plot B			Pass
39	2480	-6.95	0.000201837	Plot C			Pass

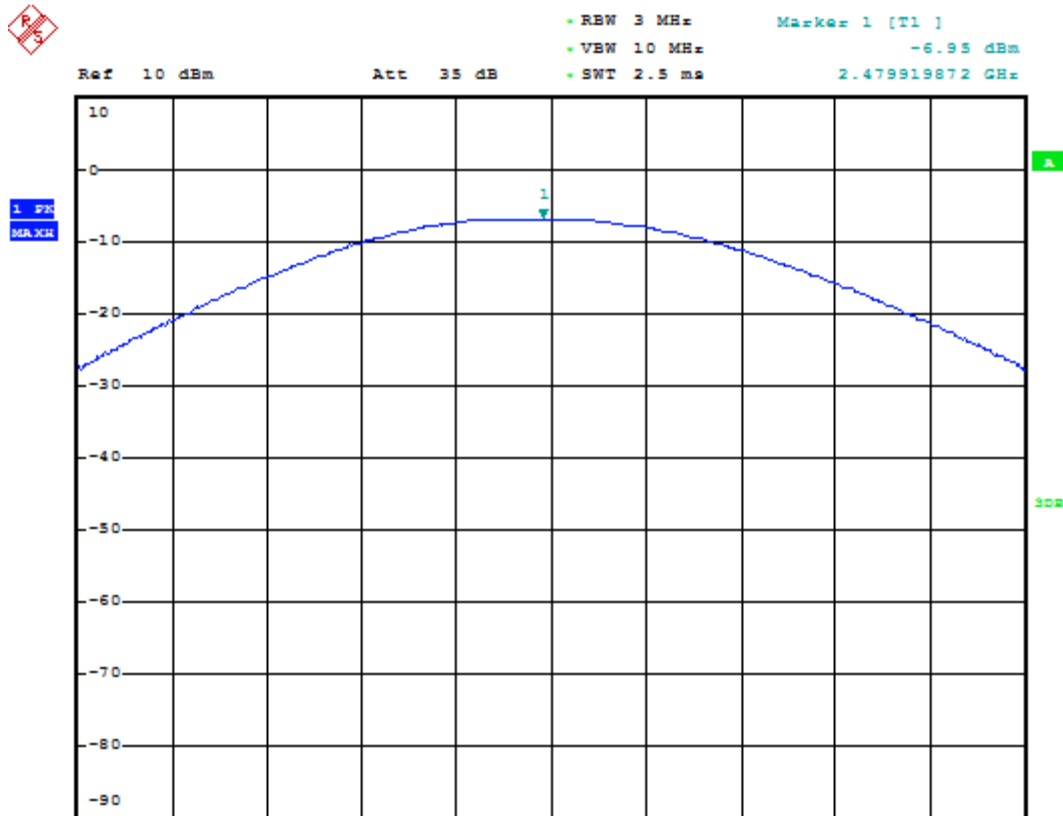
B. Test Plots:



(Plot A: Channel 0:2402MHz)



(Plot B:Channel 19: 2440MHz)



(Plot C: Channel 39:2480MHz)

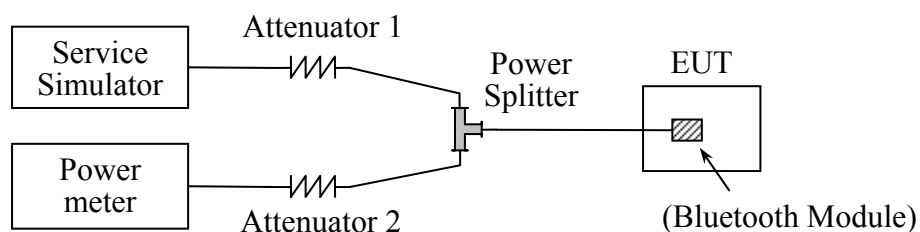
5.2 Average Power

5.2.1 Requirement

None; for reporting purposes only.

5.2.2 Test Description

The transmitter output was split to 2 ways, the one was connected to Service Simulator as monitor, the other one was connected to Power Meter.



5.2.3 Results

Channel	Frequency (MHz)	Average Power	
		dBm	W
0	2402	-9.77	0.000105439
19	2440	-2.72	0.000534564
39	2480	-8.53	0.000140281

5.3 6dB &20dB(99%) Bandwidth

5.3.1 Requirement

According to FCC section 15.247(a) (2) and RSS-210 A8.1(a), Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.3.2 Test Description

See section 5.1.2 of this report.

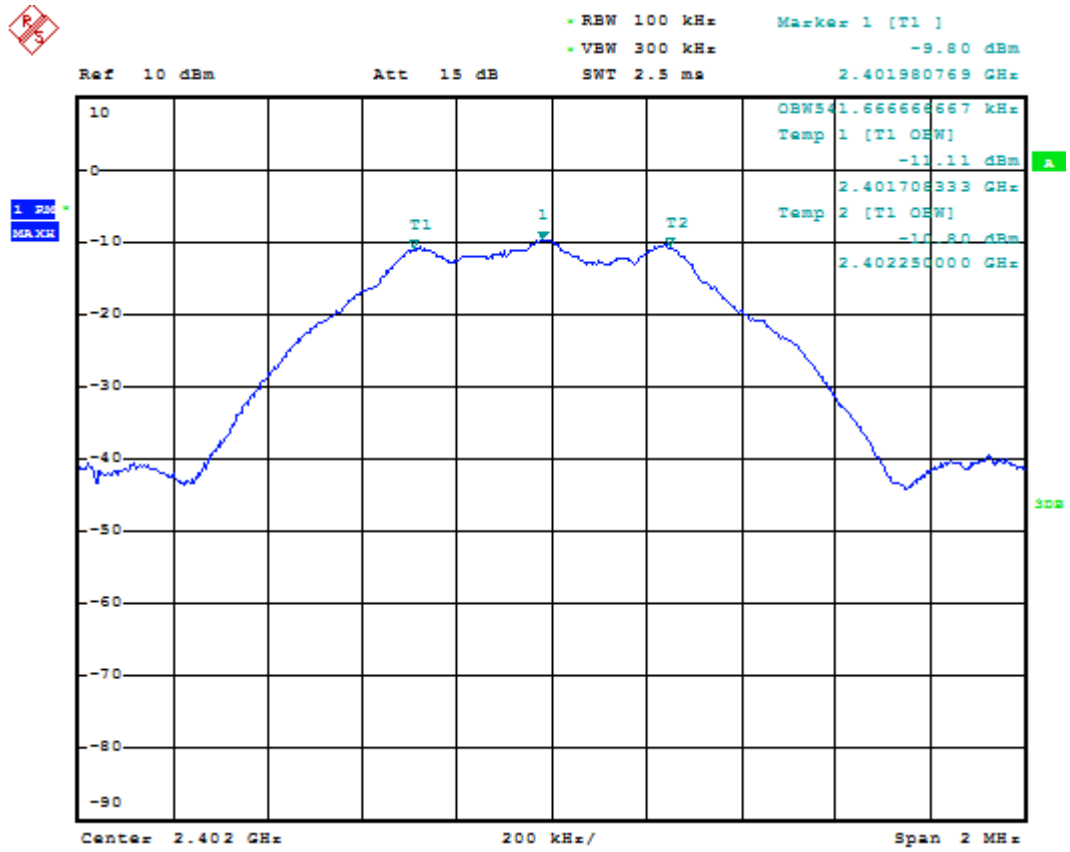
5.3.3 Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

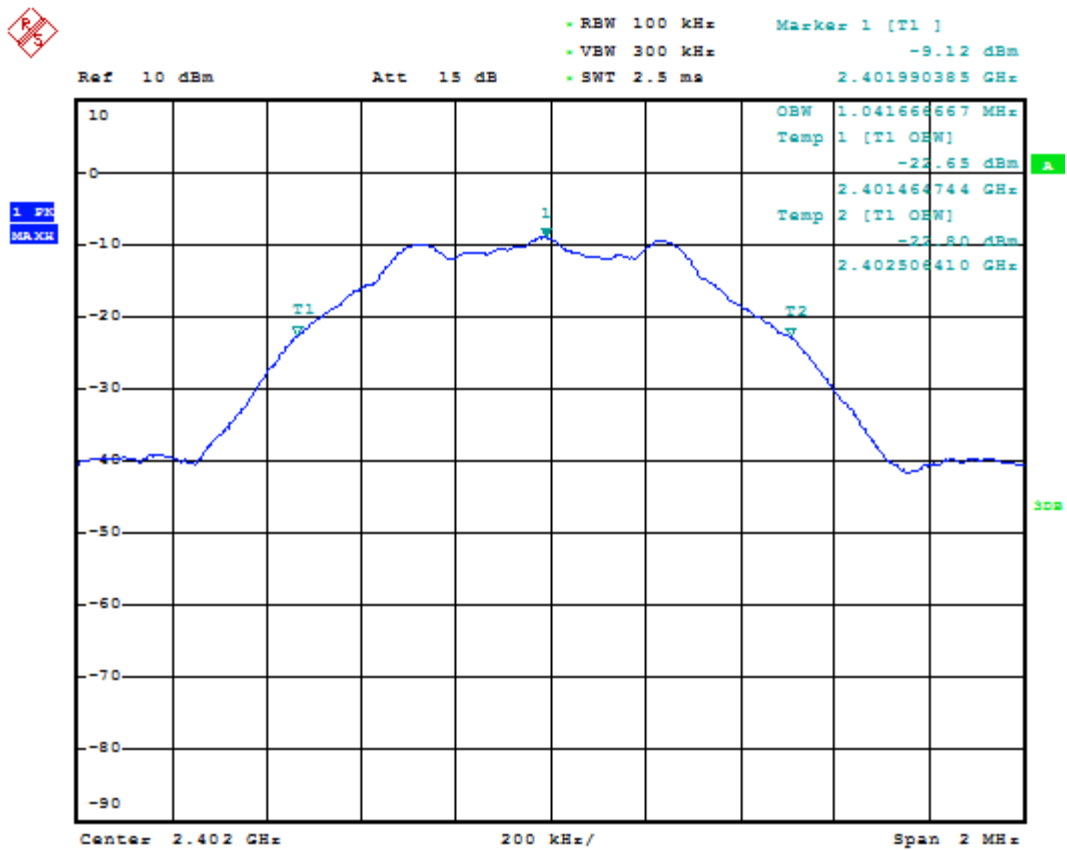
A. Test Verdict:

