

# FCC RADIO TEST REPORT

**FCC ID:2A3OC-ISO**

**Product :** Isolation Tool (ISO)

**Trade Name :** N/A

**Model Name :** ISO

**Serial Model :** I01

**Report No. :** UNIA21111516-04

## **Prepared for**

Building Shooters Technology llc.

PO Box 159, Silver Point, TN, United States 38582

## **Prepared by**

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang  
Community, Xixiang Str, Bao'an District, Shenzhen, China

## TEST RESULT CERTIFICATION

**Applicant's name** ..... : Building Shooters Technology llc.

Address ..... : PO Box 159, Silver Point, TN, United States 38582

**Manufacture's Name**..... : Building Shooters Technology llc.

Address ..... : PO Box 159, Silver Point, TN, United States 38582

### Product description

Product name ..... : Isolation Tool (ISO)

Trade Mark ..... : N/A

Model and/or type reference : Reference P1

**Standards** ..... : FCC Rules and Regulations Part 15 Subpart C Section 15.247  
ANSI C63.10: 2013

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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**Date of Test** ..... :

Date (s) of performance of tests ..... : Oct. 13, 2021 ~ Nov. 10, 2021

Date of Issue ..... : Nov. 10, 2021

Test Result..... : Pass

Prepared by:

*Bob Liao*

Bob liao/Editor

Reviewer:

*kahn.yang*

Kahn yang/Supervisor

Approved & Authorized Signer:

*Liuze*

Liuze/Manager

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## 1. TEST SUMMARY

### 1.1 TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	STANDARD	RESULT
CONDUCTED EMISSION	FCC Part 15.207	N/A
RADIATED EMISSION	FCC Part 15.209(a)	COMPLIANT
OCCUPIED BANDWIDTH	FCC Part 15.247(a)(2)	COMPLIANT
POWER SPECTRAL DENSITY	FCC Part 15.247(e)	COMPLIANT
PEAK OUTPUT POWER	FCC Part 15.247(b)	COMPLIANT
OUT OF BAND EMISSIONS	FCC Part 15.247(d)	COMPLIANT
CONDUCTED SPURIOUS EMISSION	FCC Part 15.247(d)	COMPLIANT
ANTENNA REQUIREMENT	FCC Part 15.203	COMPLIANT

### 1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

A2LA Certificate Number: 4747.01

The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

### 1.3 MEASUREMENT UNCERTAINTY

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

#### Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Isolation Tool (ISO)
Trade Mark	N/A
Model Name	ISO
Serial No.	I01
Model Difference	Only the model name is different.
FCC ID	2A3OC-ISO
Antenna Type	PCB Antenna
Antenna Gain	1.0dBi
Frequency Range	2402~2480 MHz
Number of Channels	40
Modulation Type	GFSK
Power Source	DC3.3V from battery
Adapter	N/A

## 2.2 Carrier Frequency of Channels

Description of Channel:			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	21	2442
02	2404	22	2444
03	2406	23	2446
04	2408	24	2448
05	2410	25	2450
06	2412	26	2452
07	2414	27	2454
08	2416	28	2456
09	2418	29	2458
10	2420	30	2460
11	2422	31	2462
12	2424	32	2464
13	2426	33	2466
14	2428	34	2468
15	2430	35	2470
16	2432	36	2472
17	2434	37	2474
18	2436	38	2476
19	2438	39	2478
20	2440	40	2480

## 2.3 Operation of EUT during testing

Operating Mode

The mode is used:

Transmitting mode for TX running at 2402MHz, 2440MHz, 2480MHz



## 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Radiation and Above1GHz Radiation testing:



Table for auxiliary equipment:

Equipment Description	Manufacturer	Model	Calibration Due Date
N/A	N/A	N/A	N/A

## 2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
CONDUCTED EMISSIONS TEST					
1	AMN	Schwarzbeck	NNLK8121	8121370	2022.9.9
2	AMN	ETS	3810/2	00020199	2022.9.9
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2022.9.9
4	AAN	TESEQ	T8-Cat6	38888	2022.9.9
RADIATED EMISSION TEST					
1	Horn Antenna	Sunol	DRH-118	A101415	2022.9.9
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2022.9.9
3	PREAMP	HP	8449B	3008A00160	2022.9.9
4	PREAMP	HP	8447D	2944A07999	2022.9.9
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2022.9.9
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2022.9.28
7	Signal Generator	Agilent	E4421B	MY4335105	2022.9.28
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2022.9.28
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2022.9.9
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2022.9.28
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2022.9.9
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2022.9.9
13	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2022.3.14

14	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2022.3.14
15	RF power divider	Anritsu	K241B	992289	2022.9.28
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2022.9.28
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2022.9.8
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2022.9.8
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2022.9.8
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2022.1.12
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2022.9.8
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2022.03.14
23	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2022.9.8
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2022.05.10
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2022.05.10
26	Frequency Meter	VICTOR	VC2000	997406086	2022.05.10
27	DC Power Source	HYELEC	HY5020E	055161818	2022.05.10
24*	Active Loop Antenna	Com-Power	AL-130R	10160009	2022.05.09
25*	Power Meter	KEYSIGHT	N1911A	MY50520168	2022.05.09
26*	Frequency Meter	VICTOR	VC2000	997406086	2022.05.09
27*	DC Power Source	HYELEC	HY5020E	055161818	2022.05.09

### 3. CONDUCTED EMISSIONS TEST

#### 3.1 Conducted Power Line Emission Limit

For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

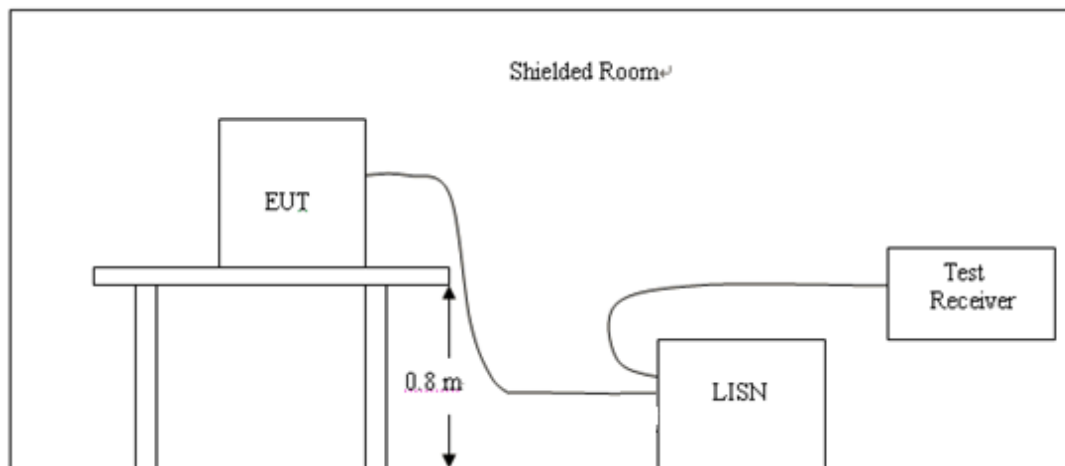
Frequency (MHz)	Maximum RF Line Voltage(dB V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

