FCC Radio Test Report

FCC ID: SJ8BM200M

Original Grant

Report No.	:	TB-FCC158184
Applicant	:	RDI Technology (Shenzhen) Co., Ltd.
Equipment Under Test (EUT)		
EUT Name	:	5 Inch Wireless Touch Monitor
Model No.	:	BM200M
Series Model No.	:	N/A
Brand Name	:	CasaCam
Receipt Date	:	2018-03-20
Test Date	:	2018-03-21 to 2018-04-08
Issue Date	:	2018-04-09
Standards	:	FCC Part 15: 2017, Subpart C(15.247)
Test Method	:	ANSI C63.10: 2013
Conclusions	:	**PASS**
		In the configuration tested, the EUT complied with the standards specified above, The EUT technically complies with the FCC requirements
Test/Witness Engineer	:	Terry.Su
Engineer Supervisor	:	JUAN SU
Engineer Manager	:	Ray Lai.

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

Contents

CONTENTS....2
1. GENERAL INFORMATION ABOUT EUT....5
1.1 Client Information....5
1.2 General Description of EUT (Equipment Under Test)....5
1.3 Block Diagram Showing the Configuration of System Tested....6
1.4 Description of Support Units....6
1.5 Description of Test Mode....6
1.6 Description of Test Software Setting....7
1.7 Measurement Uncertainty....7
1.8 Test Facility....8
2. TEST SUMMARY....9
3. TEST EQUIPMENT....10
4. CONDUCTED EMISSION TEST....11
4.1 Test Standard and Limit....11
4.2 Test Setup....11
4.3 Test Procedure....11
4.4 EUT Operating Mode....12
4.5 Test Data....12
5. RADIATED EMISSION TEST....13
5.1 Test Standard and Limit....13
5.2 Test Setup....14
5.3 Test Procedure....15
5.4 EUT Operating Condition....15
5.5 Test Data....15
6. RESTRICTED BANDS REQUIREMENT....16
6.1 Test Standard and Limit....16
6.2 Test Setup....16
6.3 Test Procedure....16
6.4 EUT Operating Condition....17
6.5 Test Data....17
7. NUMBER OF HOPPING CHANNEL....18
7.1 Test Standard and Limit....18
7.2 Test Setup....18
7.3 Test Procedure....18
7.4 EUT Operating Condition....18
7.5 Test Data....18
8. AVERAGE TIME OF OCCUPANCY....19
8.1 Test Standard and Limit....19
8.2 Test Setup....19

8.3 Test Procedure 19
8.4 EUT Operating Condition 19
8.5 Test Data 19
9. CHANNEL SEPARATION AND BANDWIDTH TEST 21
9.1 Test Standard and Limit 21
9.2 Test Setup 21
9.3 Test Procedure 21
9.4 EUT Operating Condition 21
9.5 Test Data 22
10. PEAK OUTPUT POWER TEST 23
10.1 Test Standard and Limit 23
10.2 Test Setup 23
10.3 Test Procedure 23
10.4 EUT Operating Condition 23
10.5 Test Data 23
11. ANTENNA REQUIREMENT 24
11.1 Standard Requirement 24
11.2 Antenna Connected Construction 24
11.3 Result 24
ATTACHMENT A-- CONDUCTED EMISSION TEST DATA 25
ATTACHMENT B-- RADIATED EMISSION TEST DATA 25
ATTACHMENT C-- RESTRICTED BANDS REQUIREMENT TEST DATA 37
ATTACHMENT D-- NUMBER OF HOPPING CHANNEL TEST DATA 43
ATTACHMENT E-- AVERAGE TIME OF OCCUPANCY TEST DATA 44
ATTACHMENT F-- CHANNEL SEPARATION AND BANDWIDTH TEST DATA 46
ATTACHMENT G-- PEAK OUTPUT POWER TEST DATA 54

Revision History

Report No.	Version	Description	Issued Date
TB-FCC158184	Rev.01	Initial issue of report	2018-04-08

1. General Information about EUT

1.1 Client Information

Applicant	:	RDI Technology (Shenzhen) Co., Ltd.
Address	:	Building C1, Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, PRC.
Manufacturer	:	RDI Technology (Shenzhen) Co., Ltd.
Address	:	Building C1, Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, PRC.

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	5 Inch Wireless Touch Monitor	
Models No.	:	BM200M	
Product Description	:	Operation Frequency:	2408~2468MHz
		Number of Channel:	16 channels **see note(2)**
		RF Output Power:	20.211dBm Conducted Power
		Antenna Gain:	2dBi Dipole Antenna
		Modulation Type:	GFSK
		Bit Rate of Transmitter:	4Mbps(GFSK)
Power Supply	:	DC Voltage supplied by AC/DC Adapter.	
Power Rating	:	AC/DC Adapter (CS6F050100FUF): Input: AC 100~240V, 50/60Hz, 0.2A. Output: DC 5V, 1.0A. DC 3.7V by 2500mAh Li-ion battery.	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

(2) Channel List:

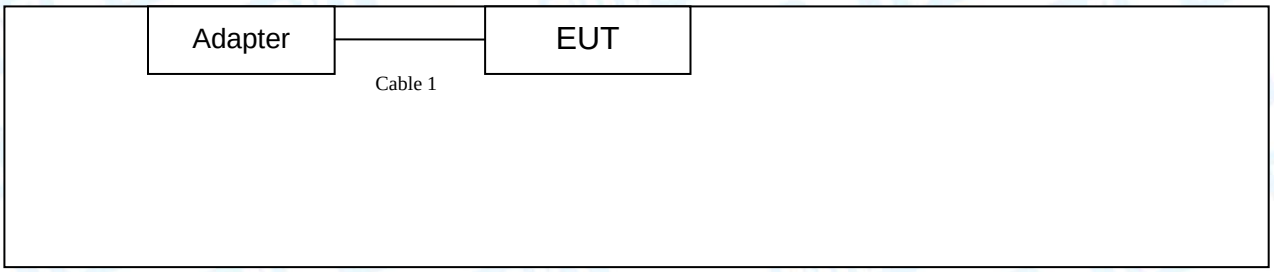
Channel List					
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
01	2408	07	2432	13	2456
02	2412	08	2436	14	2460
03	2416	**09**	2440	15	2464
04	2420	10	2444	**16**	2468

05	2424	11	2448		
06	2428	12	2452		

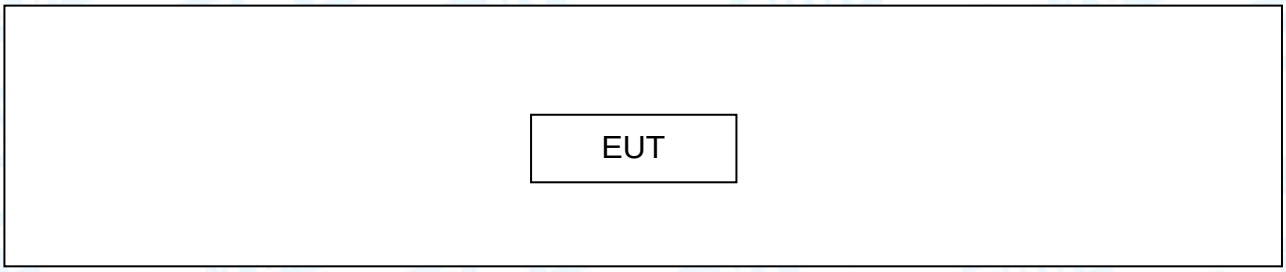
(3) The Antenna information about the equipment is provided by the applicant.

1.3 Block Diagram Showing the Configuration of System Tested

Charging + TX Mode



TX Mode



1.4 Description of Support Units

Equipment Information				
Name	**Model**	**FCC ID/VOC**	**Manufacturer**	**Used "√"**
/	/	/	/	/
Cable Information				
Number	**Shielded Type**	**Ferrite Core**	**Length**	**Note**
Cable 1	NO	NO	2.7M	

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test

Final Test Mode	Description
Mode 1	Charing + TX Mode (CH01/CH09/CH16)

For Radiated Test	
Final Test Mode	**Description**
Mode 2	TX Mode
Mode 3	TX Mode (CH01/CH09/CH16)
Mode 4	Hopping Mode

Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test modes above.
According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:
TX Mode: GFSK Modulation Transmitting mode.

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

Test Software Version	**N/A**		
Frequency	2408 MHz	2440MHz	2468MHz
GFSK	DEF	DEF	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	**Parameters**	**Expanded Uncertainty (U_{Lab})**
Conducted Emission	Level Accuracy:	±3.42 dB

	9kHz~150kHz 150kHz to 30MHz	±3.42 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.40 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.

IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2. Test Summary

FCC Part 15 Subpart C(15.247)/ RSS 247 Issue 1				
Standard Section		Test Item	Judgment	Remark
FCC	IC			
15.203		Antenna Requirement	PASS	N/A
15.207	RSS-GEN 7.2.2	Conducted Emission	PASS	N/A
15.205	RSS-Gen 7.2.3	Restricted Bands	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (2)	Hopping Channel Separation	PASS	N/A
15.247(a)(1)	RSS 247 5.1 (4)	Dwell Time	PASS	N/A
15.247(b)(1)	RSS 247 5.4 (2)	Peak Output Power	PASS	N/A
15.247(b)(1)	RSS 247 5.1 (4)	Number of Hopping Frequency	PASS	N/A
15.247(d)	RSS 247 5.5	Band Edge	PASS	N/A
15.247(c)& 15.209	RSS 247 5.5	Radiated Spurious Emission	PASS	N/A
15.247(a)	RSS 247 5.1 (1)	99% Occupied Bandwidth & 20dB Bandwidth	PASS	99%OBW: GFSK: 4592.1kHz
Note: N/A is an abbreviation for Not Applicable.				

3. Test Equipment

Conducted Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 20, 2017	Jul. 19, 2018
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 20, 2017	Jul. 19, 2018
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 20, 2017	Jul. 19, 2018
LISN	Rohde & Schwarz	ENV216	101131	Jul. 20, 2017	Jul. 19, 2018
Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 20, 2017	Jul. 19, 2018
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.16, 2018	Mar. 15, 2019
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.16, 2018	Mar. 15, 2019
Loop Antenna	Laplace instrument	RF300	0701	Mar.16, 2018	Mar. 15, 2019
Pre-amplifier	Sonoma	310N	185903	Mar.16, 2018	Mar. 15, 2019
Pre-amplifier	HP	8449B	3008A00849	Mar.16, 2018	Mar. 15, 2019
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.16, 2018	Mar. 15, 2019
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 20, 2017	Jul. 19, 2018
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Oct. 26, 2017	Oct. 25, 2018
Vector Signal Generator	Agilent	N5182A	MY50141294	Oct. 26, 2017	Oct. 25, 2018
Analog Signal Generator	Agilent	N5181A	MY50141953	Oct. 26, 2017	Oct. 25, 2018
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Oct. 26, 2017	Oct. 25, 2018

4. Conducted Emission Test

4.1 Test Standard and Limit

4.1.1Test Standard

FCC Part 15.207

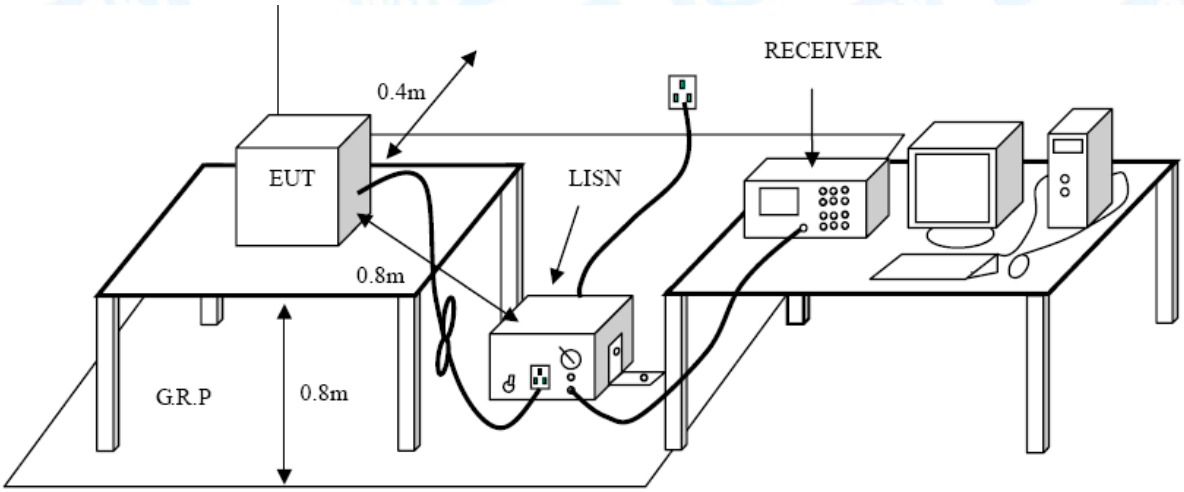
4.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2 Test Setup



4.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

4.4 EUT Operating Mode

Please refer to the description of test mode.

4.5 Test Data

Please refer to the Attachment A.