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Refer to Plot	20dB(99%) Bandwidth (MHz)	Refer to Plot	Limites (KHz)	Result
0	2402	0.541667	Plot A.1	1.041667	Plot A.2	≥ 500	PASS
19	2440	0.544872	Plot B.1	1.044872	Plot B.2	≥ 500	PASS
39	2480	0.544872	Plot C.1	1.057692	Plot C.2	≥ 500	PASS

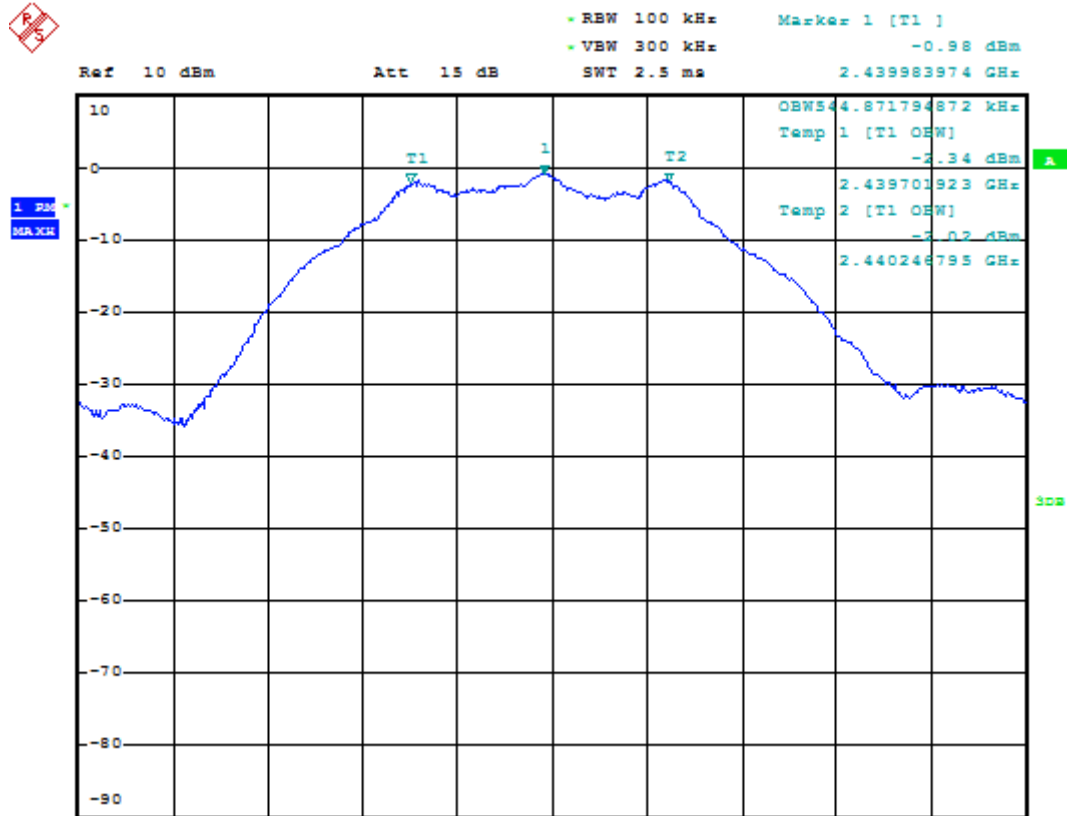
B. Test Plots:



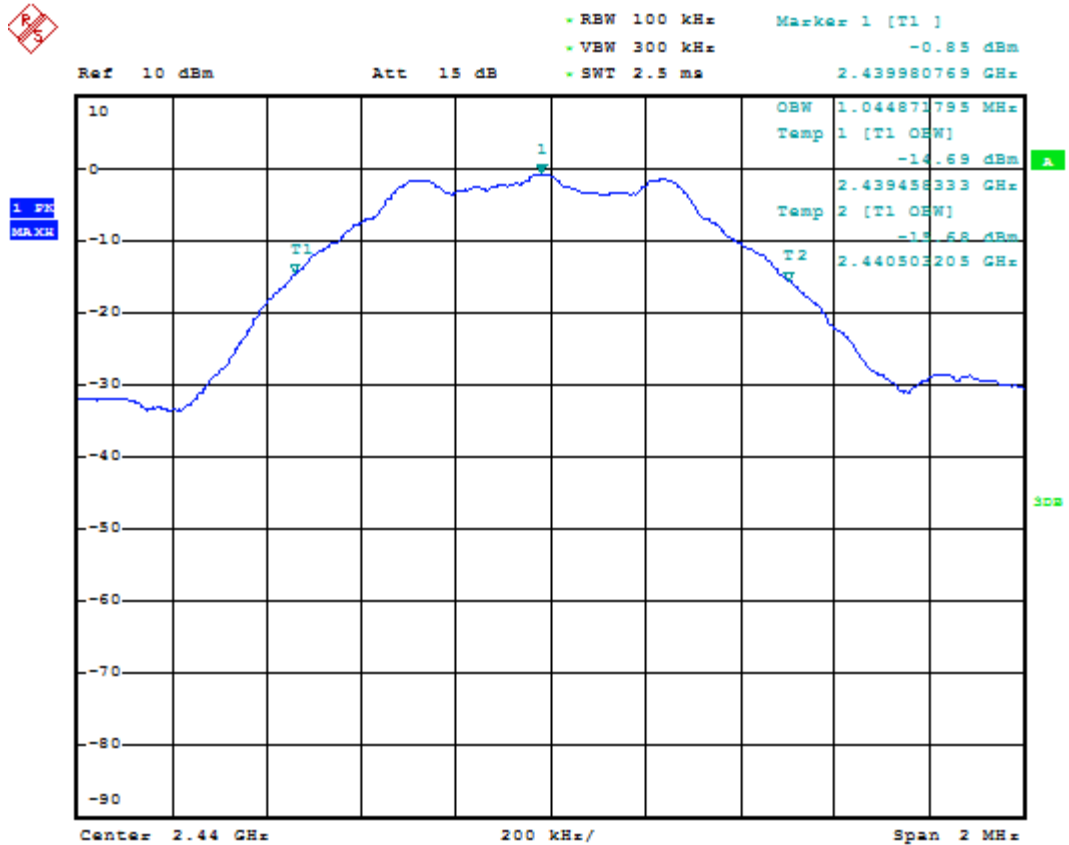
(Plot A.1:Channel 0:2402MHz)



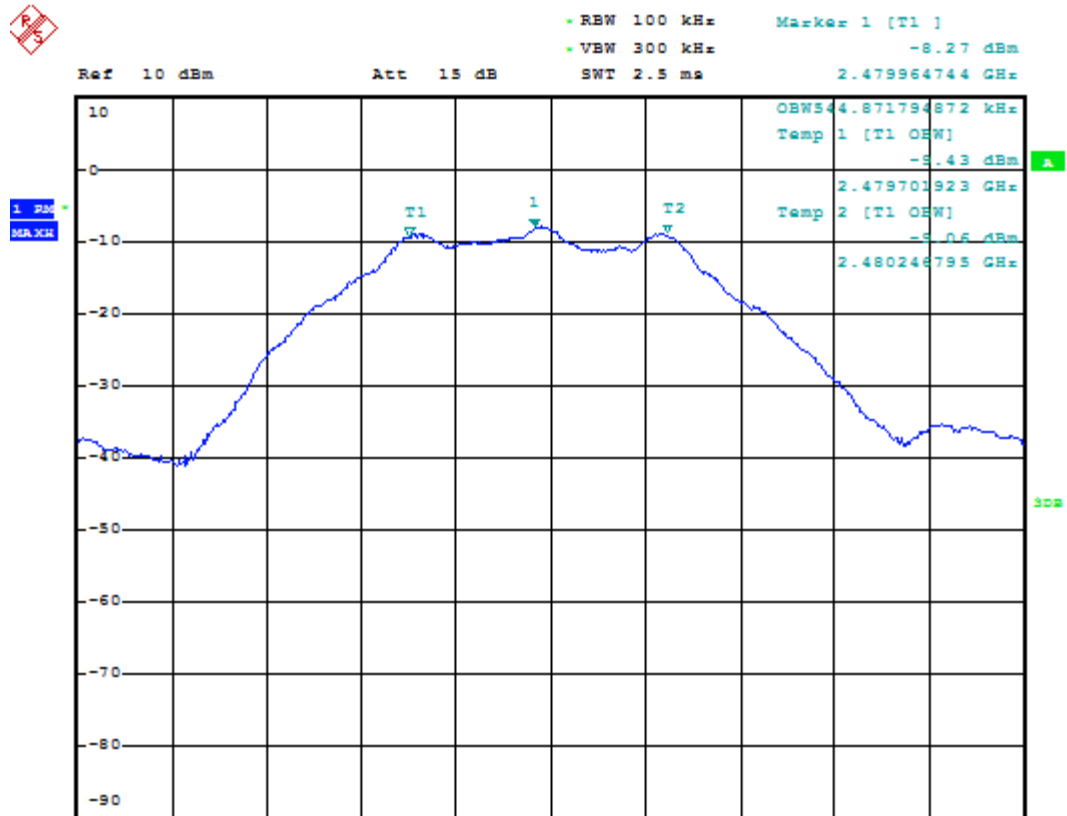
(Plot A.2:Channel 0:2402MHz)