\*

Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

#### 3.2 Test Setup



#### 3.3 Test Procedure

- 1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. A wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
- 2, Support equipment, if needed, was placed as per ANSI C63.10.
- 3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5, All support equipments received AC power from a second LISN, if any.
- 6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

#### 3.4 Test Result

N/A

## 4 RADIATED EMISSION TEST

### 4.1 Radiation Limit

For unintentional device, according to § 15.209(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m )	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F (kHz)	-	Quasi-peak	300
0.490MHz-1.705MHz	24000/F (kHz)	-	Quasi-peak	30
1.705MHz-30MHz	30	-	Quasi-peak	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3
		74.0	Peak	3

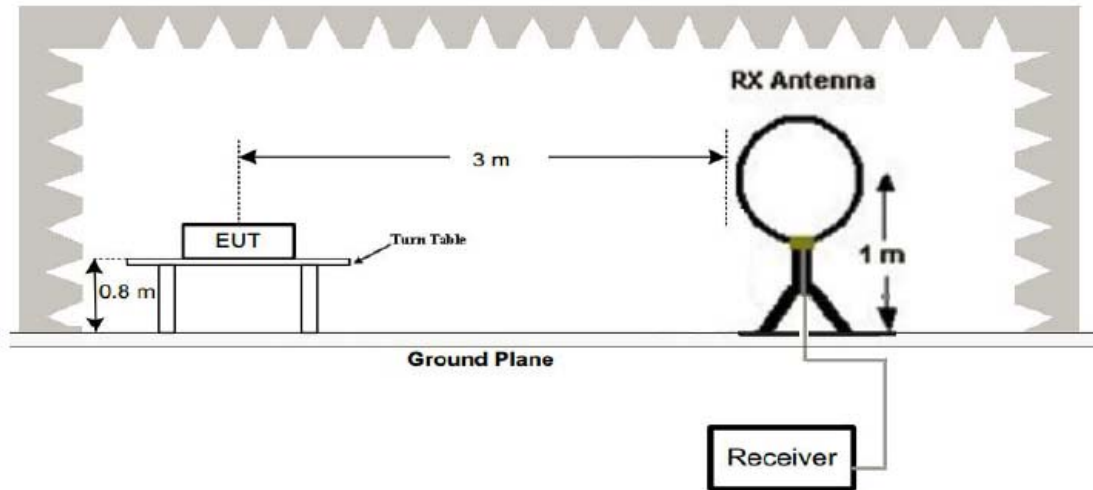
Limit calculation and transfer to 3m distance as showed in the following table:

Frequency (MHz)	Limit (dBuV/m)	Distance (m)
0.009-0.490	$20\log(2400/F(KHz))+40\log(300/3)$	3
0.490-1.705	$20\log(24000/F(KHz))+40\log(30/3)$	3
1.705-30.0	69.5	3
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

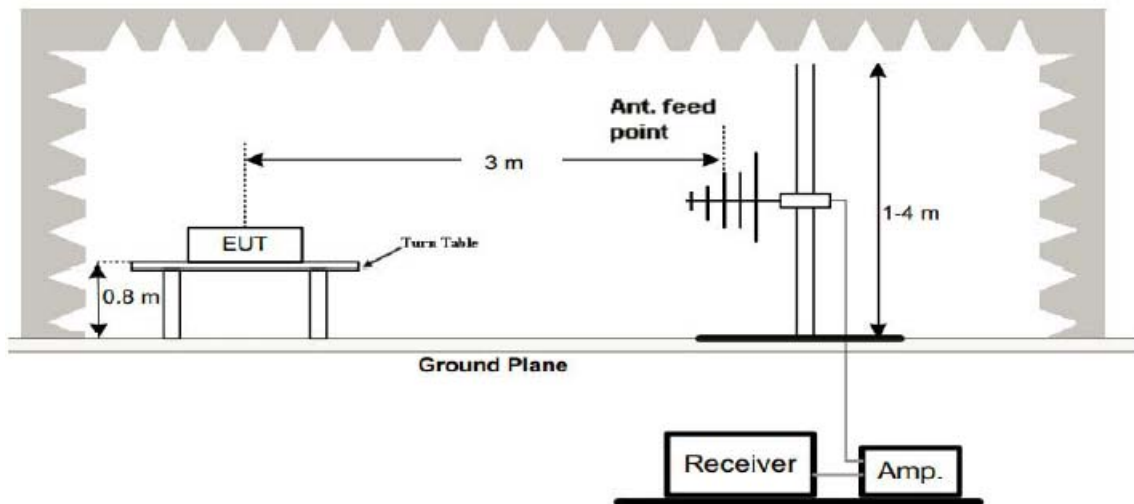
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

### 4.2 Test Setup

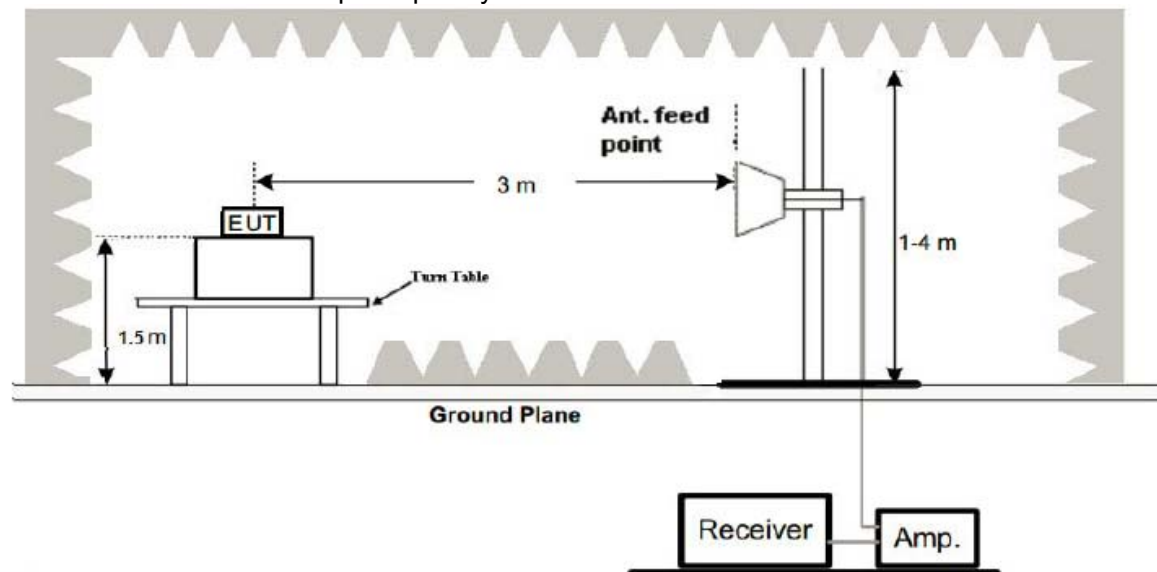
## 1. Radiated Emission Test-Up Frequency Below 30MHz



## 2. Radiated Emission Test-Up Frequency 30MHz~1GHz



## 3. Radiated Emission Test-Up Frequency Above 1GHz



#### 4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).

Note:

For battery operated equipment, the equipment tests shall be performed using a new battery.