5. Radiated Emission Test

5.1 Test Standard and Limit

5.1.1 Test Standard

FCC Part 15.209

5.1.2 Test Limit

Radiated Emission Limit (9 kHz~1000MHz)

Frequency (MHz	Field Strength (microvolt/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

Radiated Emission Limit (Above 1000MHz)

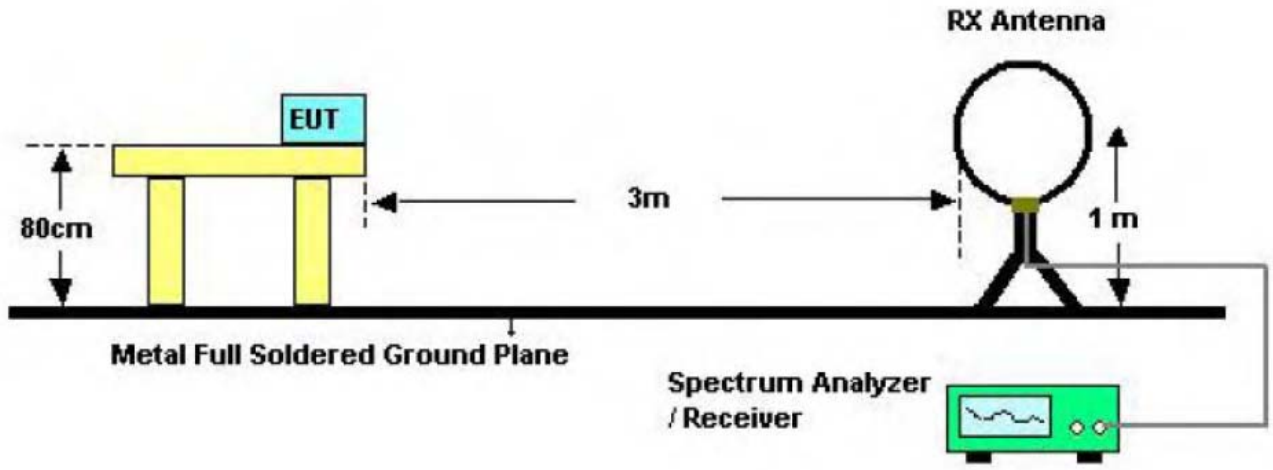
Frequency (MHz)	Class B (dBuV/m)(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

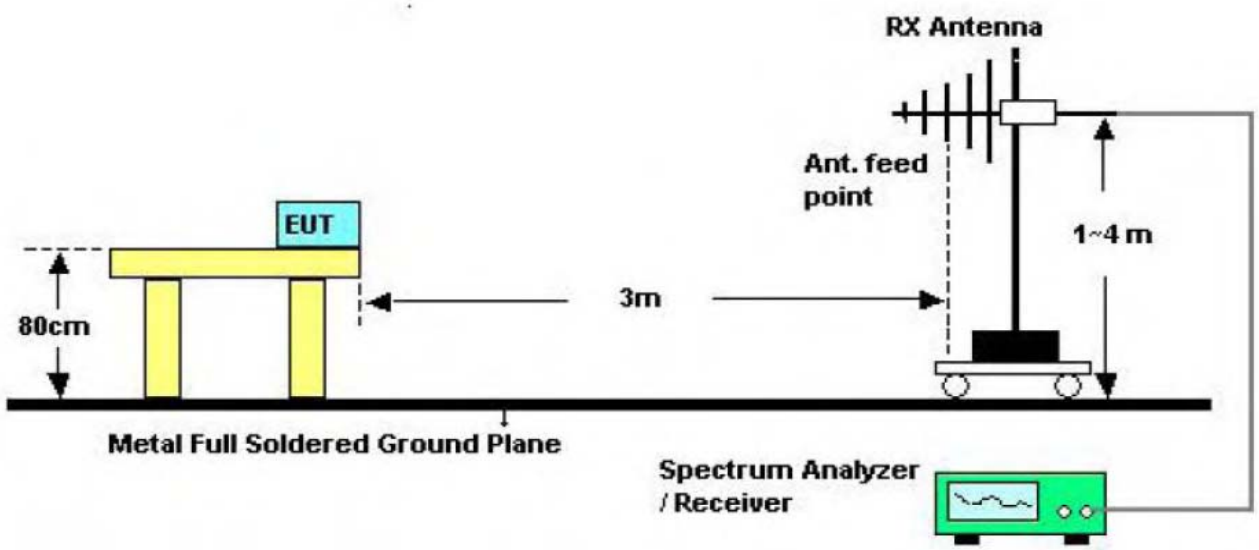
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

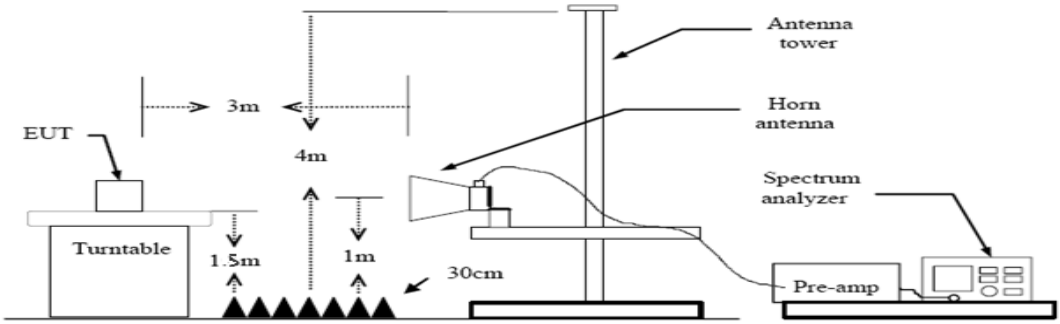
5.2 Test Setup



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

5.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

5.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power in TX mode.

5.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment B.

6. Restricted Bands Requirement

6.1 Test Standard and Limit

6.1.1 Test Standard

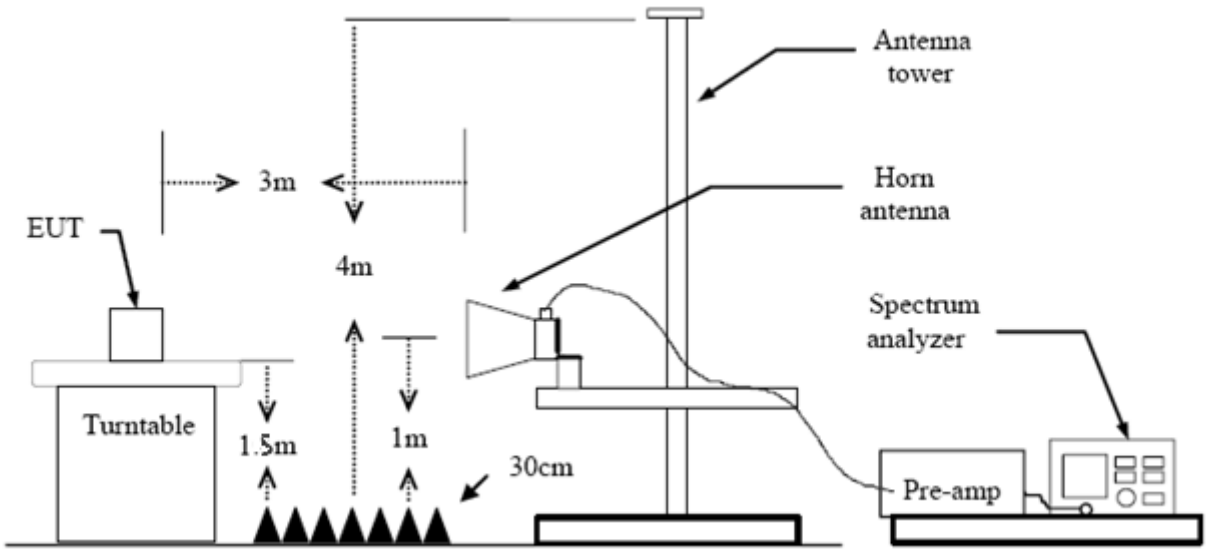
FCC Part 15.209

FCC Part 15.205

6.1.2 Test Limit

Restricted Frequency Band (MHz)	Class B (dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

6.2 Test Setup



6.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with AVG Detector for Average Values.
(8) For the actual test configuration, please see the test setup photo.

6.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

6.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

All restriction bands have been tested, only the worst case is reported.

Please refer to the Attachment C.

7. Number of Hopping Channel

7.1 Test Standard and Limit

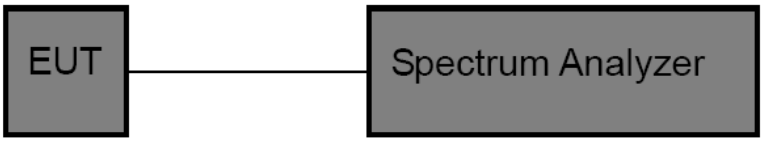
6.1.1 Test Standard

FCC Part 15.247 (a)(1)

6.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

7.2 Test Setup



7.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.

7.4 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

7.5 Test Data

Please refer to the Attachment D.

8. Average Time of Occupancy

8.1 Test Standard and Limit

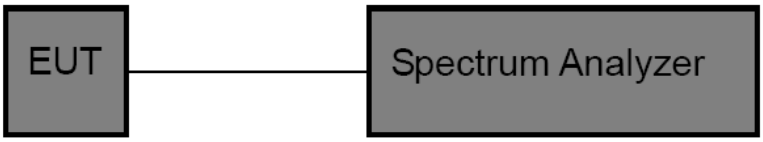
8.1.1 Test Standard

FCC Part 15.247 (a)(1)

8.1.2 Test Limit

Section	Test Item	Limit
15.247(a)(1)/ RSS-210 Annex 8(A8.1d)	Average Time of Occupancy	0.4 sec

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
(2) Spectrum Setting: RBW=1MHz, VBW=1MHz.
(3) Use video trigger with the trigger level set to enable triggering only on full pulses.
(4) Sweep Time is more than once pulse time.
(5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
(6) Measure the maximum time duration of one single pulse.
(7) Set the EUT for packet transmitting.
(8) Measure the maximum time duration of one single pulse.

8.4 EUT Operating Condition

The average time of occupancy on any channel within the Period can be calculated with formulas:
{Total of Dwell} = Ton*Ton times in 1s*0.4s*Channel numbers
The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

The EUT was set to the Hopping Mode by the Customer.

8.5 Test Data

Please refer to the Attachment E.

9. Channel Separation and Bandwidth Test

9.1 Test Standard and Limit

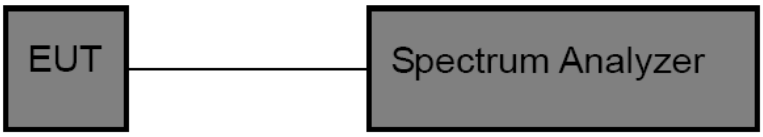
9.1.1 Test Standard

FCC Part 15.247

9.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

9.2 Test Setup



9.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:
Channel Separation: RBW=100 kHz, VBW=100 kHz.
Bandwidth: RBW=30 kHz, VBW=100 kHz.

(3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst –case (i.e the widest) bandwidth.

(4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

9.4 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

9.5 Test Data

Please refer to the Attachment F.

10. Peak Output Power Test

10.1 Test Standard and Limit

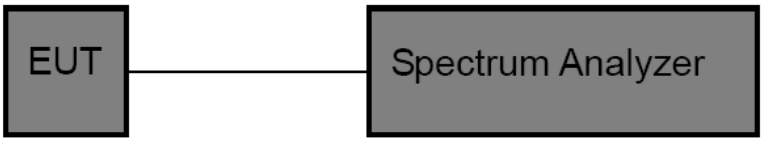
10.1.1 Test Standard

FCC Part 15.247 (b) (1)

10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125 mW(21dBm)	2400~2483.5

10.2 Test Setup



10.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:

Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.

Bandwidth⩽RBW, VBW⩾RBW for bandwidth more than 1MHz.

10.4 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

10.5 Test Data

Please refer to the Attachment G.

11. Antenna Requirement

11.1 Standard Requirement

11.1.1 Standard

FCC Part 15.203

11.1.2 Requirement

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

11.2 Antenna Connected Construction

The directional gains of the antenna used for transmitting is 2dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

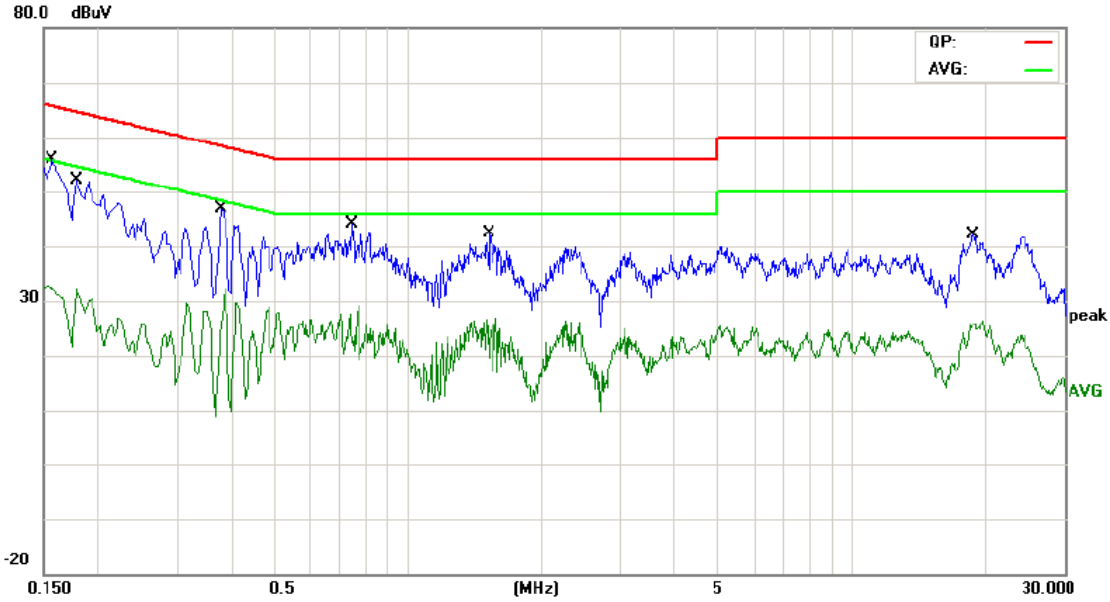
11.3 Result

The EUT antenna is a Dipole Antenna Antenna. It complies with the standard requirement.