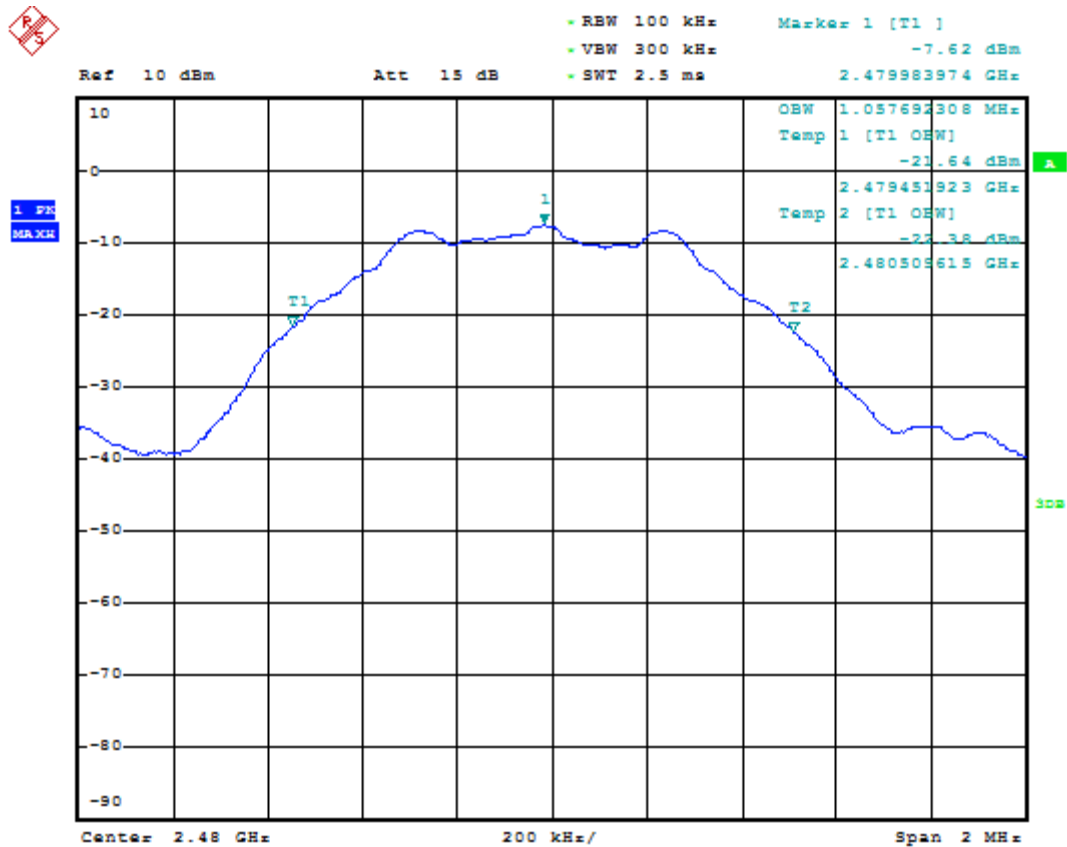
(Plot B.1:Channel 19:2440MHz)



(Plot B.2:Channel 19:2440MHz)



(Plot C.1:Channel 39:2480MHz)



(Plot C.2:Channel 39:2480MHz)

5.4 Conducted Spurious Emissions and Band Edge

5.4.1 Requirement

According to FCC section 15.247(d) and RSS-210 A8.5, in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.4.2 Test Description

See section 5.1.2 of this report.

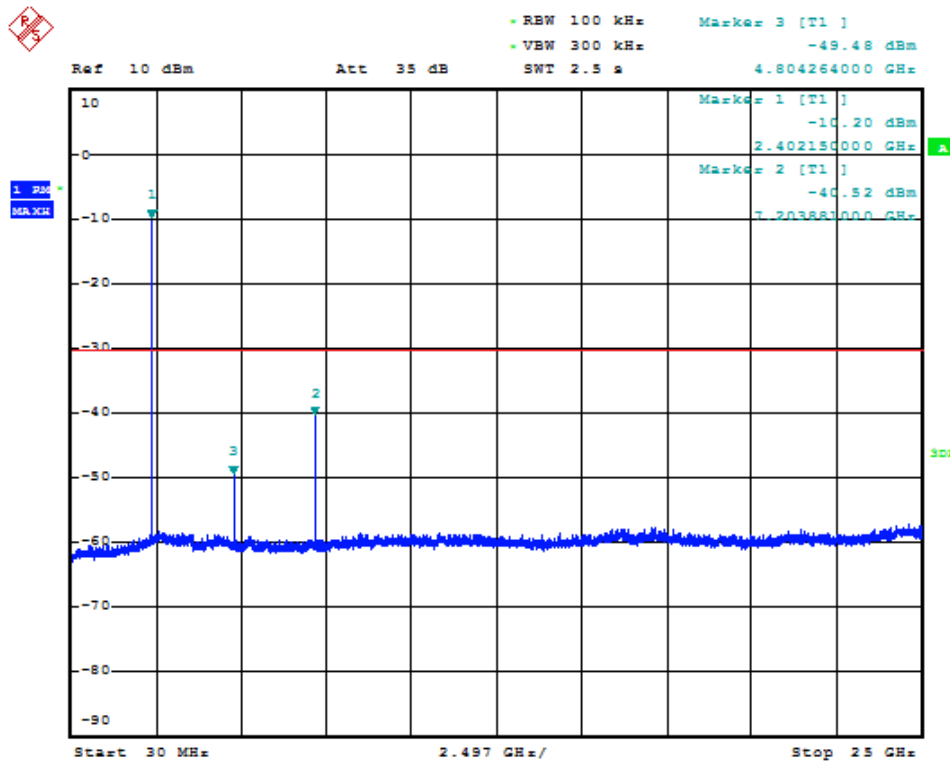
5.4.3 Test Result

The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

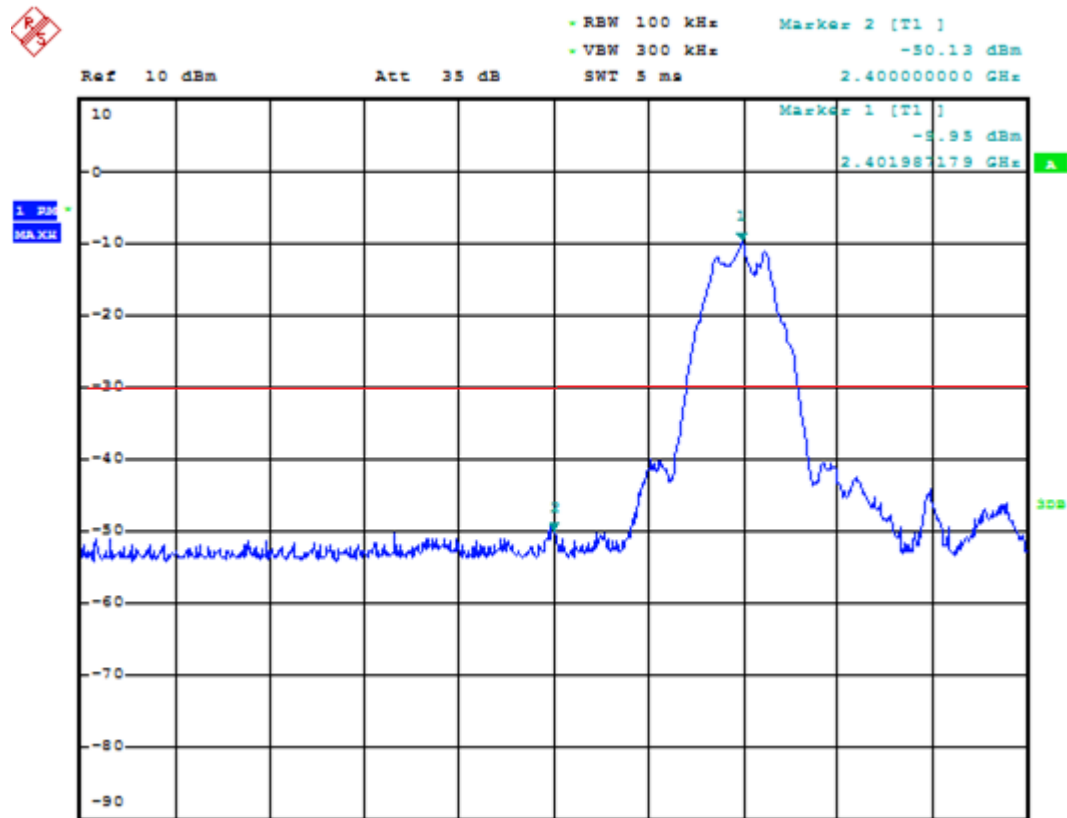
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max out of band Emission(dBm)	Refer to Plot	Limited(dBm)		Verdict
				Carrier Level	Calculated - 20dBc Limit	
0	2402	-40.32	Plot A.1/A.2	-10.2	-30.2	PASS
19	2440	-30.6	Plot B	-4.54	-24.54	PASS
39	2480	-34.34	Plot C.1/C.2	-8.84	-28.84	PASS