#### 4.4 Test Result

PASS

Remark:

1. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.

##### Below 30M

Temperature:	22°C	Relative Humidity:	48%
Test Date:	2021-11-02	Pressure:	1010hPa
Test Voltage:	DC3.3V from battery	Polarization:	Horizontal
Test Mode:	TX		

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

Note:

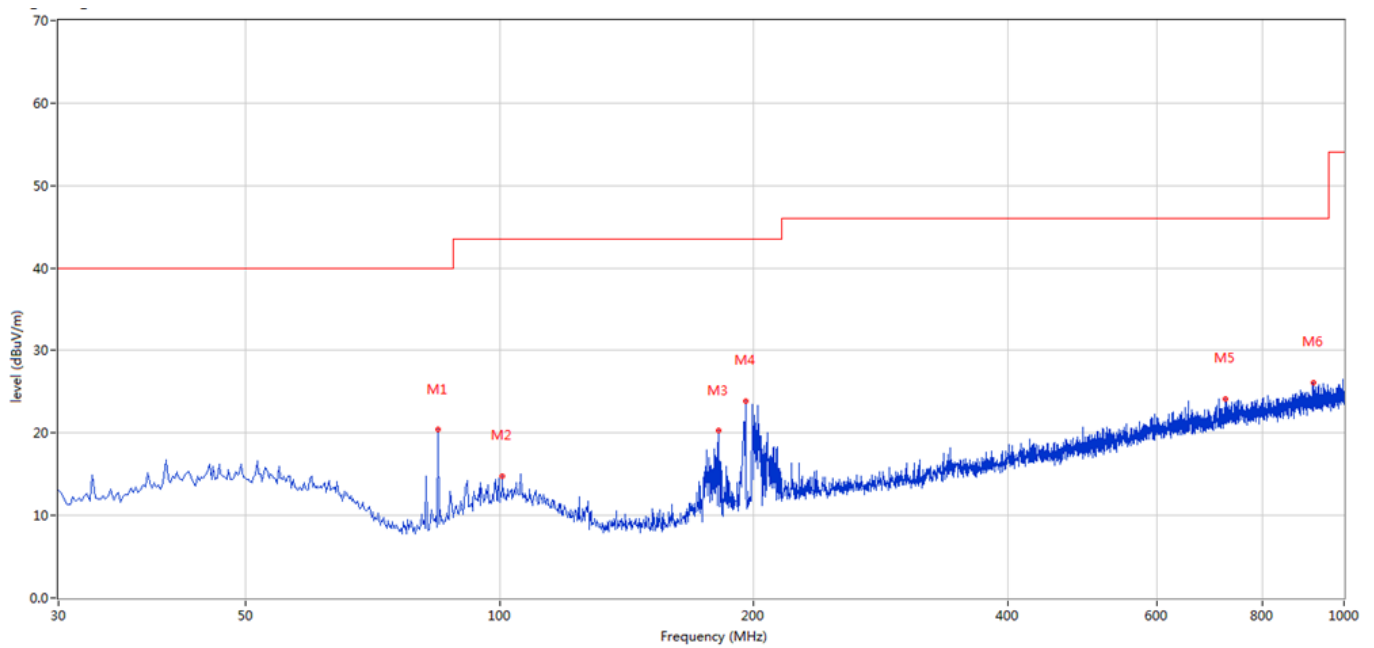
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $20 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor

## Below 1GHz Test Results:

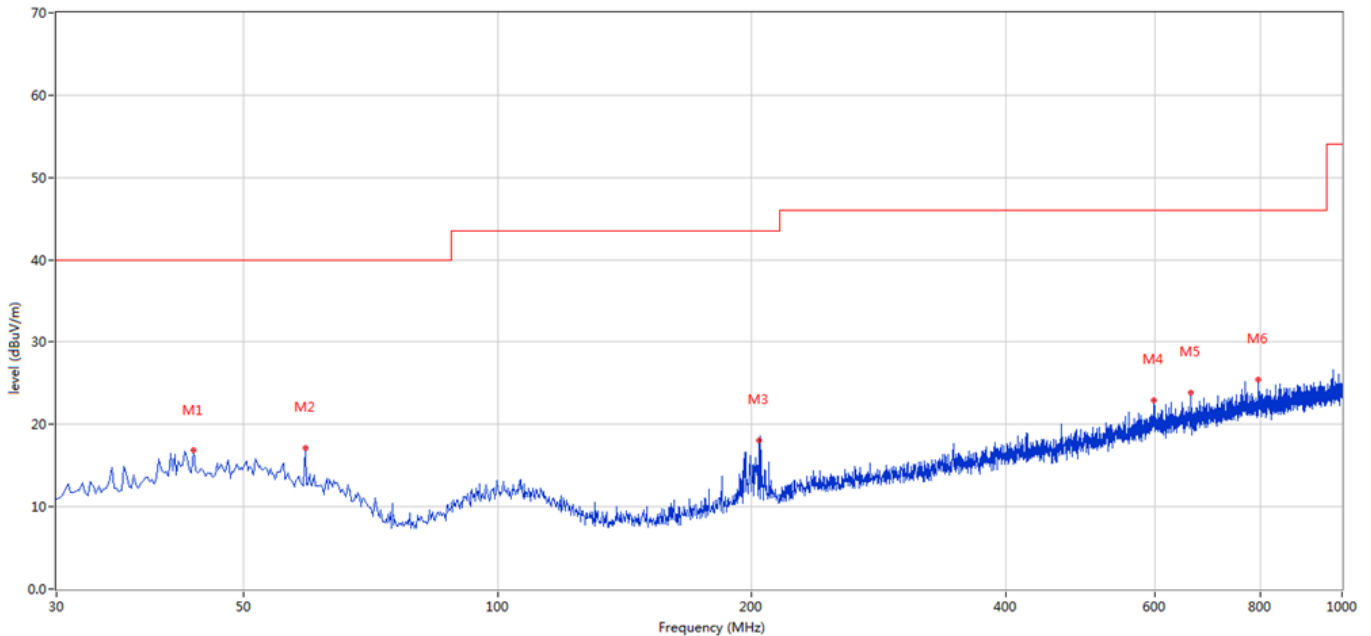
Temperature:	22°C	Relative Humidity:	48%
Test Date:	2021-11-02	Pressure:	1010hPa
Test Voltage:	DC3.3V from battery	Polarization:	Horizontal
Test Mode:	TX		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1	84.549	20.37	-16.62	40.0	-19.63	Peak	Horizontal	Pass
2	100.792	14.72	-13.46	43.5	-28.78	Peak	Horizontal	Pass
3	181.525	20.24	-15.07	43.5	-23.26	Peak	Horizontal	Pass
4	195.344	23.84	-13.74	43.5	-19.66	Peak	Horizontal	Pass
5	723.862	24.18	-3.79	46.0	-21.82	Peak	Horizontal	Pass
6	921.207	26.15	-1.71	46.0	-19.85	Peak	Horizontal	Pass

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit  
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Temperature:	22°C	Relative Humidity:	48%
Test Date:	2021-11-02	Pressure:	1010hPa
Test Voltage:	DC3.3V from battery	Polarization:	Vertical
Test Mode:	TX		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1	43.577	16.82	-11.49	40.0	-23.18	Peak	Vertical	Pass
2	59.093	17.09	-12.87	40.0	-22.91	Peak	Vertical	Pass
3	203.829	18.07	-13.50	43.5	-25.43	Peak	Vertical	Pass
4	598.763	22.91	-5.10	46.0	-23.09	Peak	Vertical	Pass
5	662.282	23.85	-4.56	46.0	-22.15	Peak	Vertical	Pass
6	796.593	25.47	-3.07	46.0	-20.53	Peak	Vertical	Pass

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit  
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark:

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
- (2) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.