Antenna Type
☐Permanent attached antenna
☒Unique connector antenna
☐Professional installation antenna

Attachment A-- Conducted Emission Test Data

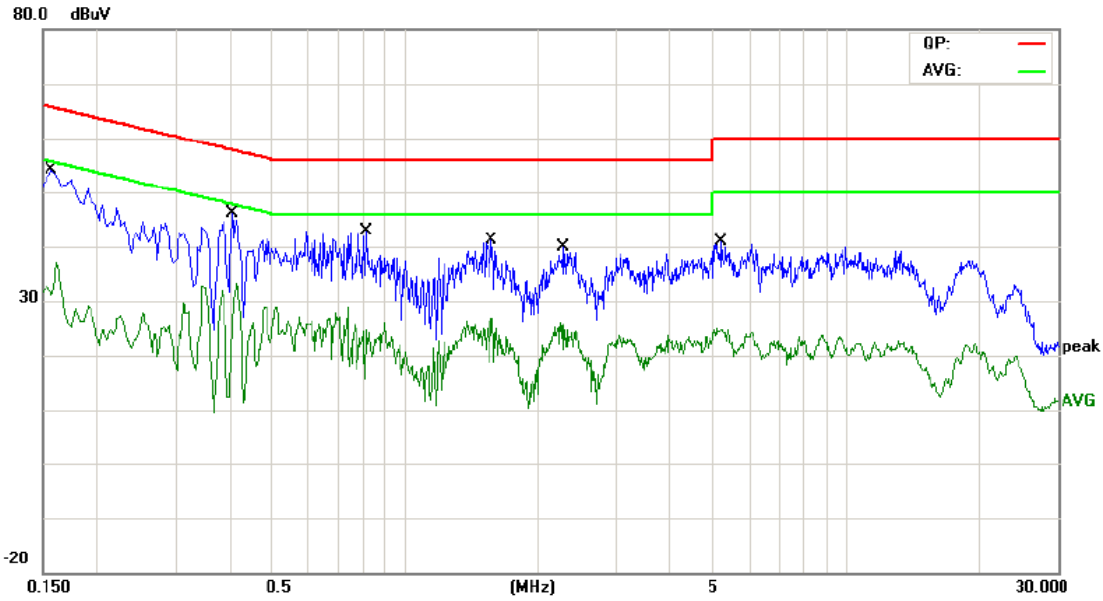
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Line		
Test Mode:	USB Charging Mode		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1580	41.32	9.58	50.90	65.56	-14.66	QP
2		0.1580	22.45	9.58	32.03	55.56	-23.53	AVG
3		0.1780	34.47	9.58	44.05	64.57	-20.52	QP
4		0.1780	15.11	9.58	24.69	54.57	-29.88	AVG
5		0.3780	33.20	9.60	42.80	58.32	-15.52	QP
6		0.3780	15.16	9.60	24.76	48.32	-23.56	AVG
7		0.7460	26.69	9.61	36.30	56.00	-19.70	QP
8		0.7460	9.02	9.61	18.63	46.00	-27.37	AVG
9		1.5260	26.87	9.61	36.48	56.00	-19.52	QP
10		1.5260	10.17	9.61	19.78	46.00	-26.22	AVG
11		18.7099	25.30	10.51	35.81	60.00	-24.19	QP
12		18.7099	13.23	10.51	23.74	50.00	-26.26	AVG

Emission Level= Read Level+ Correct Factor

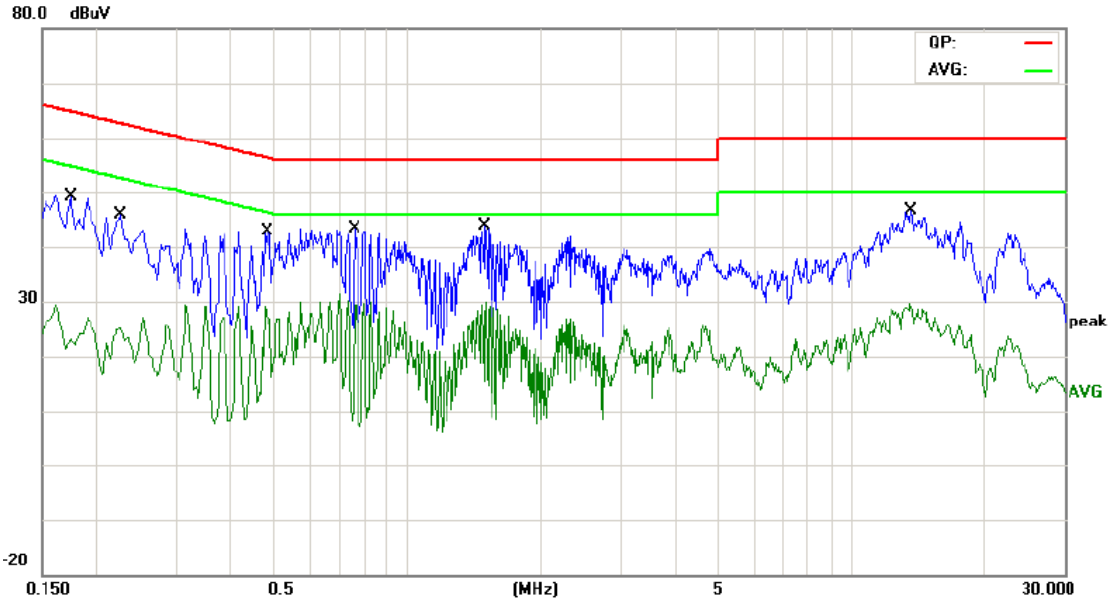
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60 Hz		
Terminal:	Neutral		
Test Mode:	USB Charging Mode		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1580	40.64	9.64	50.28	65.56	-15.28	QP
2		0.1580	22.37	9.64	32.01	55.56	-23.55	AVG
3	*	0.4060	33.04	9.58	42.62	57.73	-15.11	QP
4		0.4060	17.97	9.58	27.55	47.73	-20.18	AVG
5		0.8139	28.60	9.59	38.19	56.00	-17.81	QP
6		0.8139	12.28	9.59	21.87	46.00	-24.13	AVG
7		1.5660	26.09	9.60	35.69	56.00	-20.31	QP
8		1.5660	15.72	9.60	25.32	46.00	-20.68	AVG
9		2.2780	26.49	9.63	36.12	56.00	-19.88	QP
10		2.2780	15.29	9.63	24.92	46.00	-21.08	AVG
11		5.2020	23.62	9.95	33.57	60.00	-26.43	QP
12		5.2020	14.15	9.95	24.10	50.00	-25.90	AVG

Emission Level= Read Level+ Correct Factor

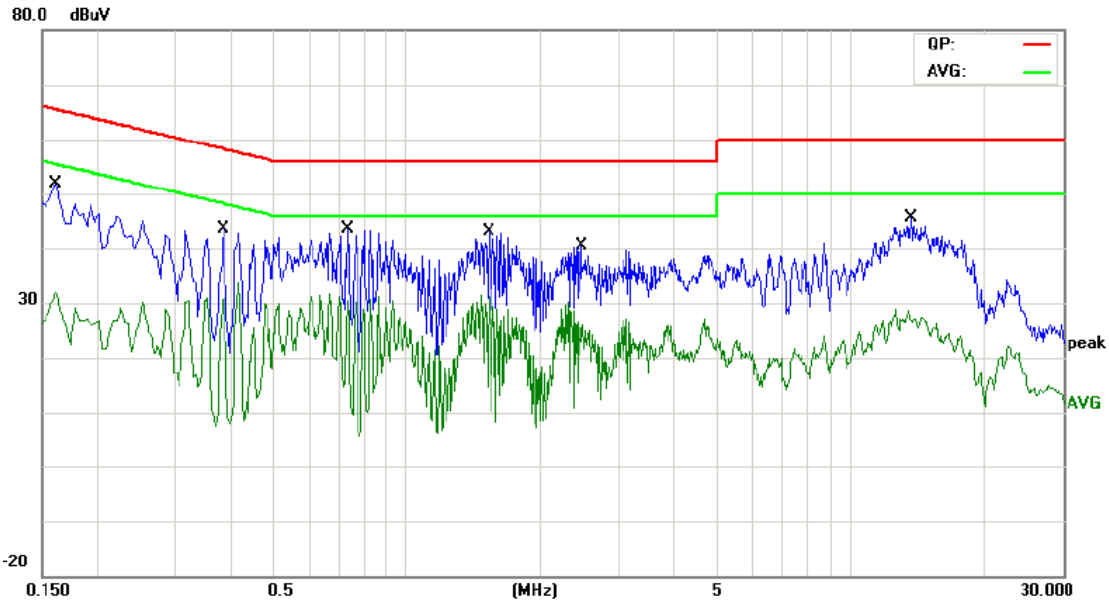
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 240V/60 Hz		
Terminal:	Line		
Test Mode:	USB Charging Mode		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1740	30.84	9.58	40.42	64.76	-24.34	QP
2		0.1740	11.14	9.58	20.72	54.76	-34.04	AVG
3		0.2260	30.09	9.58	39.67	62.59	-22.92	QP
4		0.2260	14.94	9.58	24.52	52.59	-28.07	AVG
5		0.4860	25.11	9.60	34.71	56.24	-21.53	QP
6		0.4860	9.82	9.60	19.42	46.24	-26.82	AVG
7	*	0.7620	29.68	9.61	39.29	56.00	-16.71	QP
8		0.7620	19.47	9.61	29.08	46.00	-16.92	AVG
9		1.4900	28.56	9.60	38.16	56.00	-17.84	QP
10		1.4900	13.86	9.60	23.46	46.00	-22.54	AVG
11		13.5540	29.36	10.35	39.71	60.00	-20.29	QP
12		13.5540	16.44	10.35	26.79	50.00	-23.21	AVG

Emission Level= Read Level+ Correct Factor

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	AC 240V/60 Hz		
Terminal:	Neutral		
Test Mode:	USB Charging Mode		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1620	36.39	9.64	46.03	65.36	-19.33	QP
2		0.1620	20.46	9.64	30.10	55.36	-25.26	AVG
3		0.3860	28.95	9.58	38.53	58.15	-19.62	QP
4		0.3860	18.96	9.58	28.54	48.15	-19.61	AVG
5		0.7340	28.97	9.59	38.56	56.00	-17.44	QP
6		0.7340	20.25	9.59	29.84	46.00	-16.16	AVG
7		1.5300	27.98	9.60	37.58	56.00	-18.42	QP
8	*	1.5300	20.61	9.60	30.21	46.00	-15.79	AVG
9		2.4620	22.29	9.64	31.93	56.00	-24.07	QP
10		2.4620	11.21	9.64	20.85	46.00	-25.15	AVG
11		13.6780	24.12	10.51	34.63	60.00	-25.37	QP
12		13.6780	14.37	10.51	24.88	50.00	-25.12	AVG

Emission Level= Read Level+ Correct Factor

Attachment B-- Radiated Emission Test Data

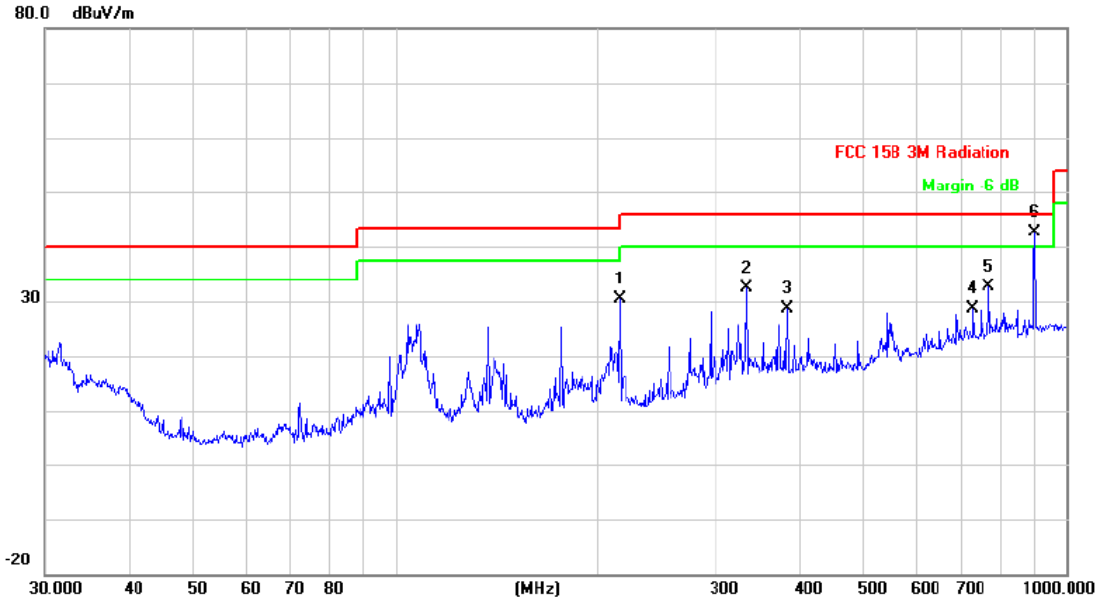
9KHz~30MHz

From 9KHz to 30MHz: Conclusion: PASS

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

30MHz~1GHz

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 2408MHz		
Remark:	Only worse case is reported		