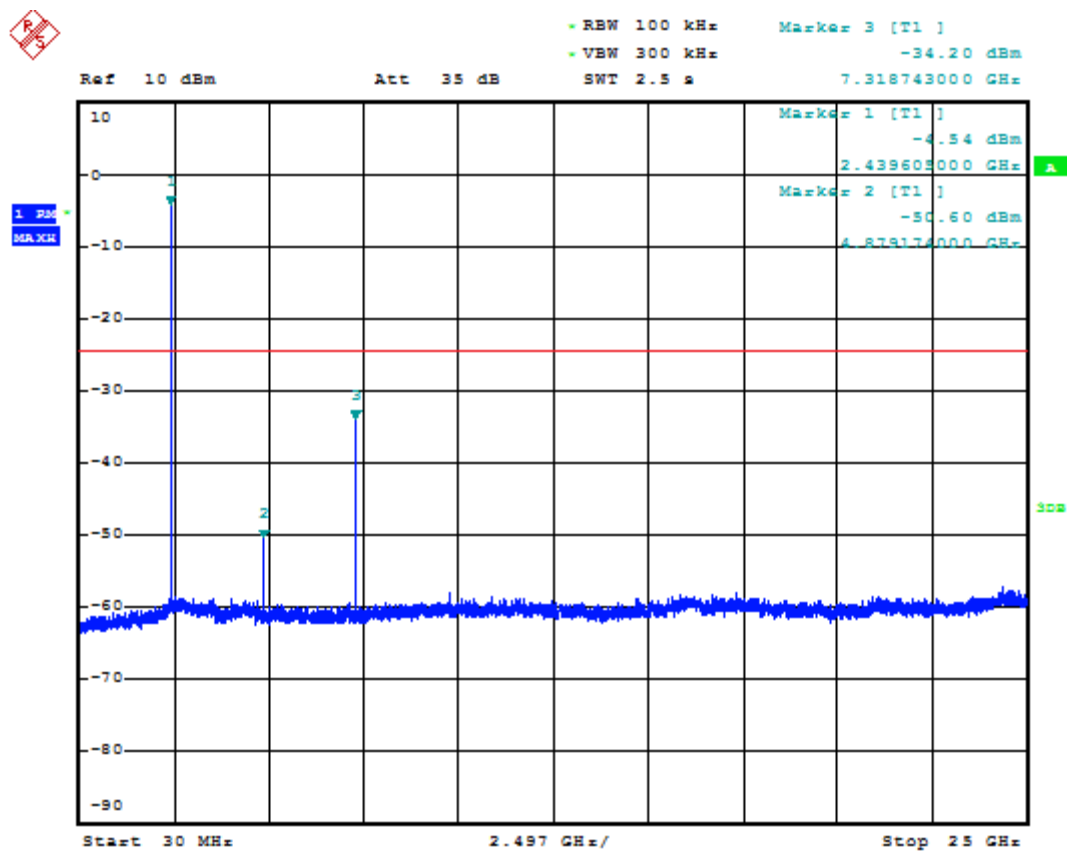
B. Test Plot:



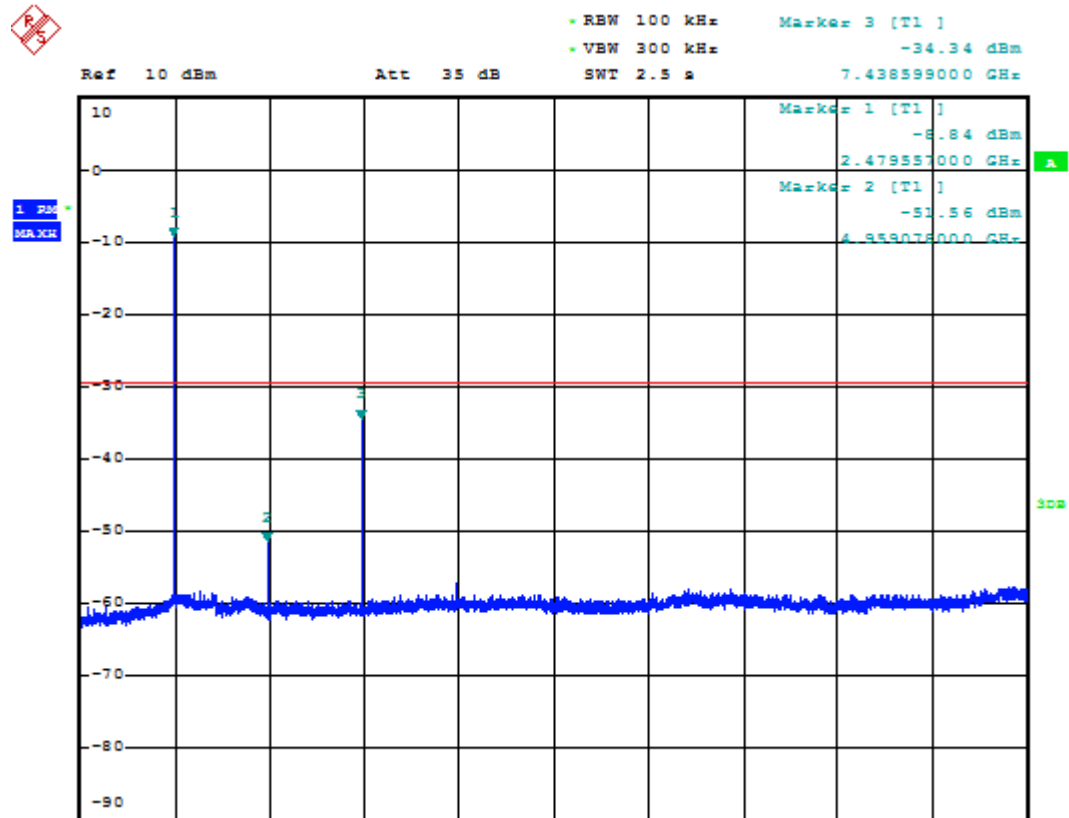
(Plot A.1:Channel0:2402MHz 30MHz~25GHz)



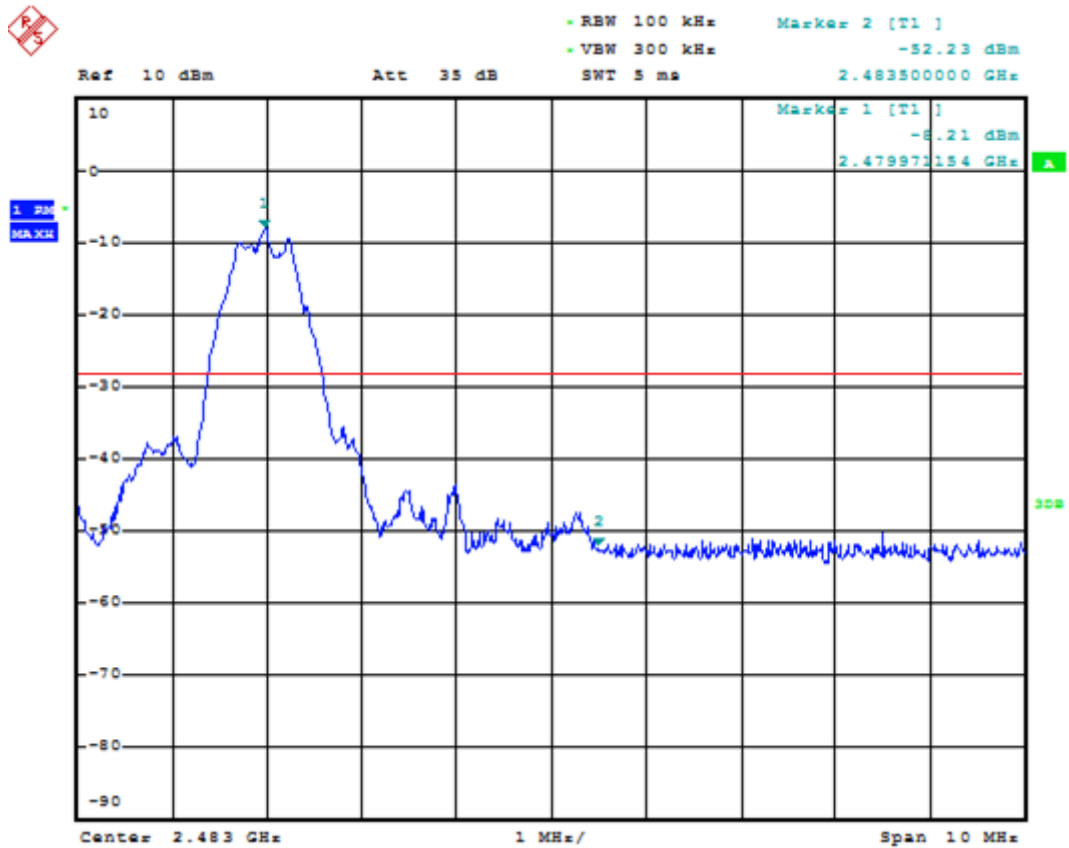
(Plot A.2:Channel0:2402MHz Band Edge)