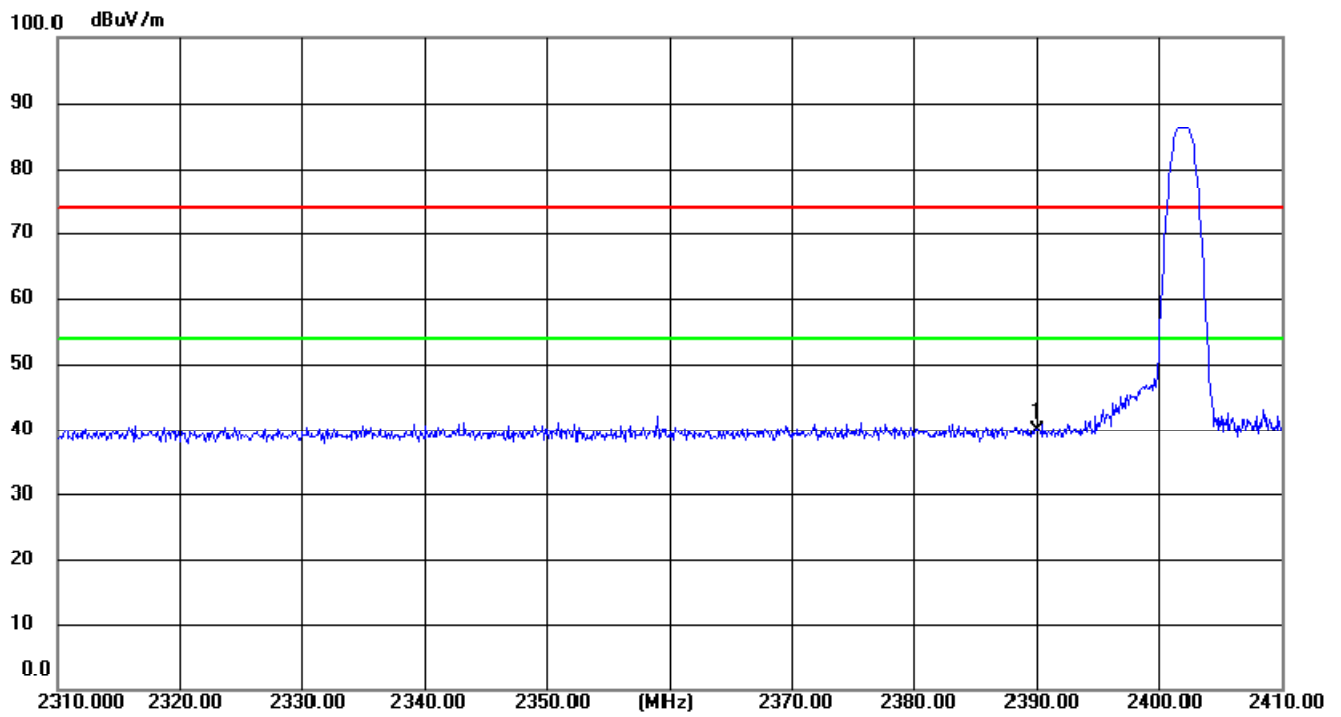
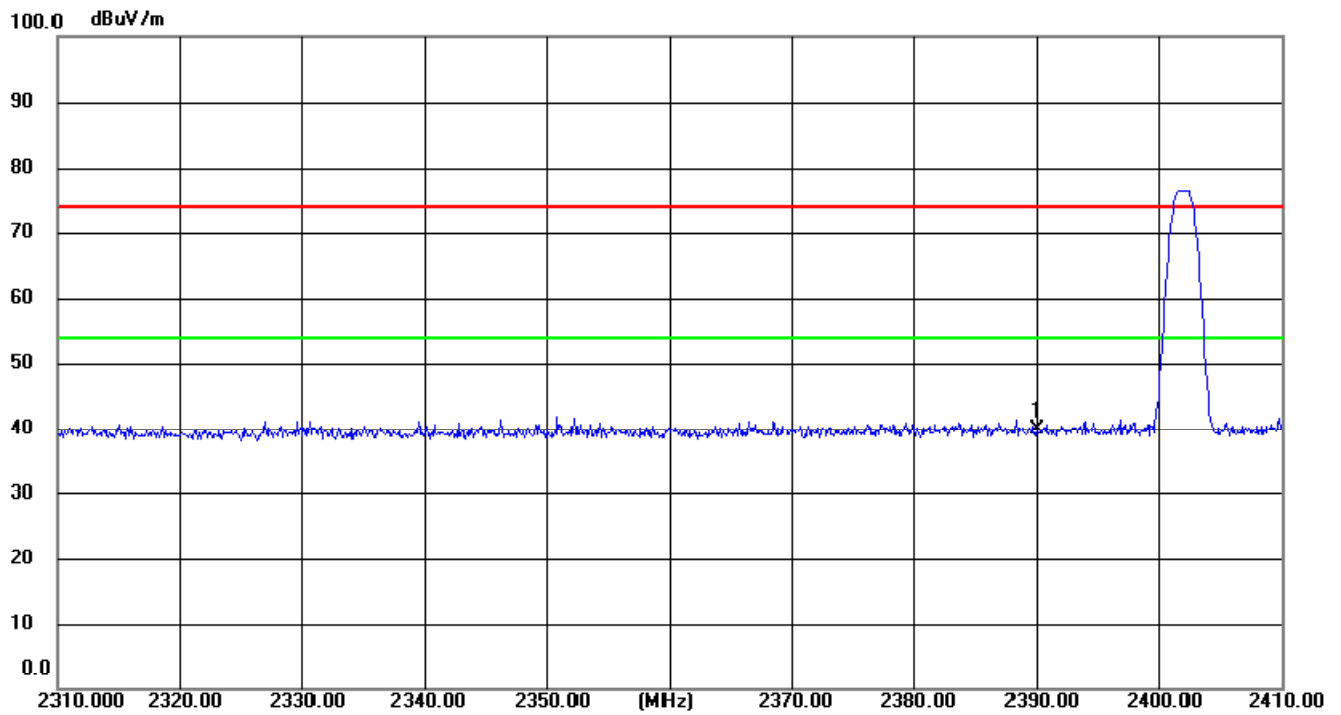
**Remark :**