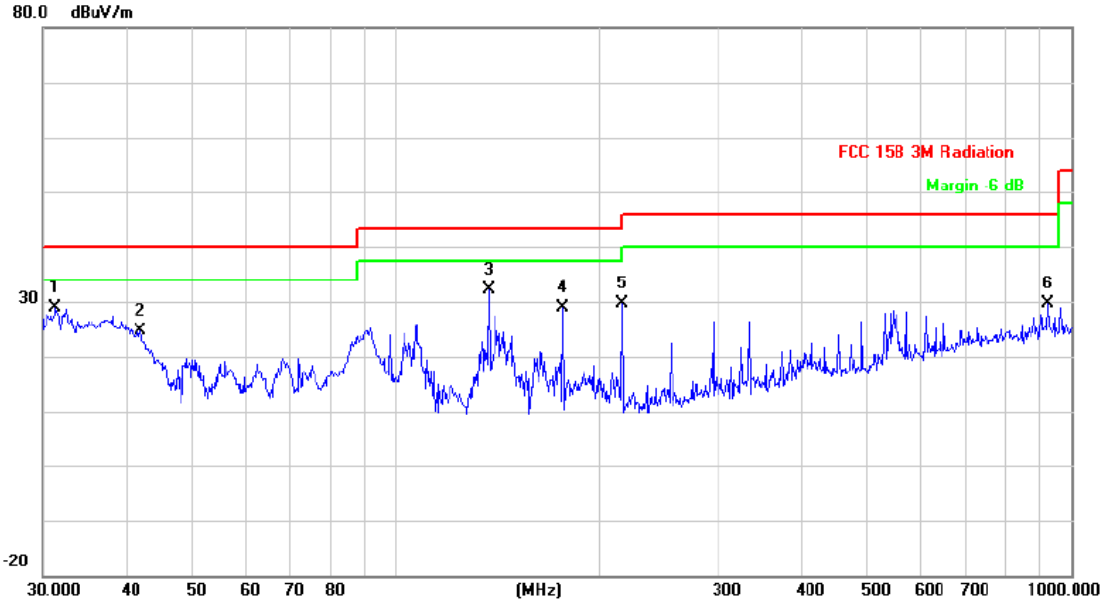


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		216.0240	49.17	-18.72	30.45	46.00	-15.55	QP
2		333.6867	46.97	-14.51	32.46	46.00	-13.54	QP
3		383.9318	41.52	-12.85	28.67	46.00	-17.33	QP
4		726.8052	34.71	-6.01	28.70	46.00	-17.30	QP
5		768.7481	38.15	-5.63	32.52	46.00	-13.48	QP
6	*	900.1474	46.40	-3.67	42.73	46.00	-3.27	QP

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 2408MHz		
Remark:	Only worse case is reported		



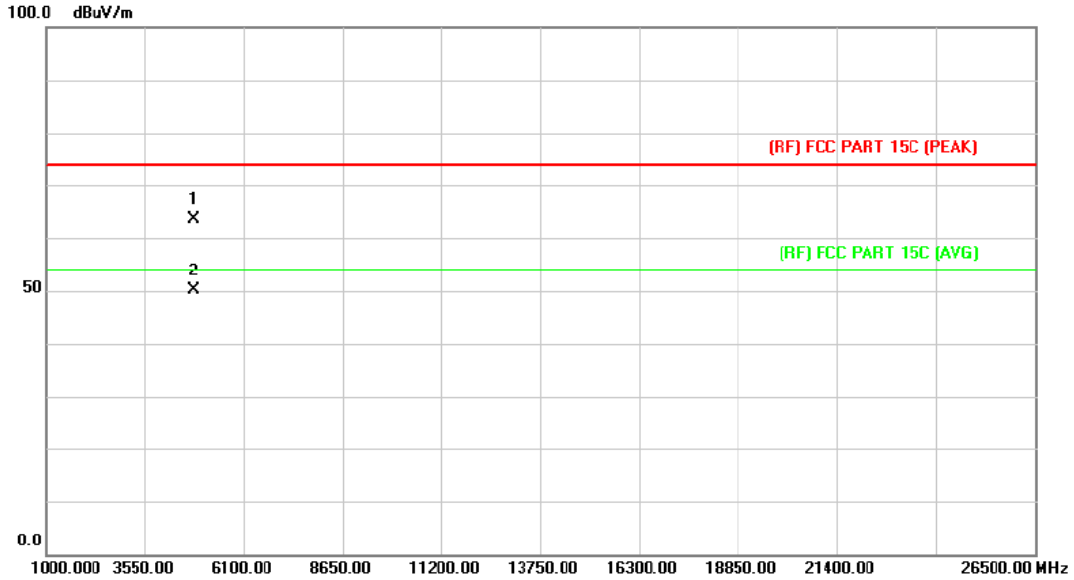
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	31.3992	43.25	-14.33	28.92	40.00	-11.08	QP
2		41.8596	45.09	-20.39	24.70	40.00	-15.30	QP
3		137.4202	53.49	-21.40	32.09	43.50	-11.41	QP
4		176.8878	48.90	-19.95	28.95	43.50	-14.55	QP
5		216.0240	48.41	-18.72	29.69	46.00	-16.31	QP
6		925.7563	33.09	-3.38	29.71	46.00	-16.29	QP

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

Above 1GHz

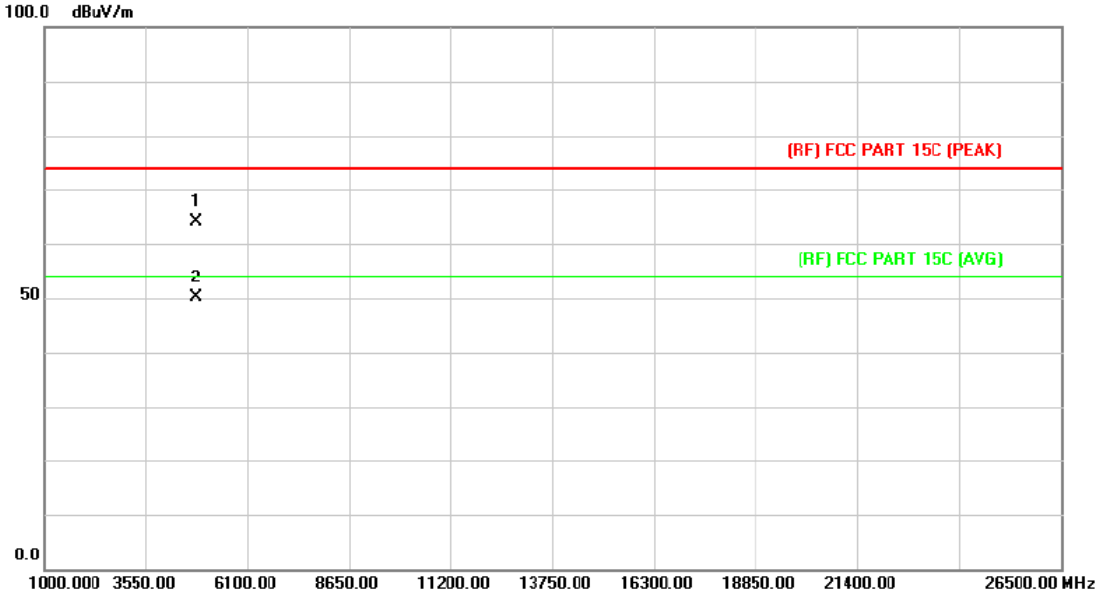
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Horizontal		
Test Mode:	TX 2408MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4815.134	47.75	15.97	63.72	74.00	-10.28	peak
2	*	4816.494	34.12	15.97	50.09	54.00	-3.91	AVG

Emission Level= Read Level+ Correct Factor

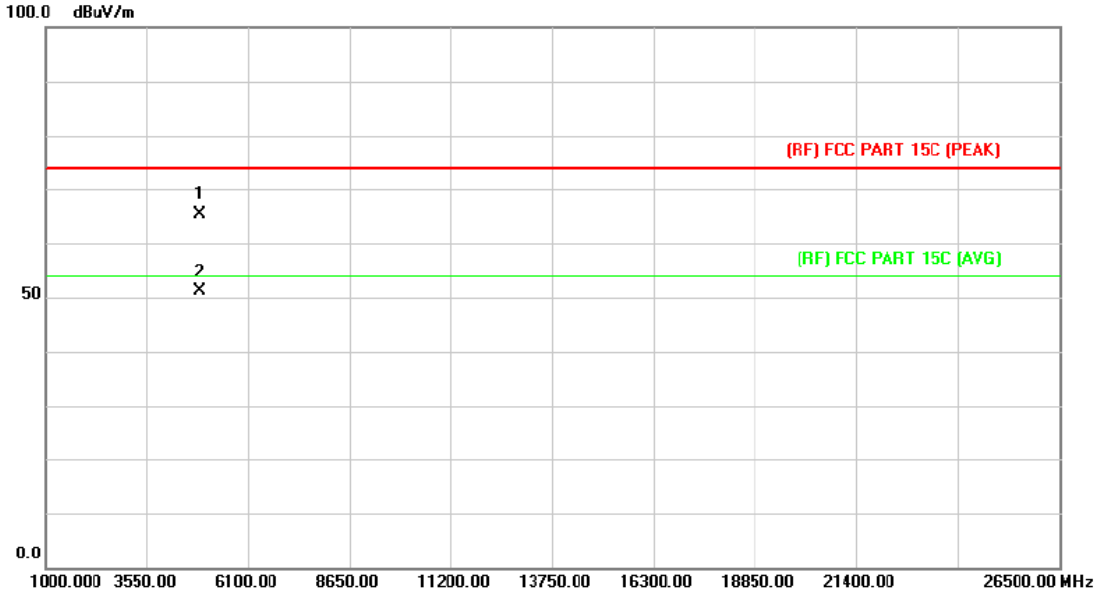
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Vertical		
Test Mode:	TX 2408MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4815.106	48.13	15.97	64.10	74.00	-9.90	peak
2	*	4816.798	34.10	15.97	50.07	54.00	-3.93	AVG

Emission Level= Read Level+ Correct Factor

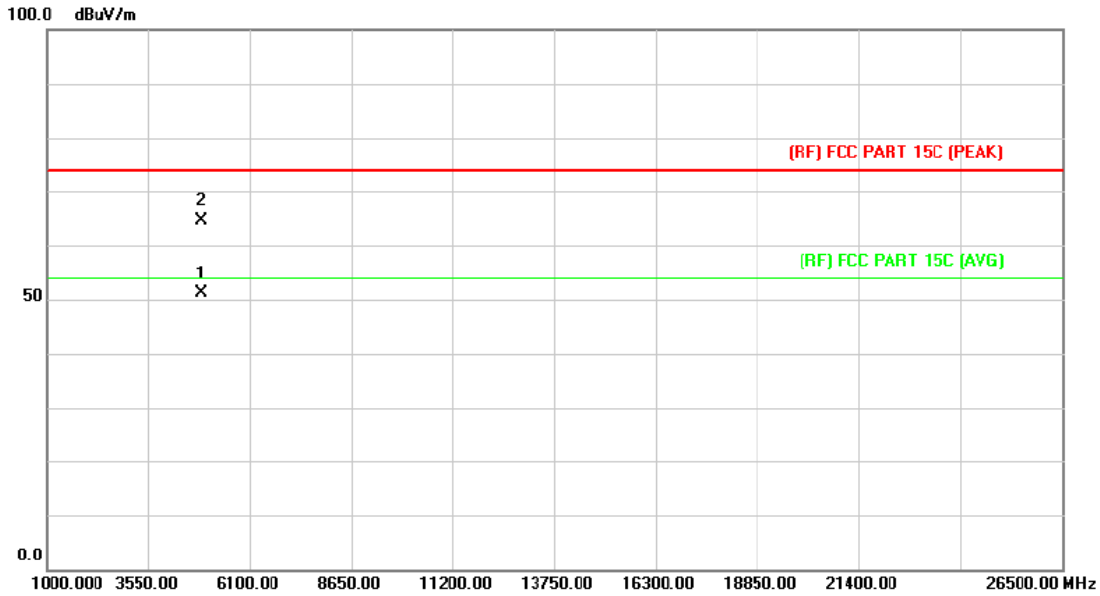
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Horizontal		
Test Mode:	TX 2440MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4879.154	48.78	16.51	65.29	74.00	-8.71	peak
2	*	4879.242	34.61	16.51	51.12	54.00	-2.88	AVG

Emission Level= Read Level+ Correct Factor

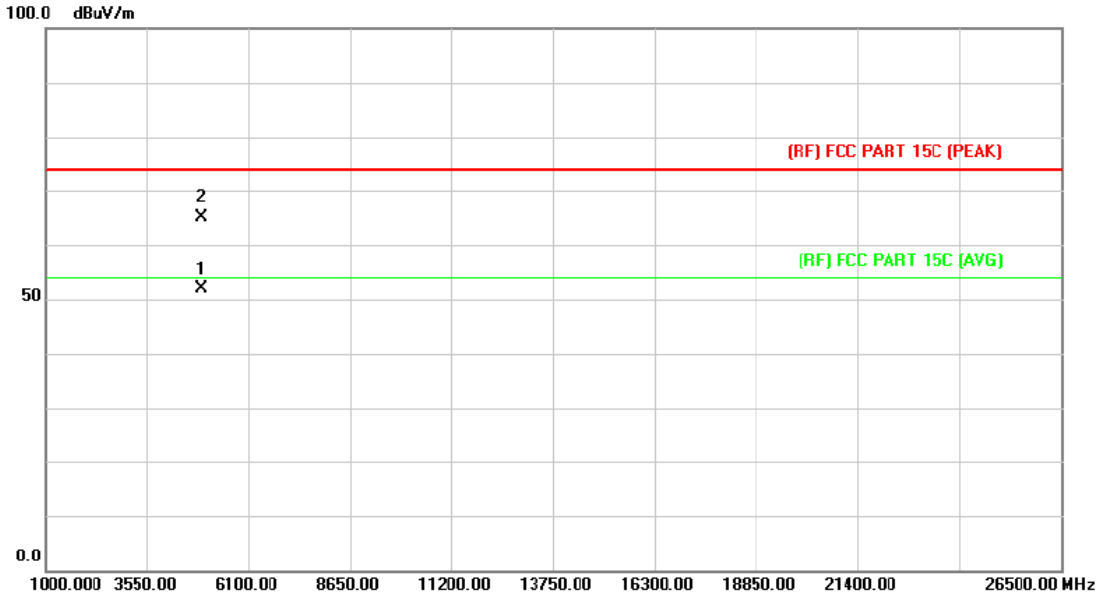
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Vertical		
Test Mode:	TX 2440MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4879.706	34.61	16.51	51.12	54.00	-2.88	AVG
2		4880.046	48.07	16.51	64.58	74.00	-9.42	peak