(PlotB: Channel 19:2440MHz 30MHz~25GHz)



(PlotC.1:Channel39:2480MHz 30MHz~25GHz)



(PlotC.2:Channel 39:2480MHz Band Edge)

5.5 Power Spectral Density(PSD)

5.5.1 Requirement

According to FCC section 15.247(e) and RSS-210 A8.5, the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used

5.5.2 Test Description

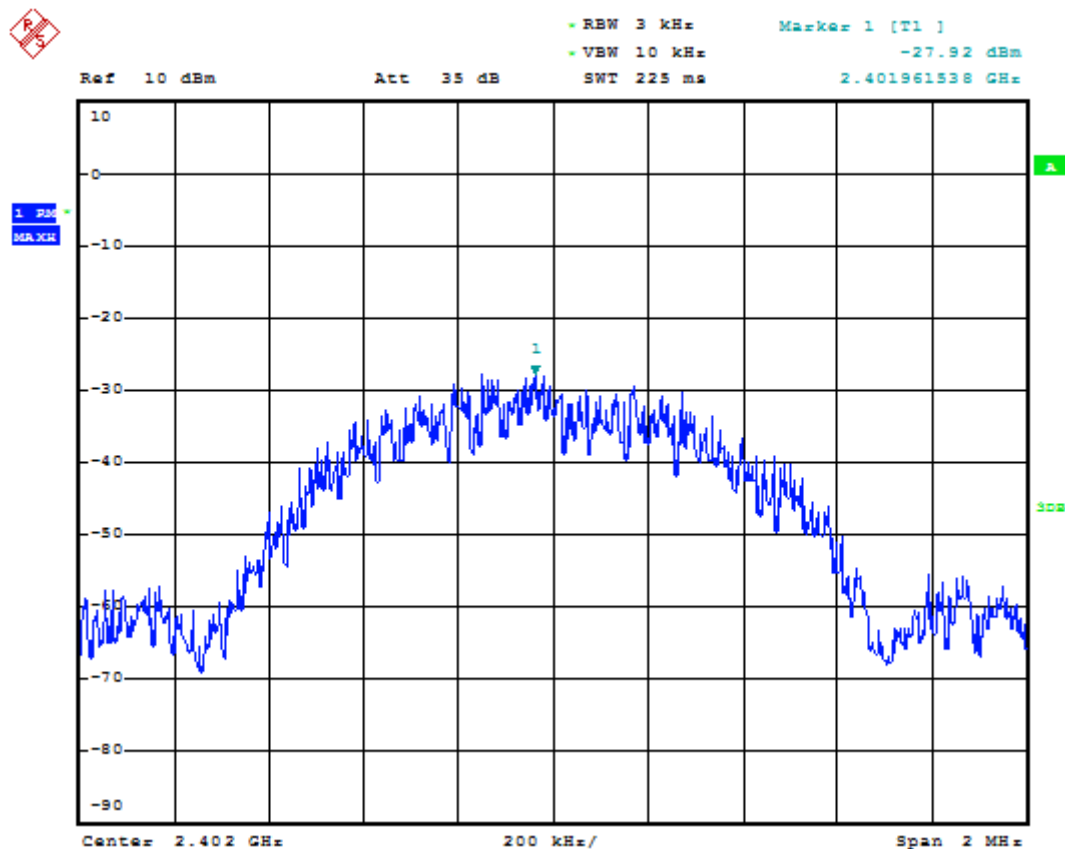
See section 5.1.2 of this report.

5.5.3 Test Result

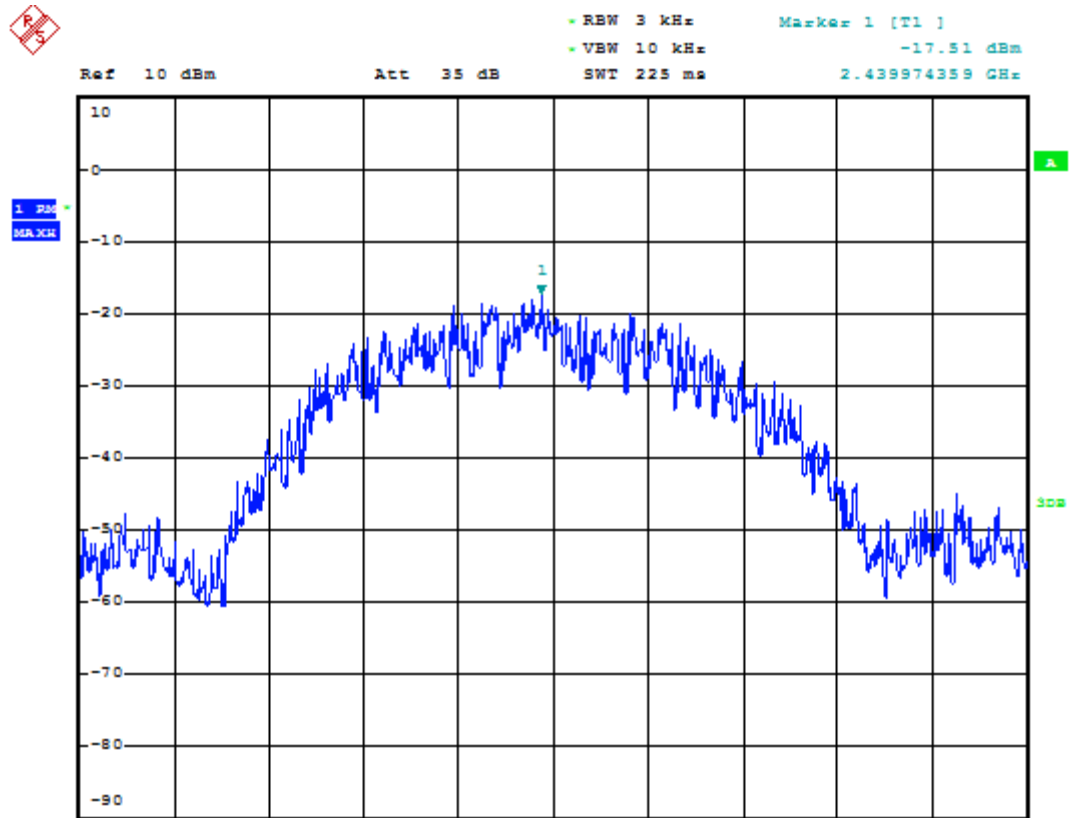
A. Test Verdict

Spectral Power Density(dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3KHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
0	2402	-27.92	Plot A	8	PASS
19	2440	-17.51	Plot B	8	PASS
39	2480	-24.14	Plot C	8	PASS

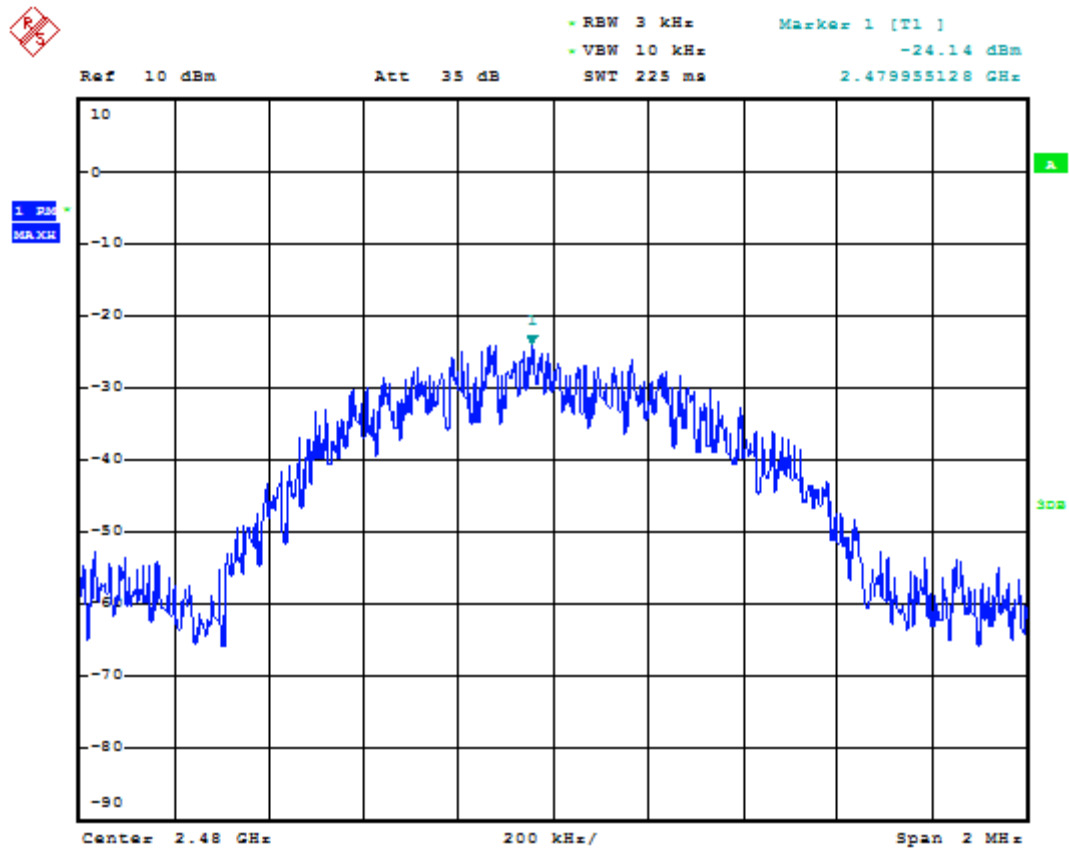
B. Test Plot



(Plot A: Channel = 0, 2402MHz)