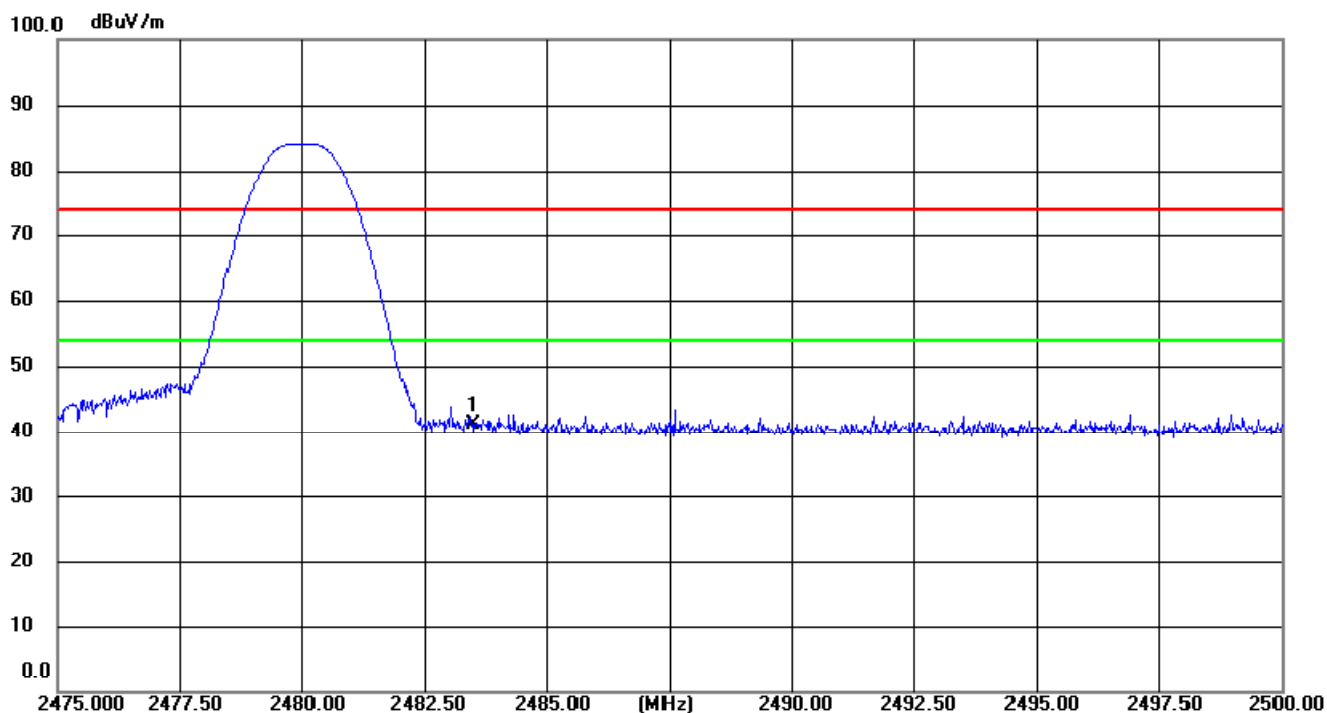
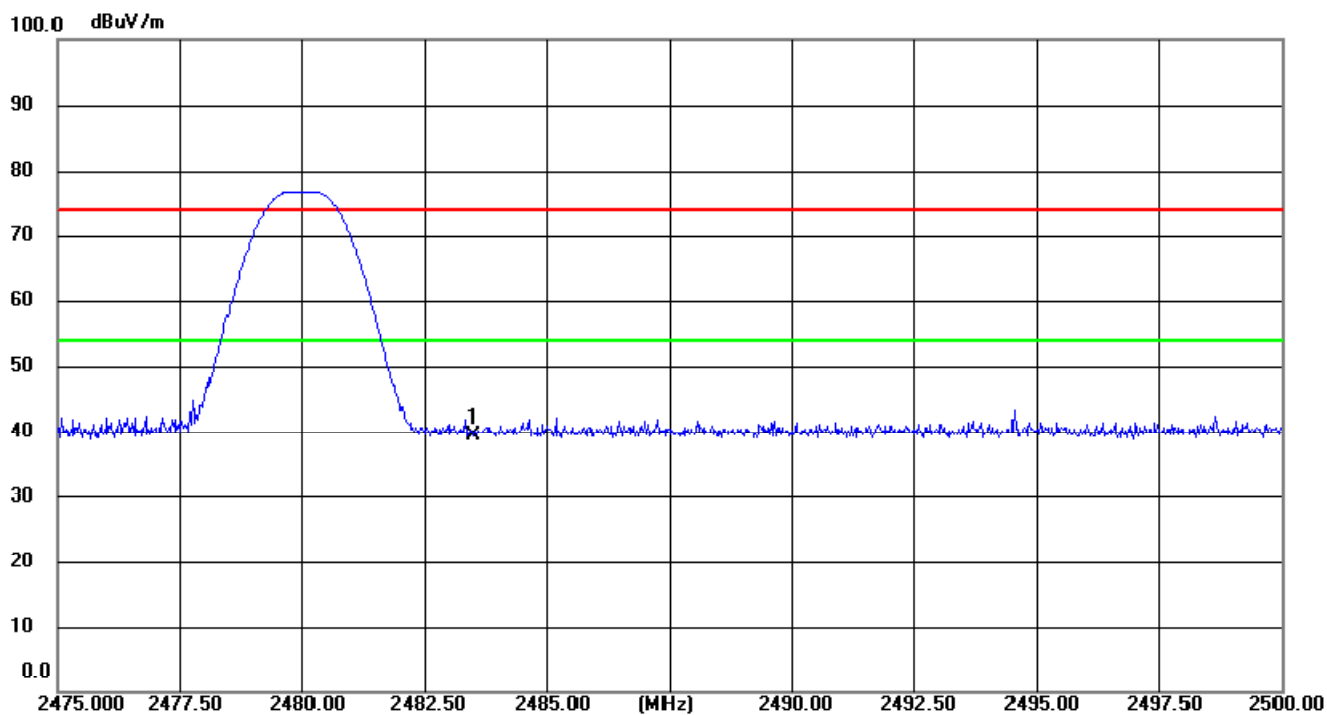
- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

## Operation Mode: TX Mode

Freq. (MHz)	Ant.Pol. H/V	Reading		Ant/CF CF(dB)	Act		Limit		Note
		Peak (dBuv)	AV (dBuv)		Peak (dBuv/m)	AV (dBuv/m)	Peak (dBuv/m)	AV (dBuv/m)	
2390.00	H	45.76	--	-5.79	39.97	--	74.00	54.00	CH01
2390.00	V	45.62	--	-5.79	39.83	--	74.00	54.00	CH01
2483.50	H	46.10	--	-4.98	41.12	--	74.00	54.00	CH01
2483.50	V	44.35	--	-4.98	39.37	--	74.00	54.00	CH01

Corr.Factor = Antenna Factor + Cable Loss – Pre-amplifier.

**Horizontal****Vertical**

**Horizontal****Vertical**

## 5 OCCUPIED BANDWIDTH MEASUREMENT

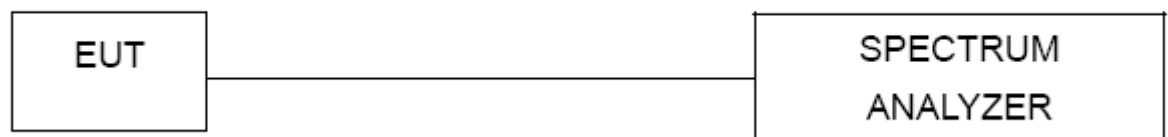
### 5.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

### 5.2 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
2. Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto, Span=6MHz.