Emission Level= Read Level+ Correct Factor

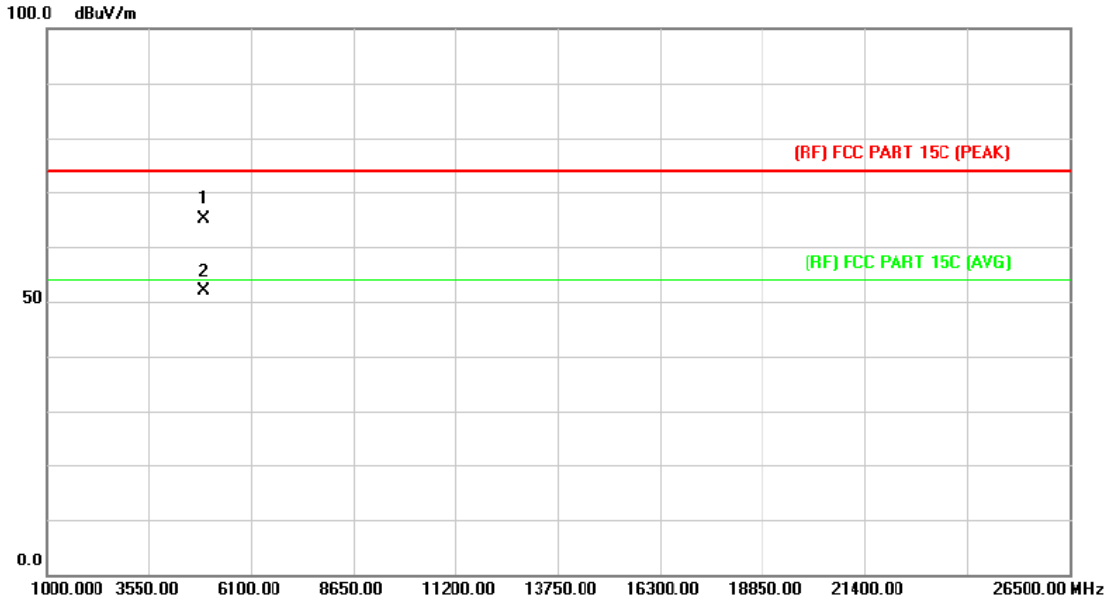
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Horizontal		
Test Mode:	TX 2468MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4935.444	34.81	16.98	51.79	54.00	-2.21	AVG
2		4936.900	48.19	16.99	65.18	74.00	-8.82	peak

Emission Level= Read Level+ Correct Factor

Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 120V/60HZ		
Ant. Pol.	Vertical		
Test Mode:	TX 2468MHz		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



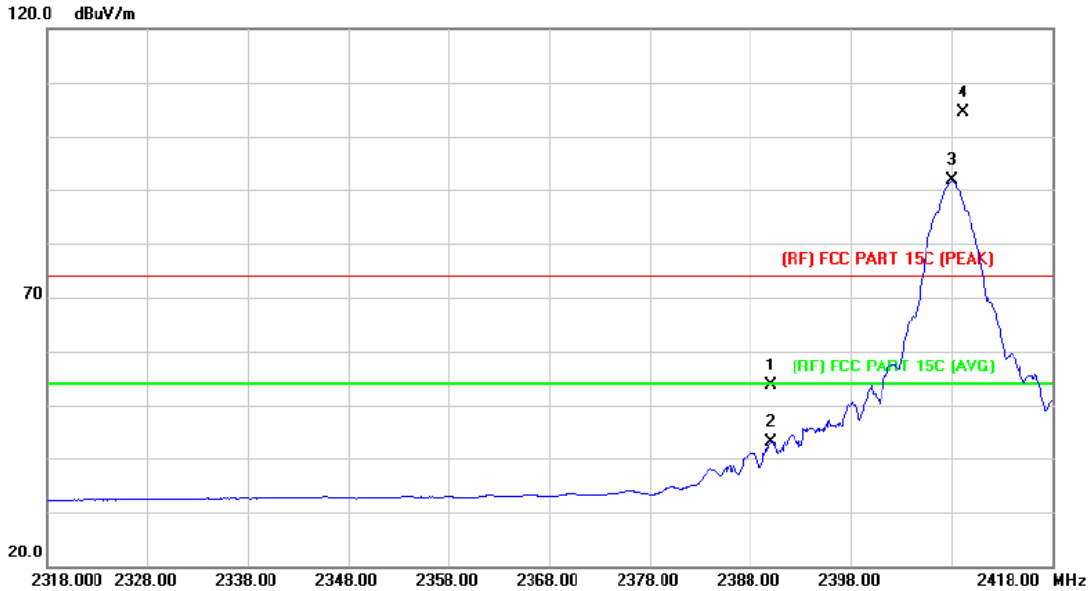
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4935.002	48.17	16.98	65.15	74.00	-8.85	peak
2	*	4936.680	34.88	16.99	51.87	54.00	-2.13	AVG

Emission Level= Read Level+ Correct Factor

Attachment C-- Restricted Bands Requirement Test Data

(1) **Radiation Test**

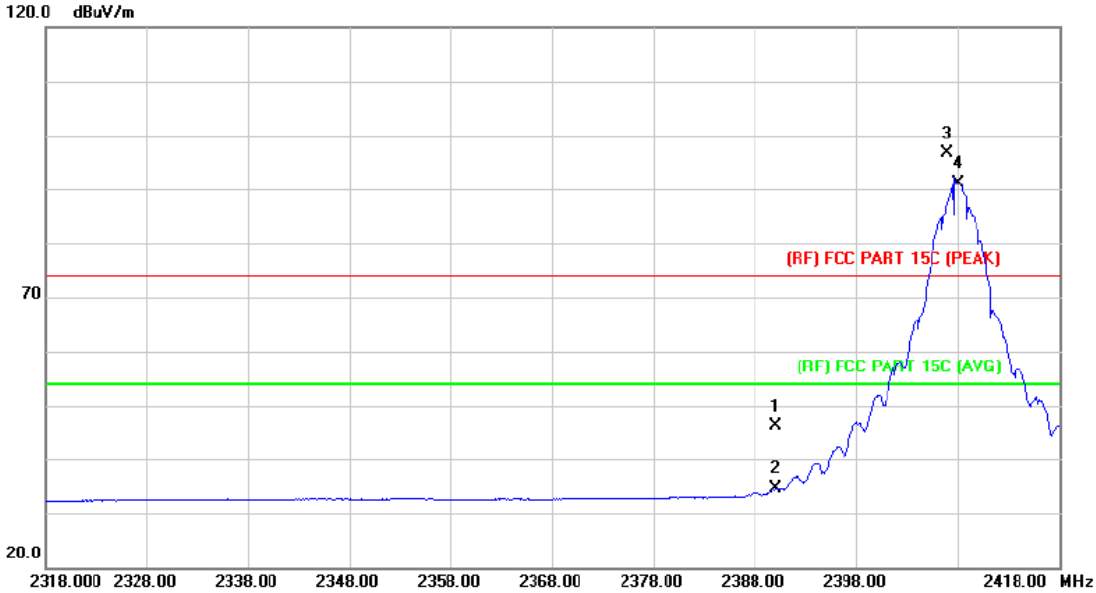
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 2408 MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	52.67	0.91	53.58	74.00	-20.42	peak
2		2390.000	42.17	0.91	43.08	54.00	-10.92	AVG
3	*	2408.100	90.82	1.01	91.83	Fundamental Frequency		AVG
4	X	2409.200	103.30	1.01	104.31	Fundamental Frequency		peak

Emission Level= Read Level+ Correct Factor

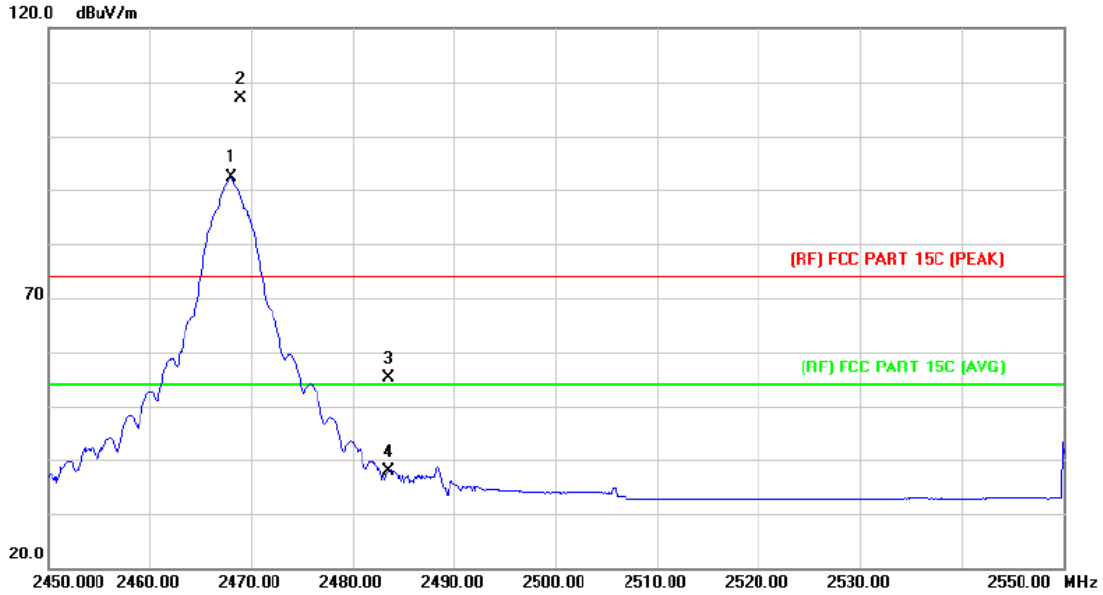
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 2408 MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	45.21	0.91	46.12	74.00	-27.88	peak
2		2390.000	33.72	0.91	34.63	54.00	-19.37	AVG
3	X	2407.000	95.69	0.99	96.68	Fundamental Frequency		peak
4	*	2408.000	90.22	1.00	91.22	Fundamental Frequency		AVG

Emission Level= Read Level+ Correct Factor

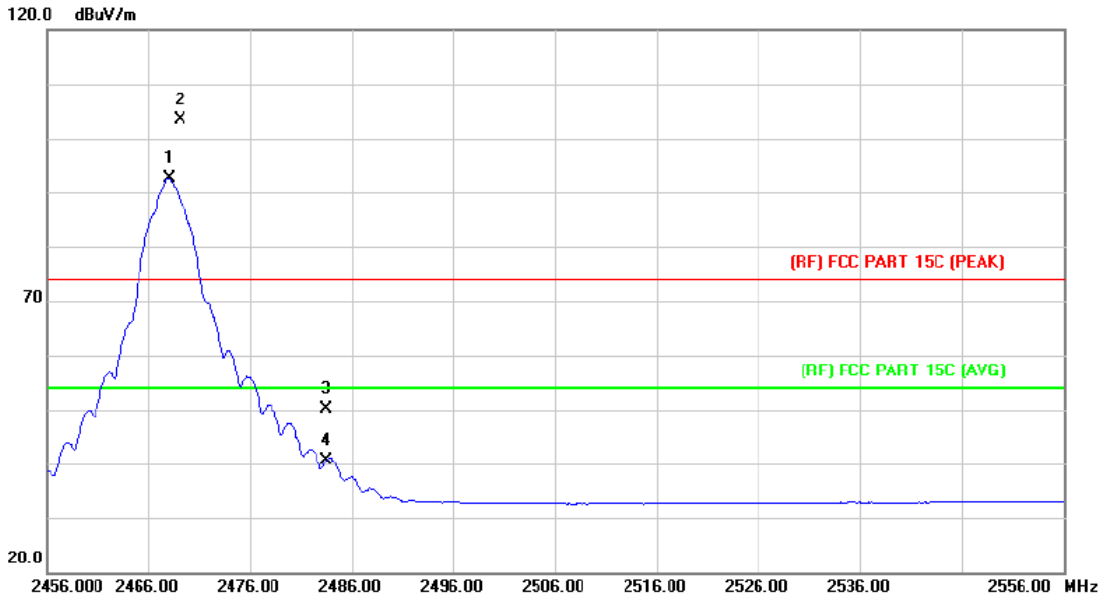
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX 2468 MHz		
Remark:	N/A		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2468.000	91.14	1.28	92.42	Fundamental Frequency		AVG
2	X	2469.000	105.62	1.28	106.90	Fundamental Frequency		peak
3		2483.500	53.88	1.34	55.22	74.00	-18.78	peak
4		2483.500	36.47	1.34	37.81	54.00	-16.19	AVG