(Plot B: Channel = 19, 2440MHz)



(Plot C: Channel = 39, 2480MHz)

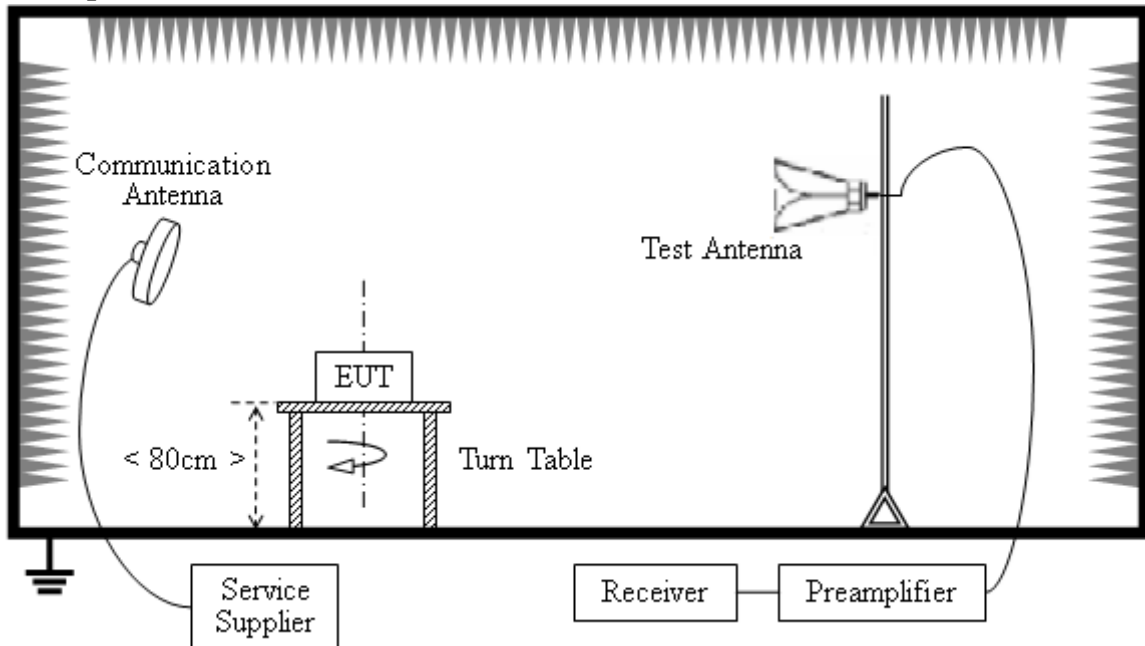
5.6 Restricted Frequency Bands

5.6.1 Requirement

According to FCC section 15.247(d) and RSS-210 A8.5, in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, , In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

5.6.2 Test Description

A. Test Setup



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

5.6.3 Test Result

The lowest and highest channels are tested to verify the Restricted Frequency Bands.

The measurement results are obtained as below:

$$E \text{ [dBV/m]} = UR + AT + A\text{Factor [dB]}; AT = LCable \text{ loss [dB]} - G\text{preamp [dB]}$$

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

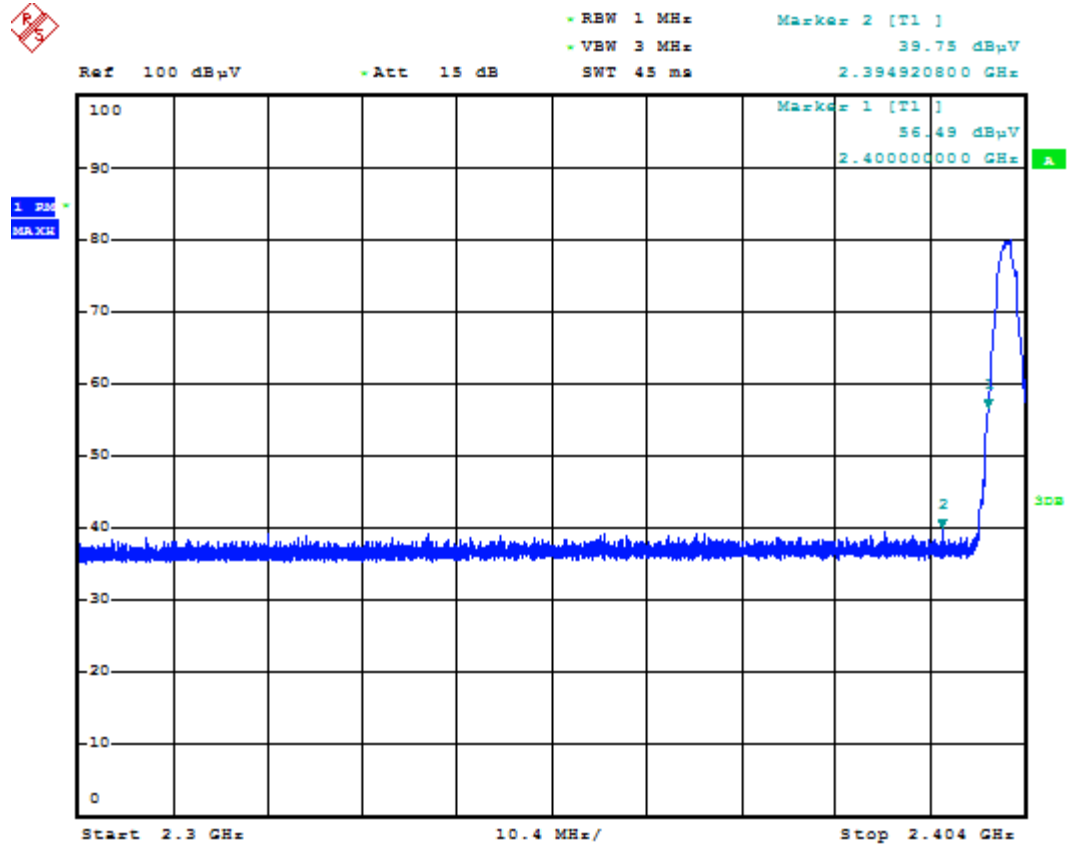
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

The lowest and highest channels are tested to verify the Restricted Frequency Bands

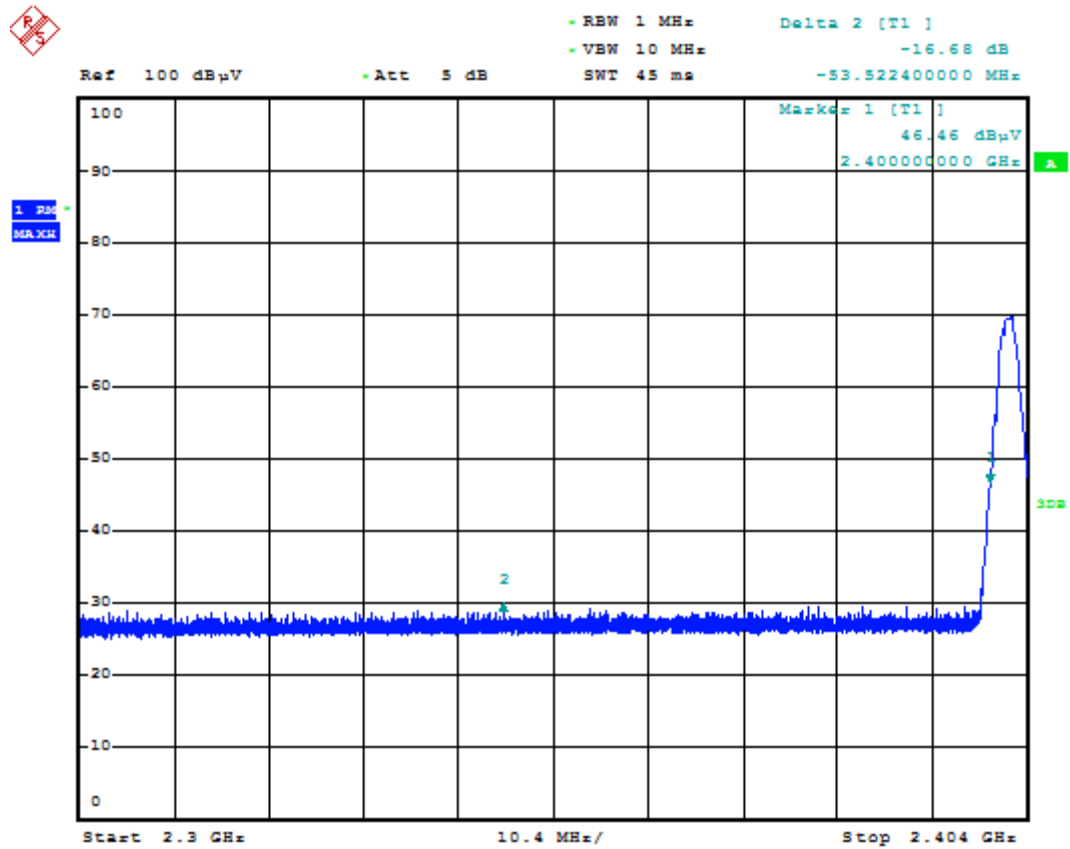
A. Test Verdict

Channel	Frequency (MHz)	Dectector PK/AV	Receiver Reading UR(dBuV)	AT (dB)	Afactor (dB@3m)	Max.Emission (dBuV/m)	Limited (dBuV/m)	Verdict
0	2356.2952	PK	39.75	-32.2	32.56	40.11	74	PASS
0	2346.4776	AV	29.8	-32.2	32.56	30.16	54	PASS
39	2490.1704	PK	38.84	-30.7	32.5	40.64	54	PASS
39	2486.657	AV	30.07	-30.7	32.5	31.87	74	PASS