### 5.3 TEST SETUP

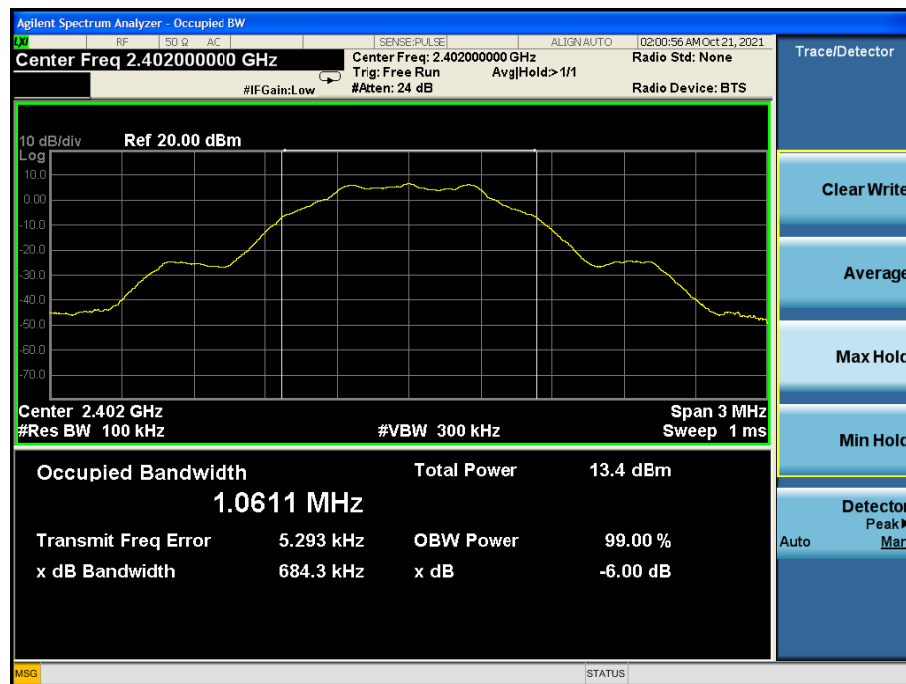


### 5.4 Test Result

PASS

Mode	Freq	6dB	99%OBW	Conclusion
	(MHz)	(kHz)	(MHz)	
TX	2402	684.3	--	PASS
	2440	679.9	--	PASS
	2480	678.5	--	PASS

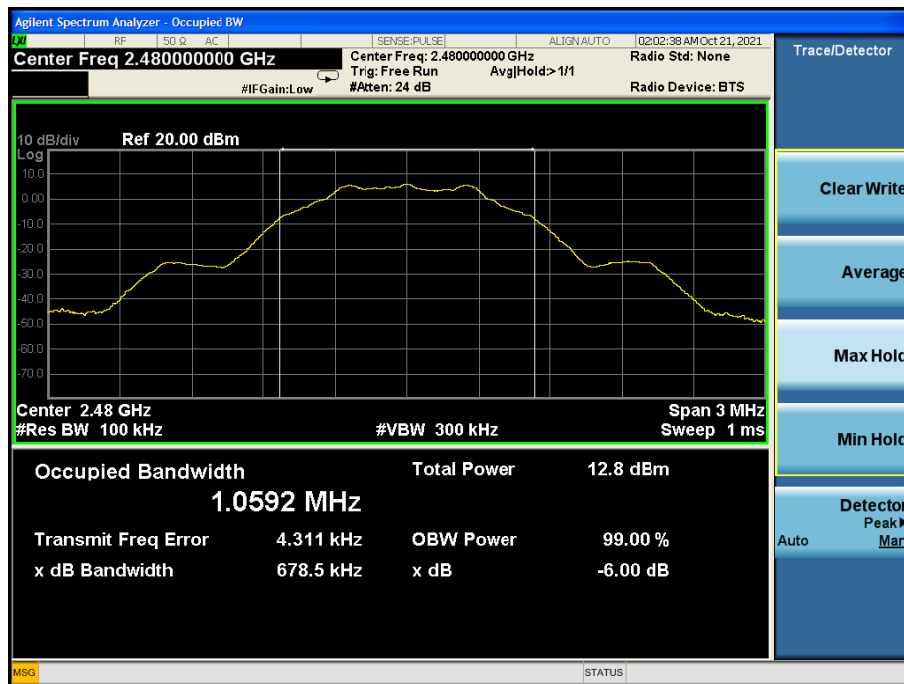
## 2402 MHZ



## 2440 MHZ



2480 MHZ





## 6 POWER SPECTRAL DENSITY

### 6.1 TEST LIMIT

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3kHz)	2400-2483.5	PASS

### 6.2 TEST PROCEDURE

1. The EUT was directly connected to the spectrum analyzer.
2. Set EUT as normal operation.
3. Based on FCC Part15 C Section 15.247: RBW=3kHz, VBW=10kHz.
4. Set detected by the spectrum analyzer with peak detector.