Emission Level= Read Level+ Correct Factor

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX 2468 MHz		
Remark:	N/A		

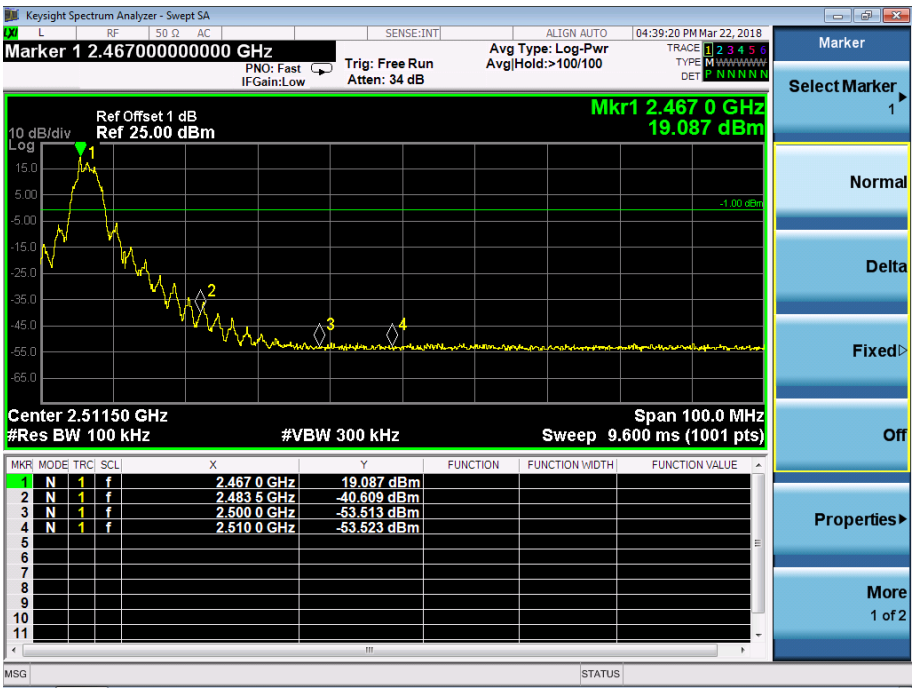


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2468.000	91.45	1.28	92.73	Fundamental Frequency		AVG
2	X	2469.100	102.05	1.28	103.33	Fundamental Frequency		peak
3		2483.500	48.73	1.34	50.07	74.00	-23.93	peak
4		2483.500	39.32	1.34	40.66	54.00	-13.34	AVG

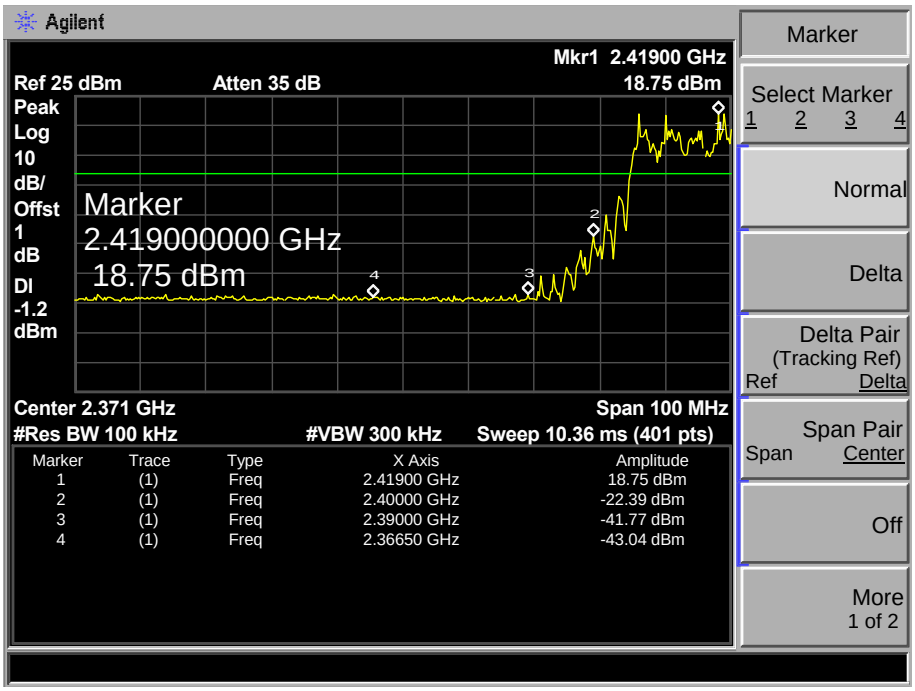
Emission Level= Read Level+ Correct Factor

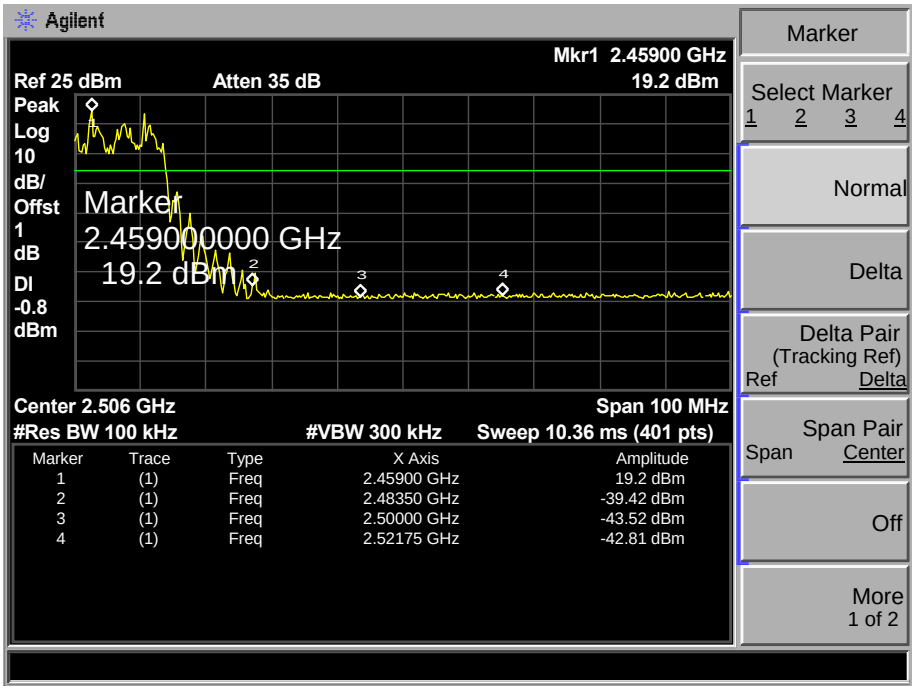
(2) Conducted Test

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode 2408MHz/2468 MHz		
Remark:	Only worse case is reported		



Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Hopping Mode		
Remark:	Only worse case is reported		



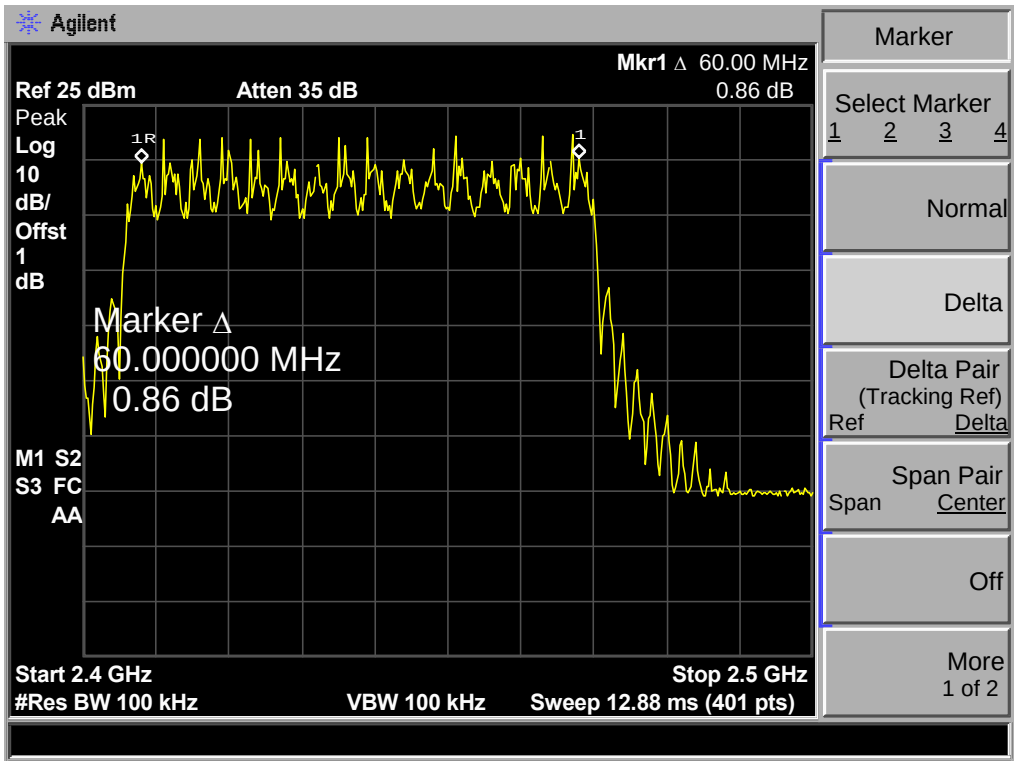


Attachment D-- Number of Hopping Channel Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Frequency Range	**Quantity of Hopping Channel**	**Limit**
2408MHz~2468MHz	16	**>15**

TX Mode



Attachment E-- Average Time of Occupancy Test Data

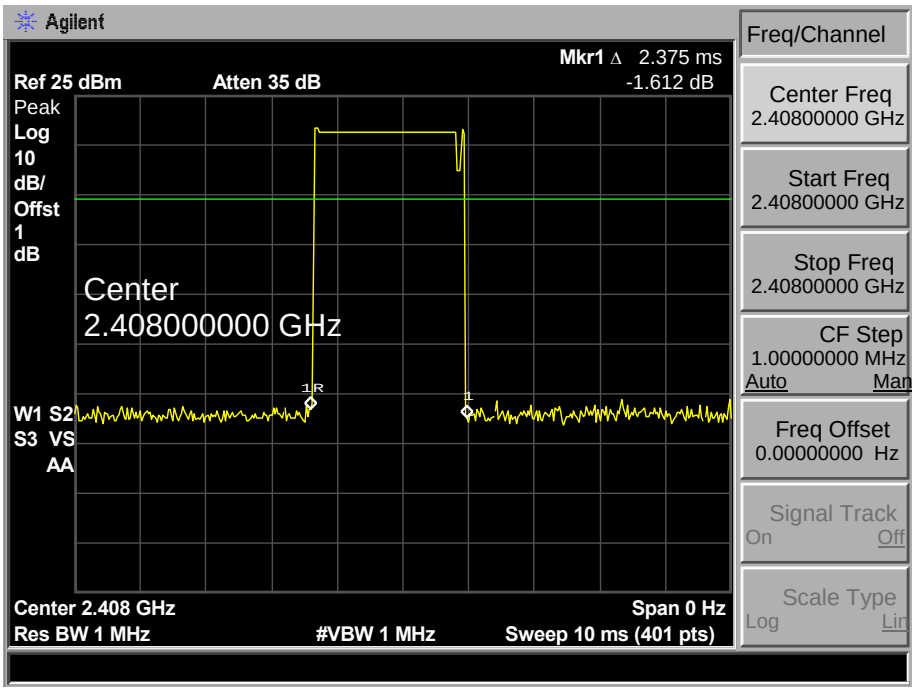
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Channel (MHz)	Ton (ms)	Dwell time(ms)	Limit (ms)	Result
2408	2.375	10.64	**400**	**PASS**

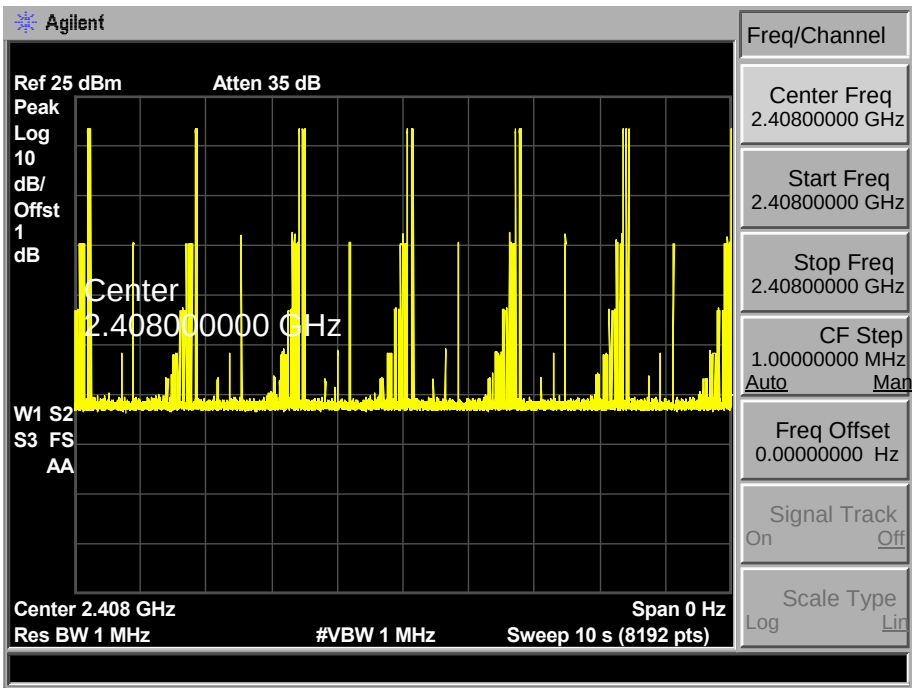
Dwell time=Ton*Ton times in 1s*0.4s*Channel numbers=2.375*(7/10)*0.4*16