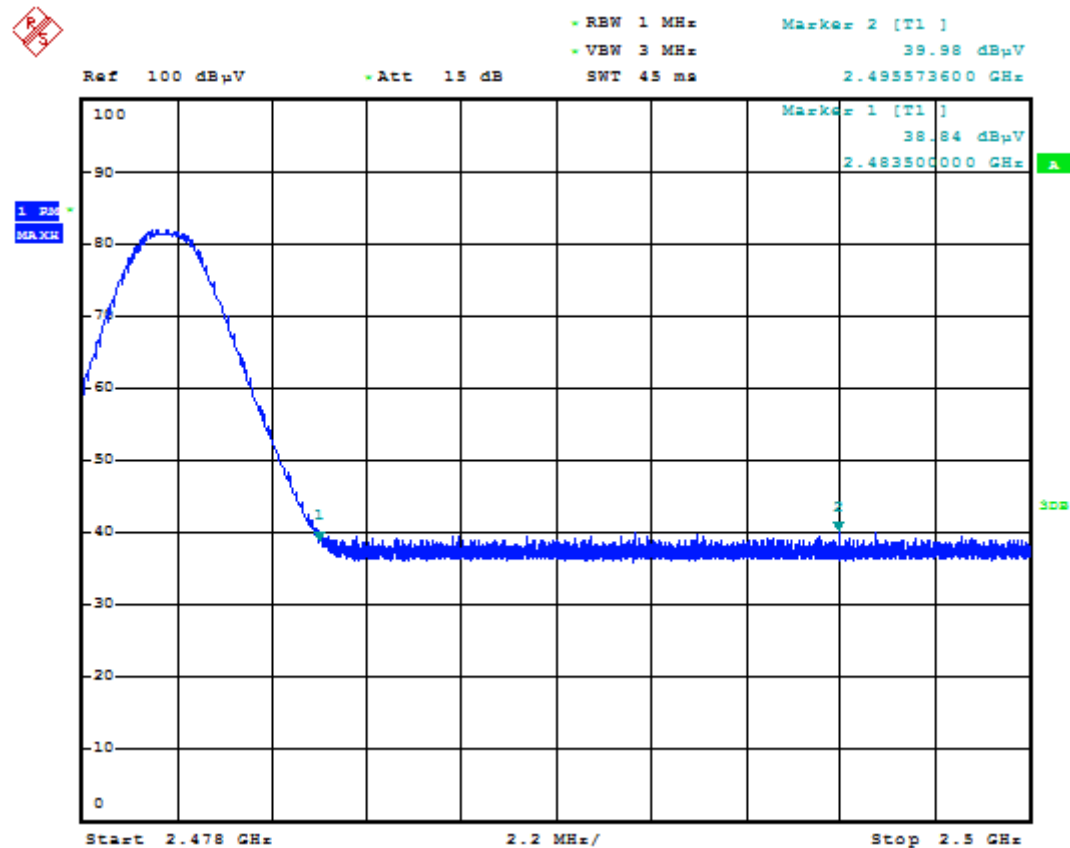
B. Test Plot



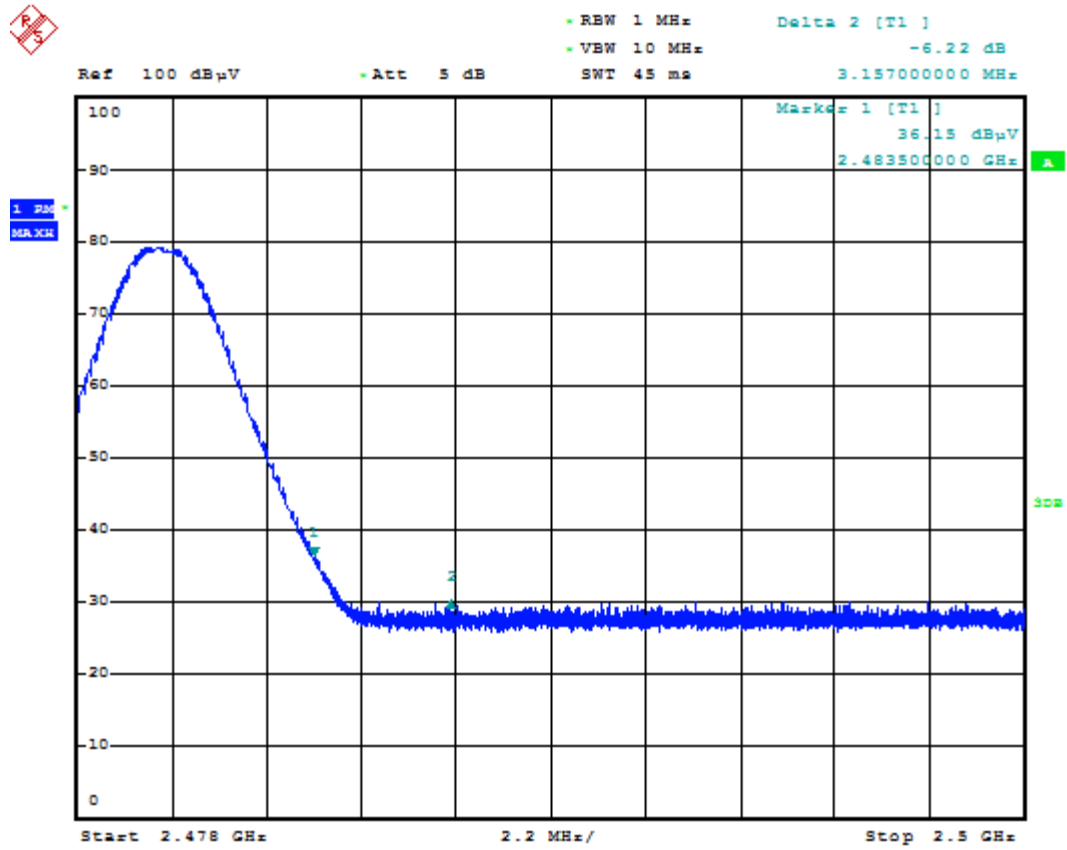
(Plot A.1 Channel = 0 PEAK)



(Plot A.2 Channel = 0 AVG)



(Plot B.1 Channel = 39 PEAK)



(Plot B.2 Channel = 39 AVG)

5.7 Conducted Emission

5.7.1 Requirement

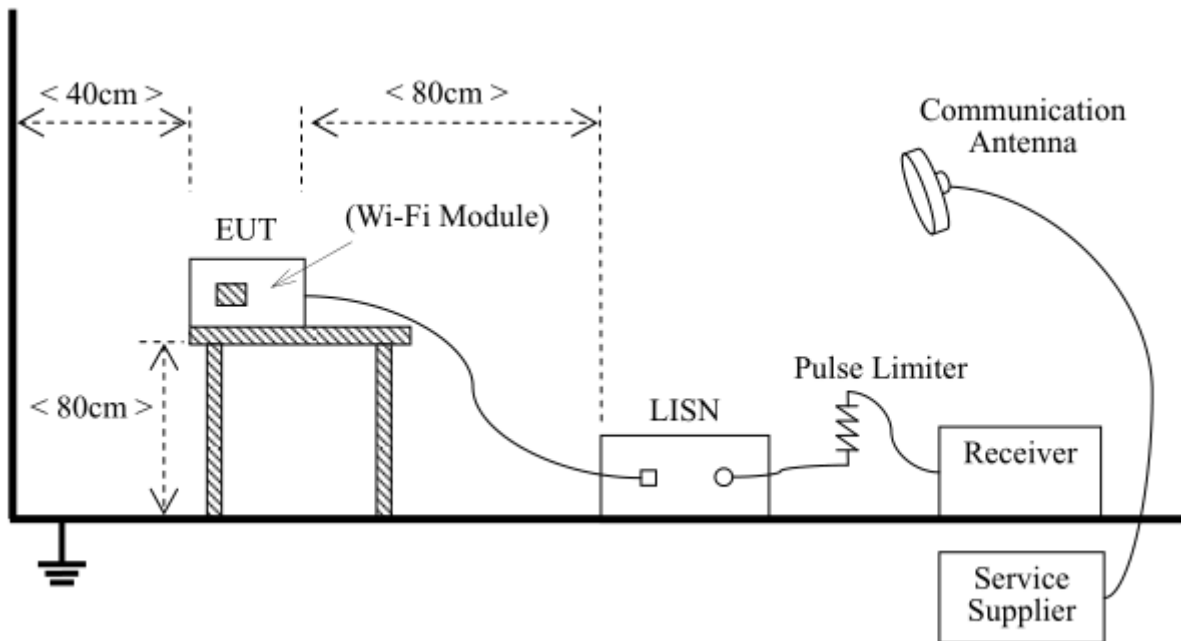
According to FCC section 15.207 and RSS-GEN 7.2.4, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network(LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

5.7.2 Test Description



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

5.7.3 Test result

This Bluetooth module designed can not to be connected to the public utility (AC) power line, so conducted emission is unnecessary.