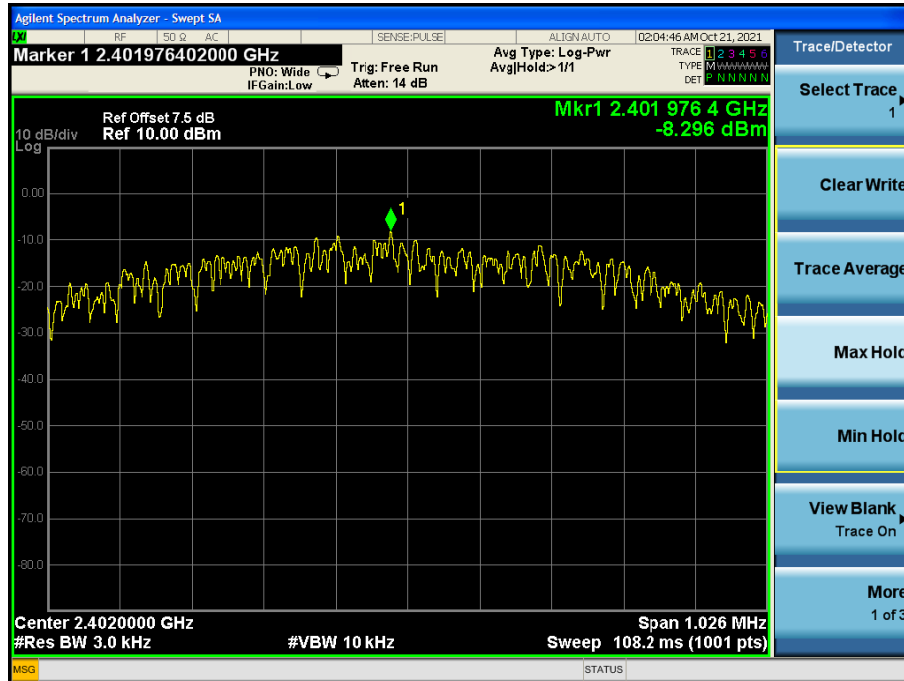
### 6.3 TEST SETUP



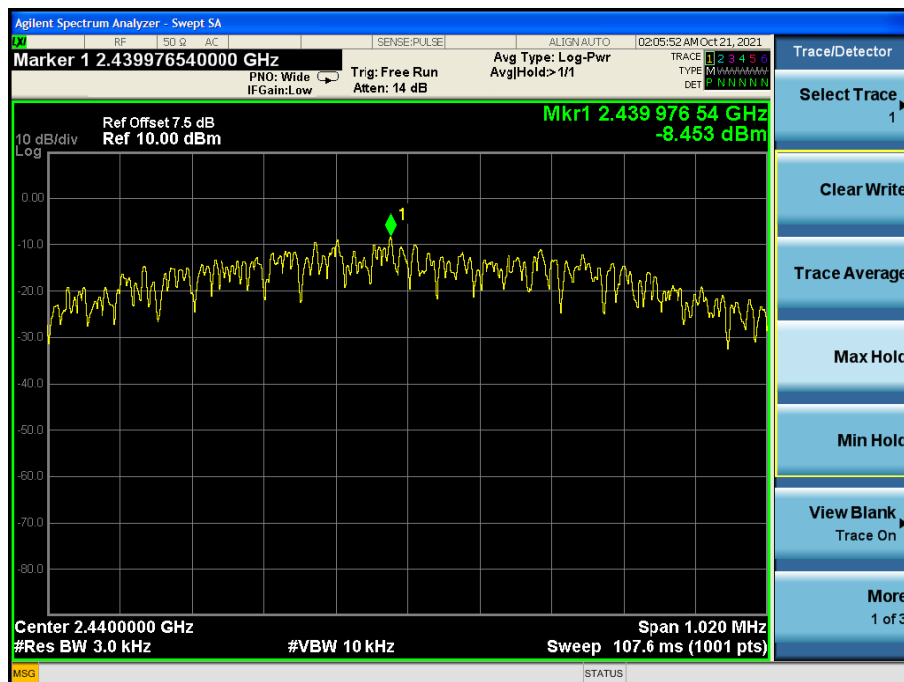
### 6.4 TEST RESULT

PASS

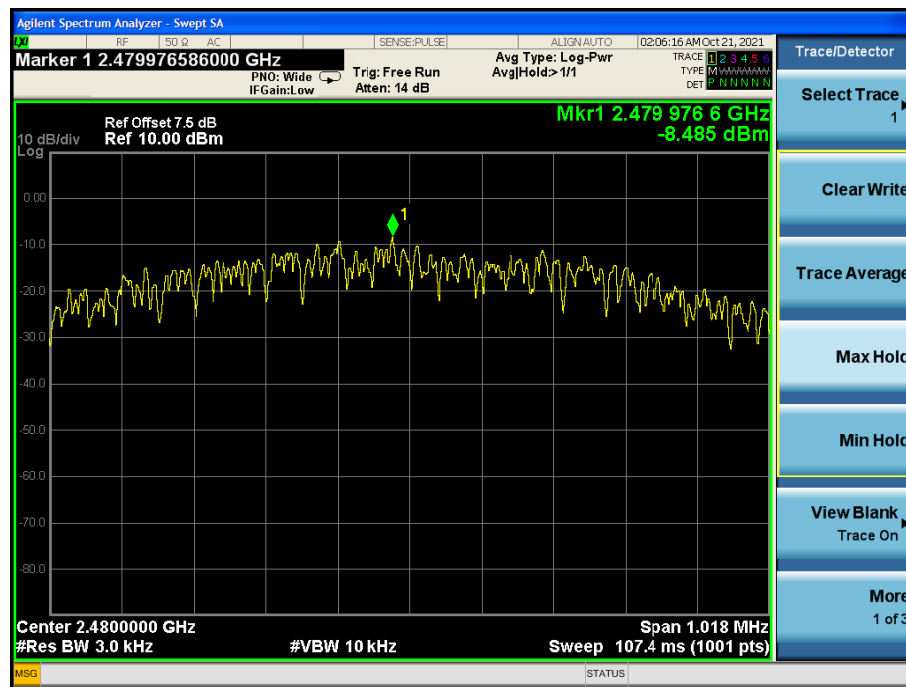
Mode	Freq	Power Density	Limit	Result
	(MHz)	(dBm/3kHz)	(dBm/3kHz)	
TX	2402	-8.296	8	PASS
	2440	-8.453	8	PASS
	2480	-8.485	8	PASS



2440 MHZ



2480 MHZ



## 7 PEAK OUTPUT POWER

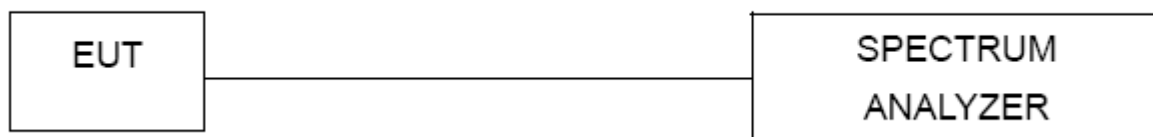
### 7.1 TEST LIMIT

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

### 7.2 TEST PROCEDURE

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
2. Spectrum Setting : RBW= 1 MHz, VBW= 3 MHz, Span=3MHz,Detector=Peak,Trace mode= Max Hold ,Sweep time = Auto.