Hopping Mode 2408 MHz

Ton



Ton times in 10s



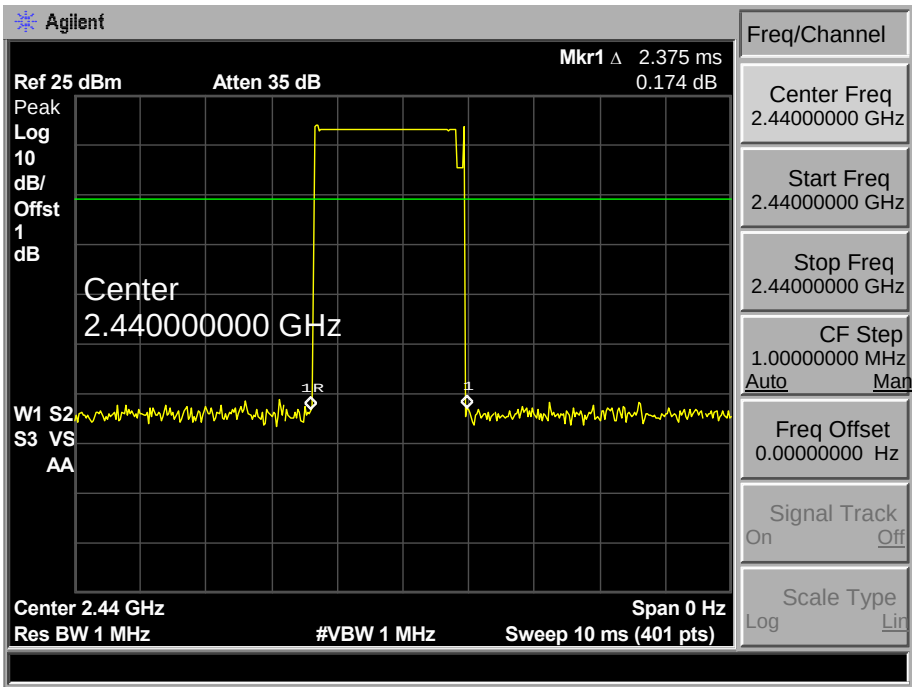
Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Channel (MHz)	Ton (ms)	Dwell time(ms)	Limit (ms)	Result
2440	2.375	10.64	**400**	**PASS**

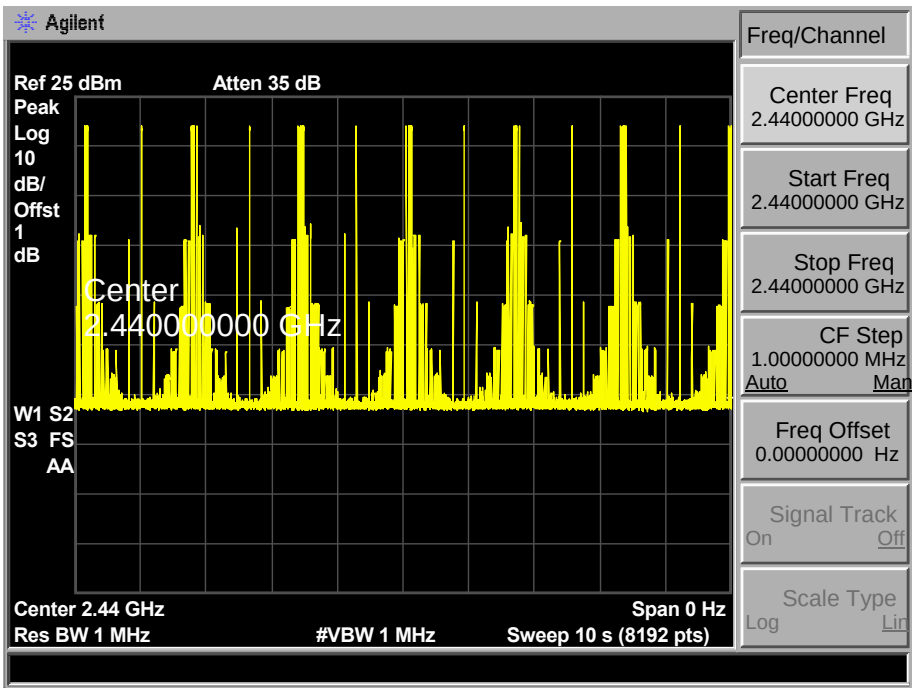
Dwell time=Ton*Ton times in 1s*0.4s*Channel numbers=2.375*(7/10)*0.4*16

Hopping Mode 2408 MHz

Ton



Ton times in 10s



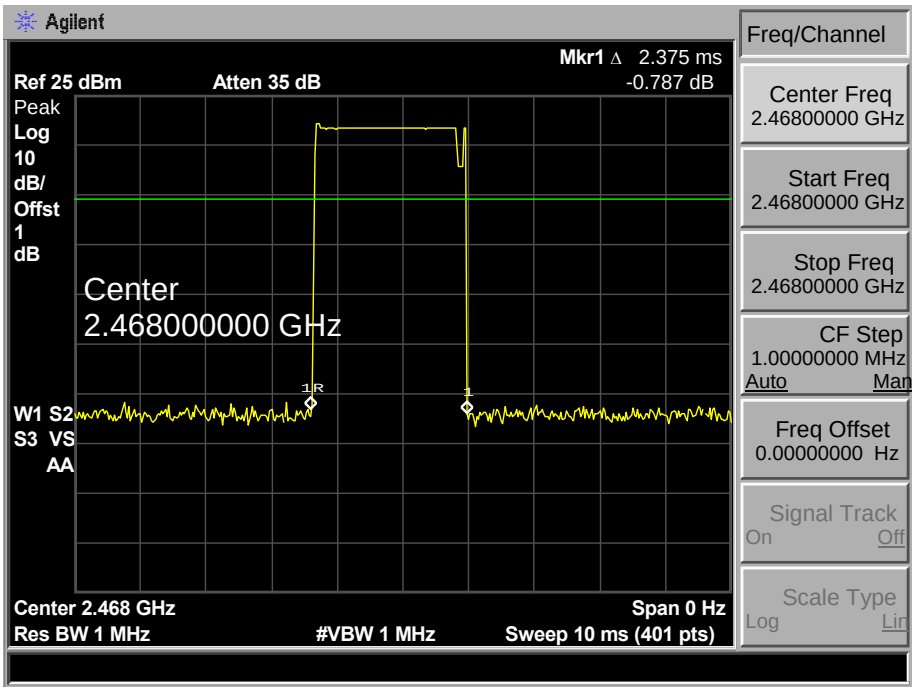
Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Channel (MHz)	Ton (ms)	Dwell time(ms)	Limit (ms)	Result
2468	2.375	10.64	**400**	**PASS**

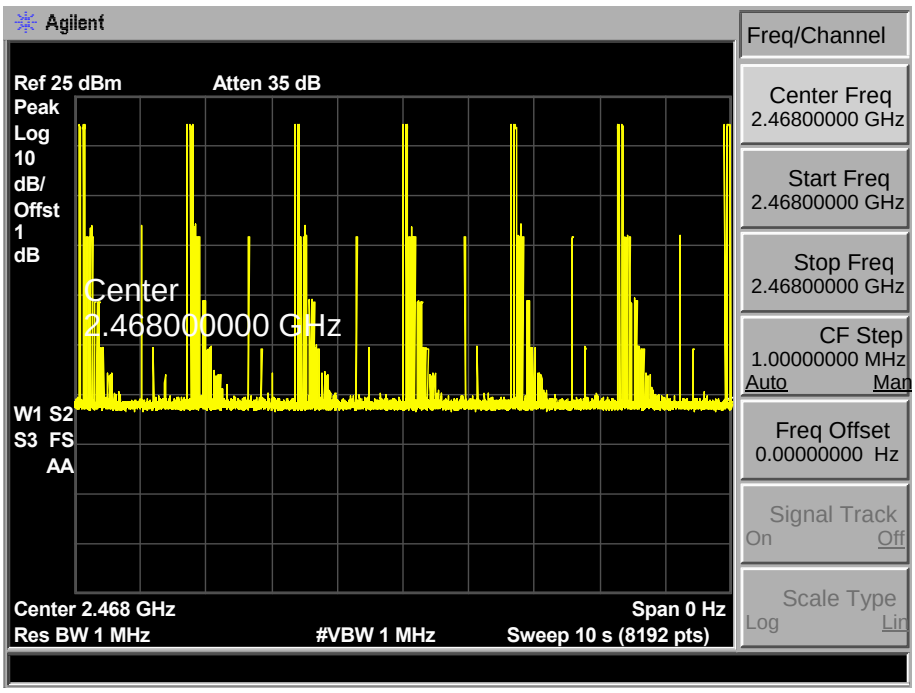
Dwell time=Ton*Ton times in 1s*0.4s*Channel numbers=2.375*(7/10)*0.4*16

Hopping Mode 2408 MHz

Ton



Ton times in 10s



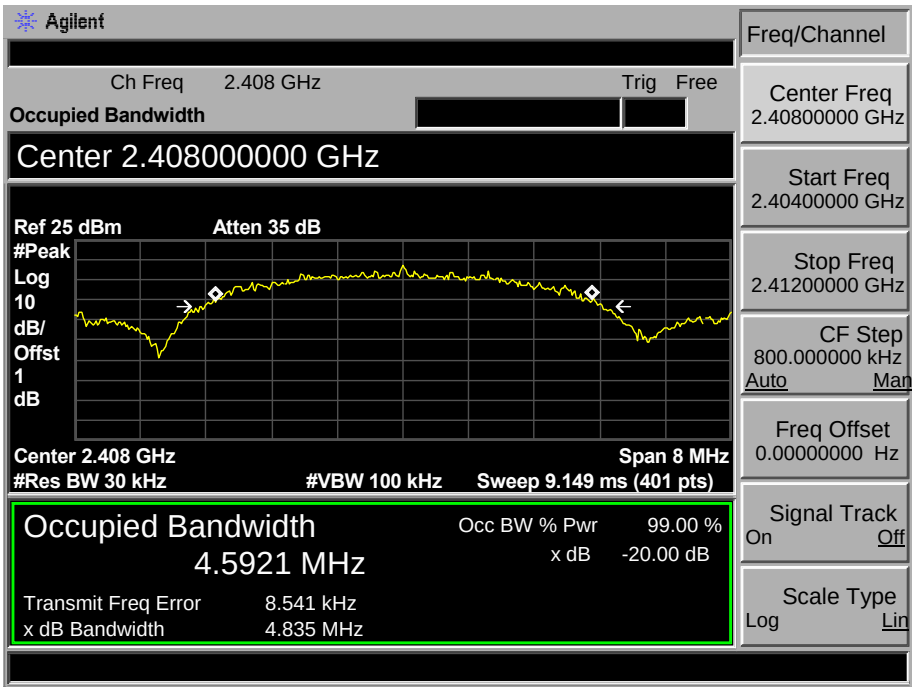
Attachment F-- Channel Separation and Bandwidth Test Data

Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode		

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2408	4592.1	4835	3223.333
2440	4495.1	4181	2787.333
2468	4526.5	4904	3269.333