5.8 Radiated Emission

5.8.1 Requirement

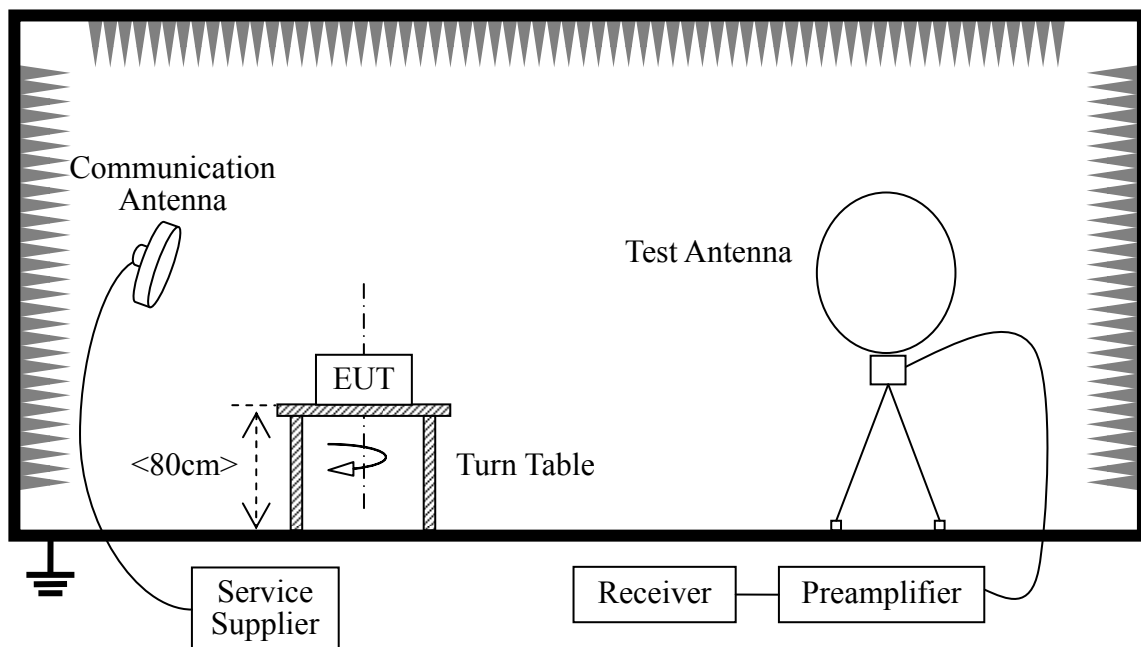
According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

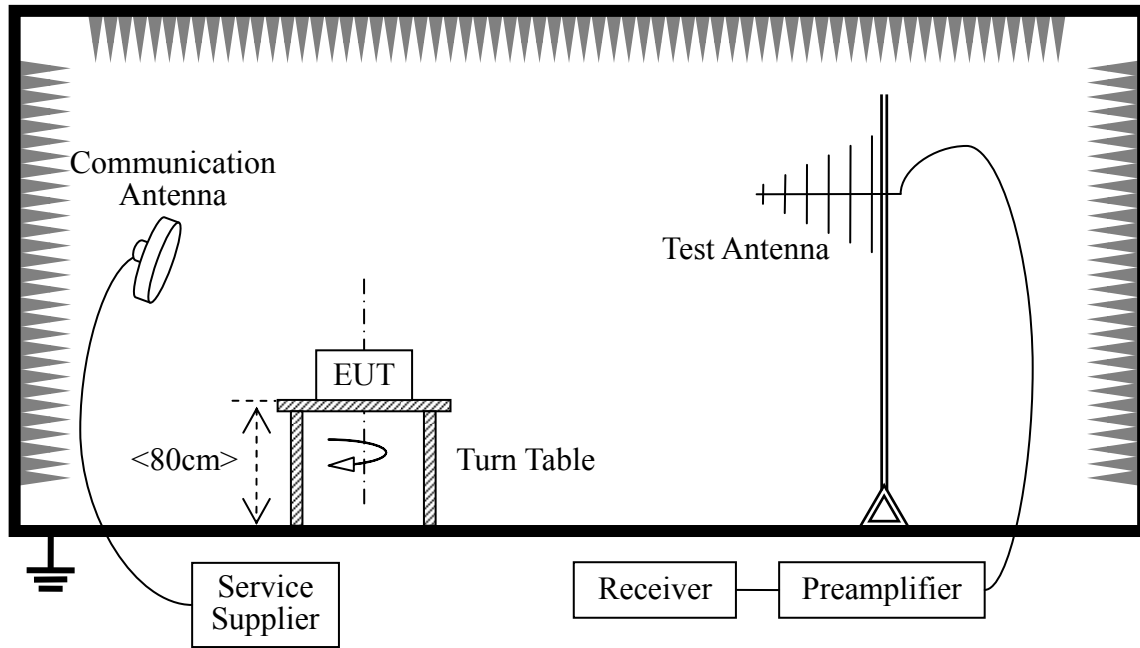
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)	Limit(dB $\mu\text{V/m}$)	Detector
0.009-0.490	2400/F(kHz)	300	/	/
0.490-1.705	24000/F(kHz)	30	/	/
1.705-30	30	30	/	/
30 - 88	100	3	40	QP
88 - 216	150	3	43.5	QP
216 - 960	200	3	46	QP
960 - 1000	500	3	54	QP
Above 1000	500	3	54	AV

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

5.8.2 Test setup



Radiated Emissions Below 30mHz



Radiated Emissions above 30mHz

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2003). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The Bluetooth Module of the EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0o to 360o, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT was placed within the 3dB beam width range of the horn antenna, and the EUT was tested in 3 orthogonal positions as recommended in ANSI C63.4 for Radiated Emissions and the worst-case data was presented.

5.8.3 Test Result

A. Test Result for 9kHz~30MHz

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
--	--	10	--	See Note

Note:

- The amplitude of spurious emissions that are attenuated by more than 10dB below the permissible value has no need to be reported.
- Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

c) *Limit line = specific limits (dBUV) + distance extrapolation factor.*

B. Test Result for 30MHz~10th Harmonic

Channel 0 (2402MHz)

Frequency (MHz)	Level (dBUV)	Limit Line (dBUV)	Margin (dB)	Antenna Polarization	Result
33.563	-	40	-	Horizontal	PASS
47.981	-	40	-	Horizontal	PASS
134.275	-	43.5	-	Horizontal	PASS
897.514	-	46	-	Horizontal	PASS
3102.143	-	54	-	Horizontal	PASS
7243.563	-	54	-	Horizontal	PASS
32.873	-	40	-	Vertical	PASS
55.432	-	40	-	Vertical	PASS
136.765	-	43.5	-	Vertical	PASS
557.879	-	46	-	Vertical	PASS
937.546	-	46	-	Vertical	PASS
5013.457	-	54	-	Vertical	PASS

Channel 19(2440MHz)

Frequency (MHz)	Level (dBUV)	Limit Line (dBUV)	Margin (dB)	Antenna Polarization	Result
32.579	-	40	-	Horizontal	PASS
87.735	-	40	-	Horizontal	PASS
237.961	-	43.5	-	Horizontal	PASS
579.365	-	46	-	Horizontal	PASS
2376.923	-	54	-	Horizontal	PASS
4781.978	-	54	-	Horizontal	PASS
35.335	-	40	-	Vertical	PASS
48.355	-	40	-	Vertical	PASS
254.275	-	43.5	-	Vertical	PASS
1187.733	-	46	-	Vertical	PASS
2357.698	-	54	-	Vertical	PASS
7241.970	-	54	-	Vertical	PASS

Channel 39(2480MHz)

Frequency (MHz)	Level (dBUV)	Limit Line (dBUV)	Margin (dB)	Antenna Polarization	Result
30.775	-	40	-	Horizontal	PASS
112.551	-	40	-	Horizontal	PASS
144.702	-	43.5	-	Horizontal	PASS
993.327	-	46	-	Horizontal	PASS
2103.575	-	54	-	Horizontal	PASS
6598.343	-	54	-	Horizontal	PASS
30.970	-	40	-	Vertical	PASS

Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Result
66.456	-	40	-	Vertical	PASS
227.358	-	43.5	-	Vertical	PASS
514.558	-	46	-	Vertical	PASS
1697.061	-	54	-	Vertical	PASS
5223.754	-	54	-	Vertical	PASS

** END OF REPORT **