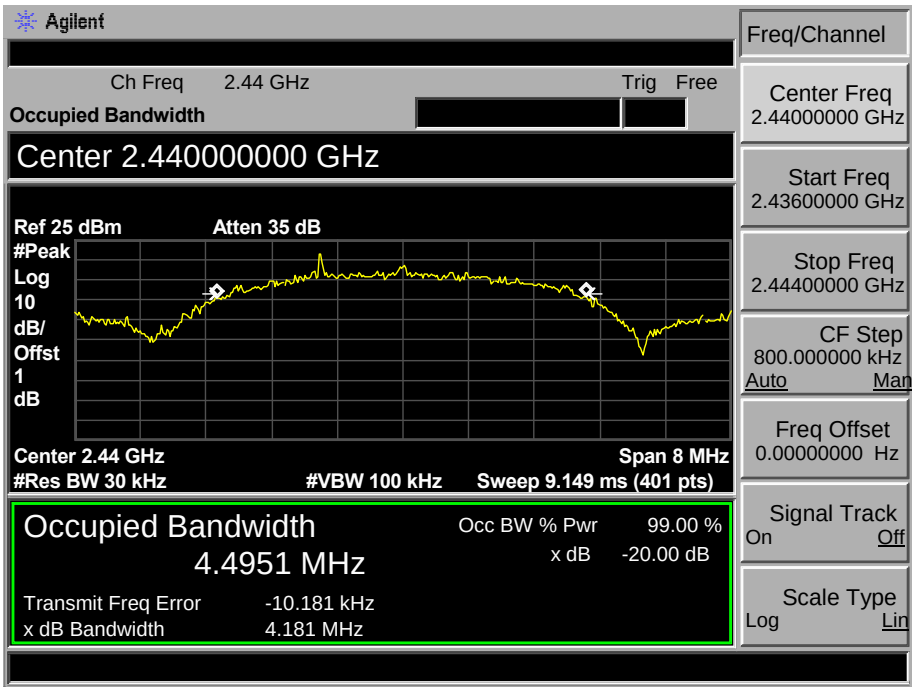
TX Mode

2408 MHz



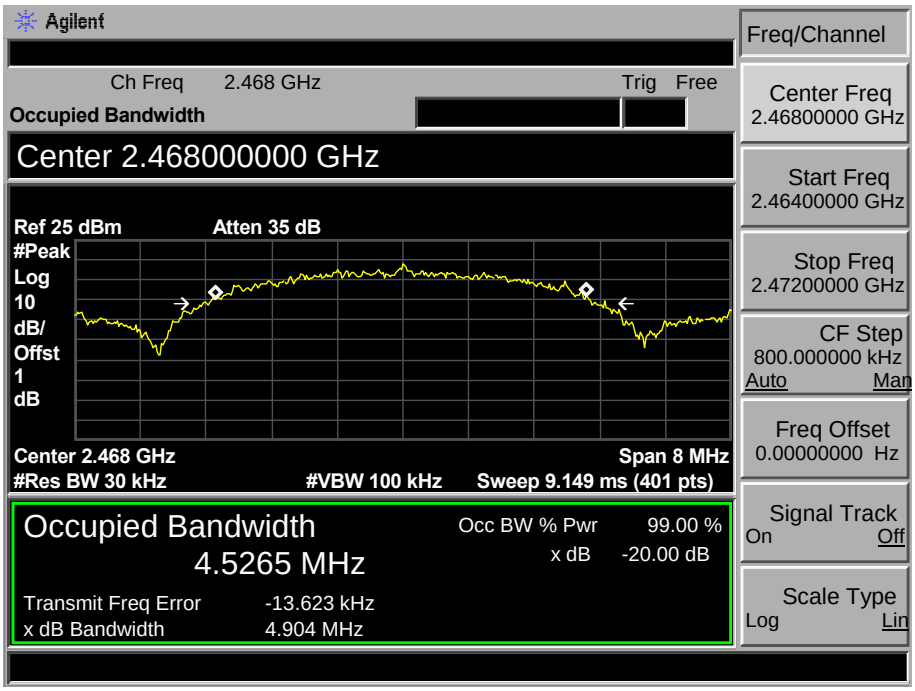
TX Mode

2440 MHz



TX Mode

2468 MHz

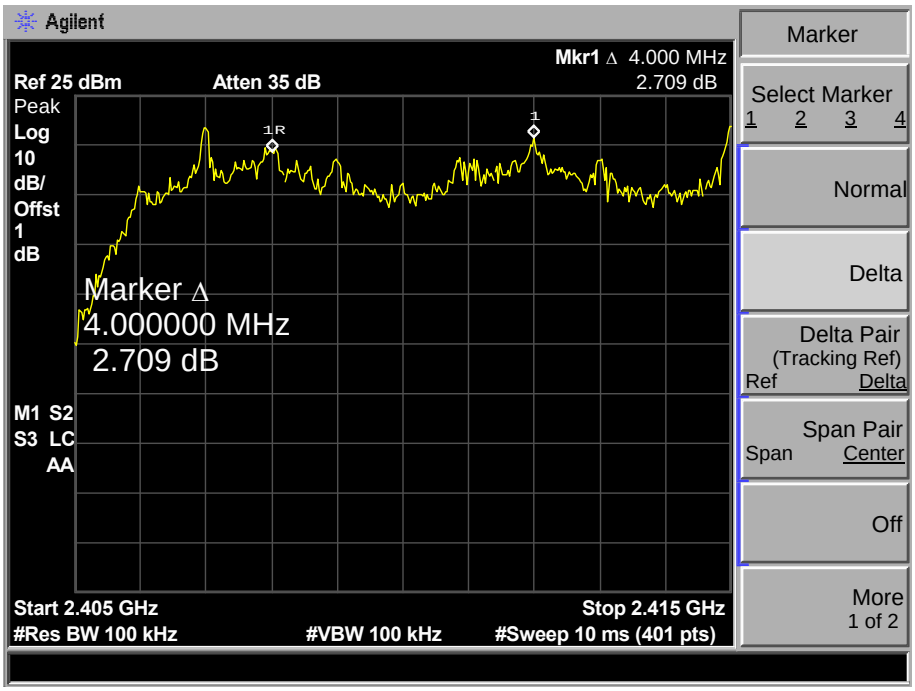


Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
2408	4000	3223.333
2440	3975	2787.333
2468	4050	3269.333

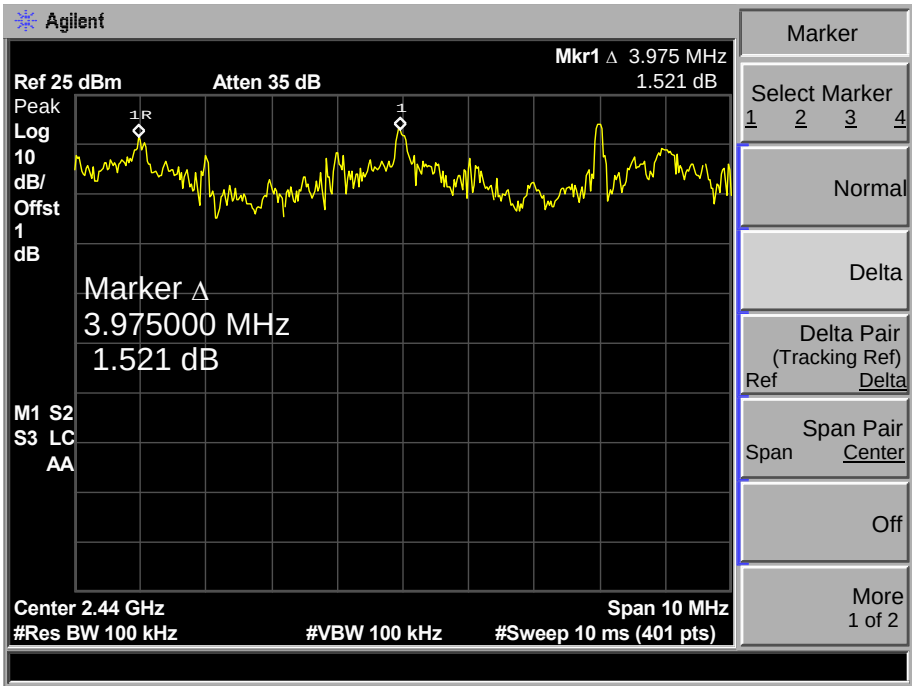
Hopping Mode

2408 MHz



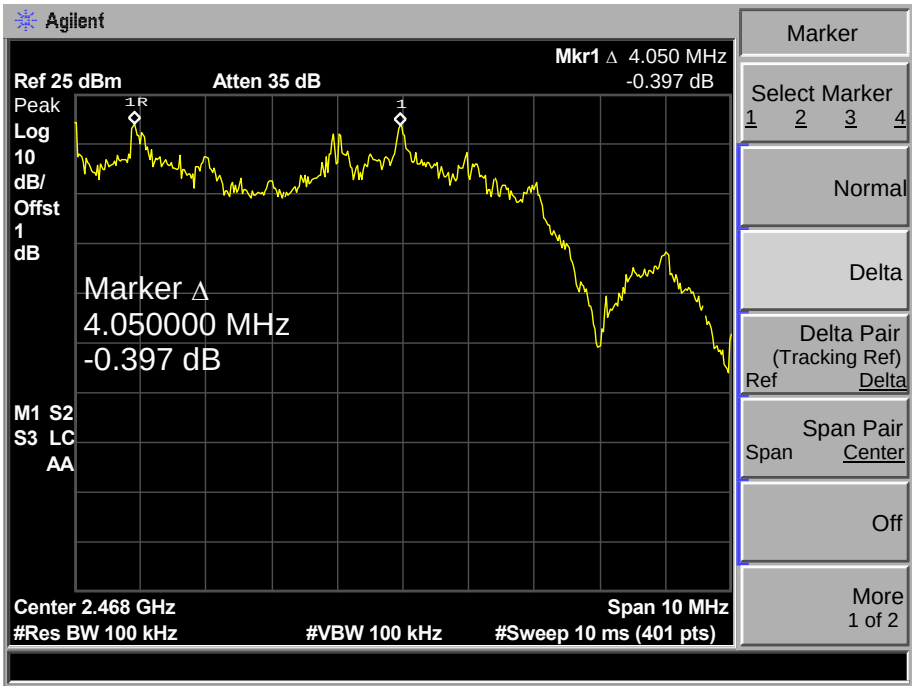
Hopping Mode

2440 MHz



Hopping Mode

2468 MHz



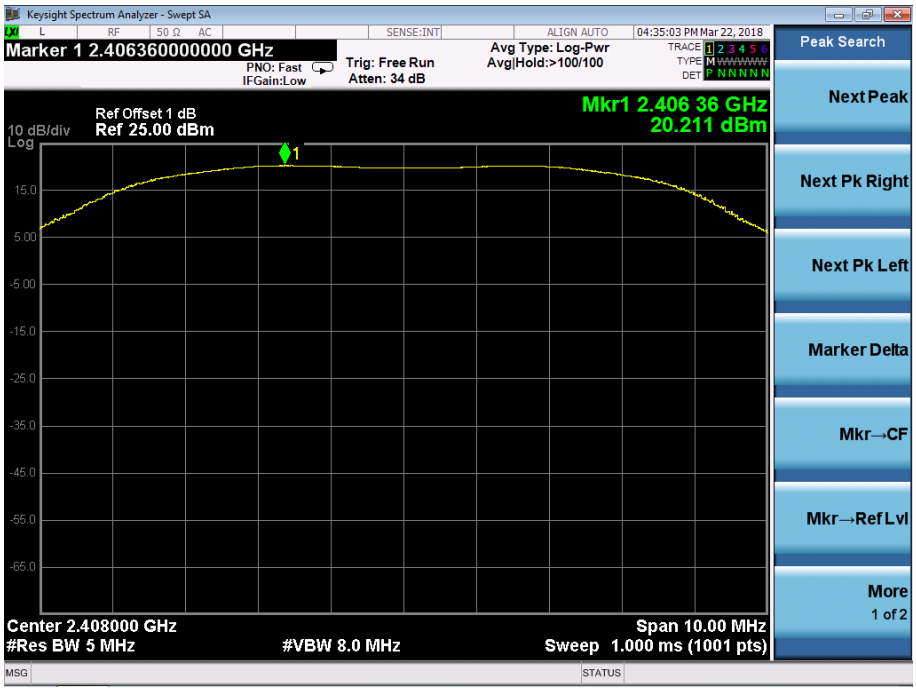
Attachment G-- Peak Output Power Test Data

Temperature:	25℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode		

Channel frequency (MHz)	Test Result (dBm)	Limit (dBm)
2408	20.211	**21**
2440	20.106	
2468	19.956	

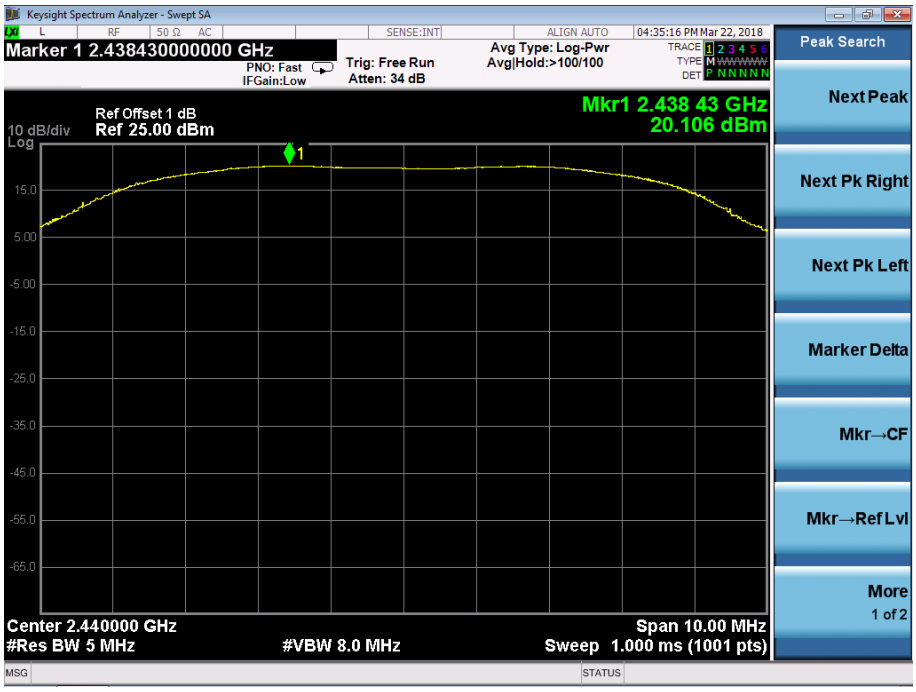
TX Mode

2408 MHz



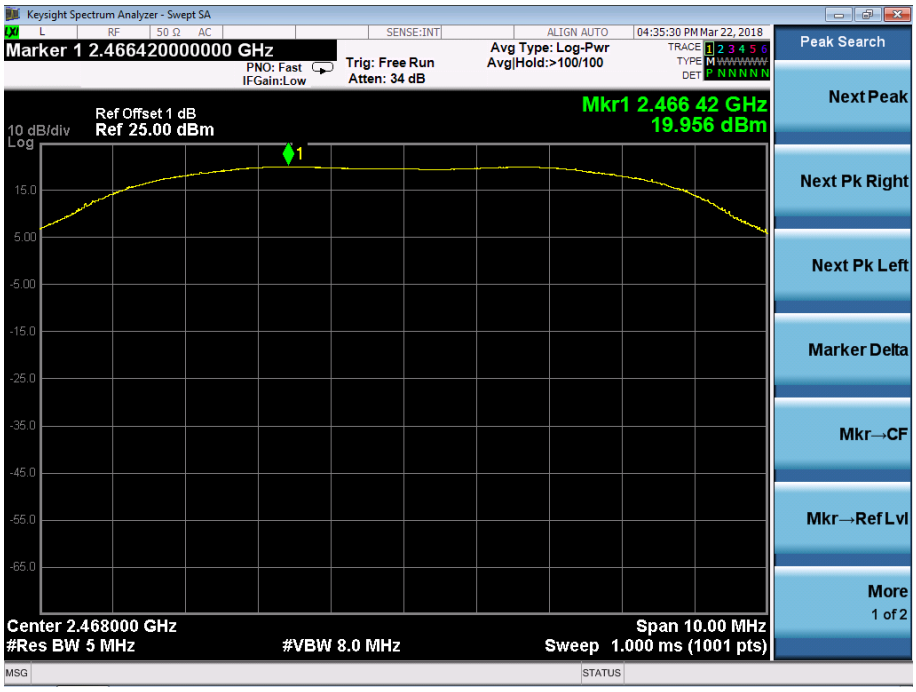
TX Mode

2440 MHz



TX Mode

2468 MHz



-----END OF REPORT-----