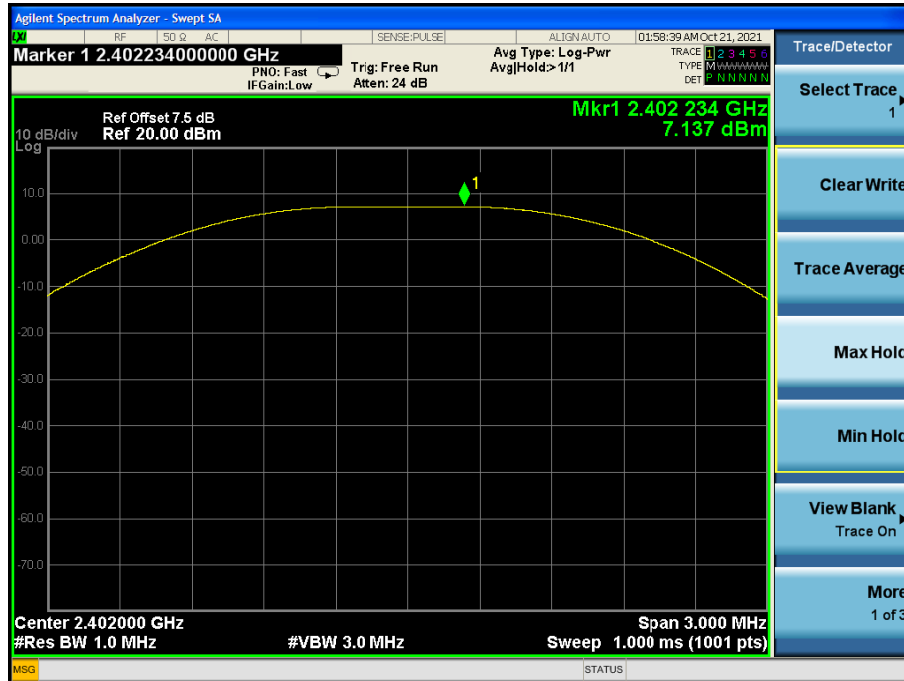
### 7.3 TEST SETUP



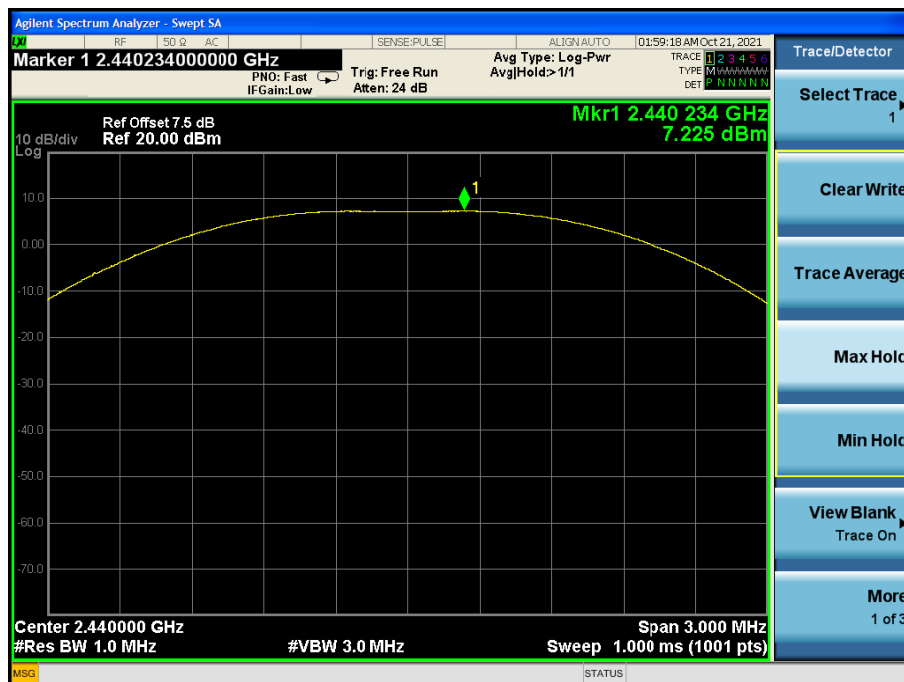
### 7.4 TEST RESULT

PASS

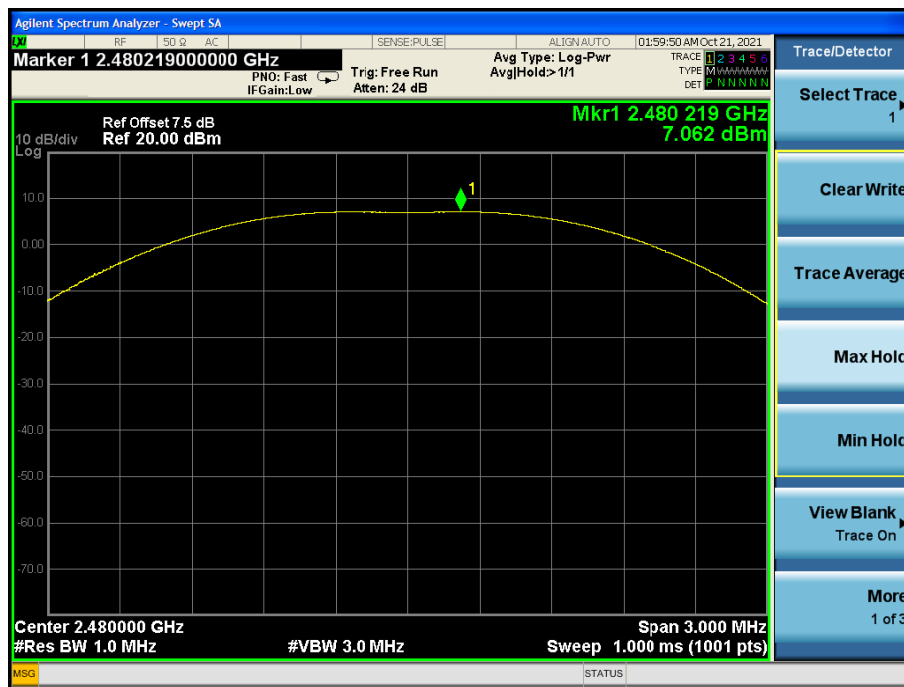
Test Mode	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	LIMIT (dBm)
TX	2402	7.137	30
	2440	7.225	30
	2480	7.062	30



2440 MHz



2480 MHz

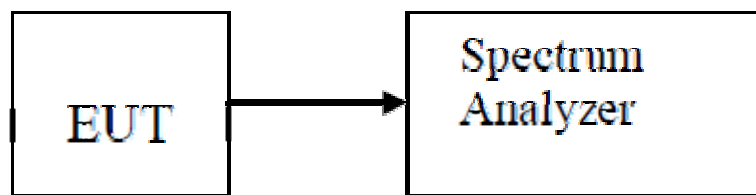


## 8 OUT OF BAND EMISSIONS

### 8.1 TEST LIMIT

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 8.2 TEST SETUP



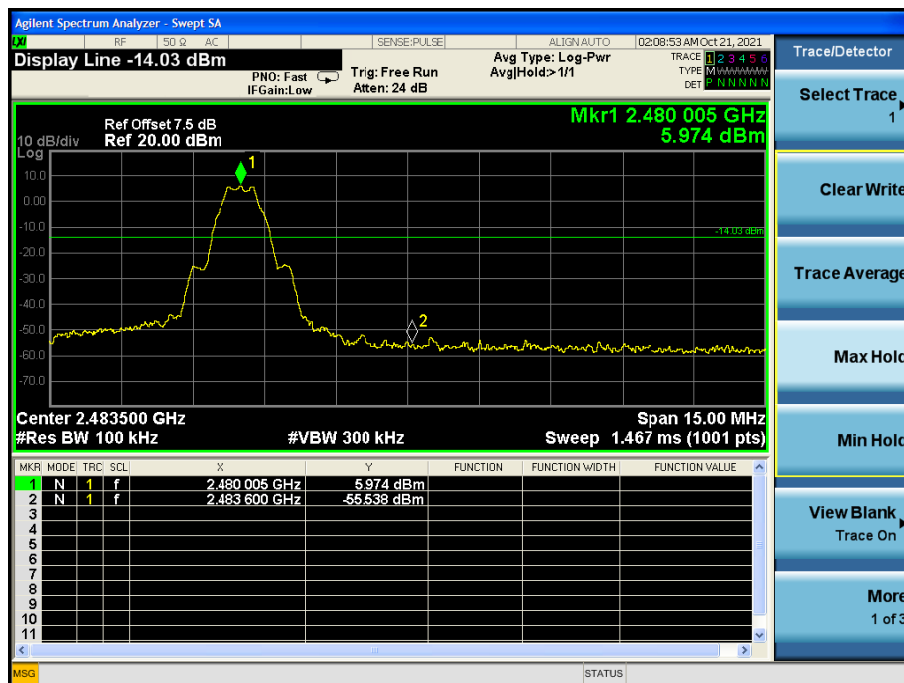
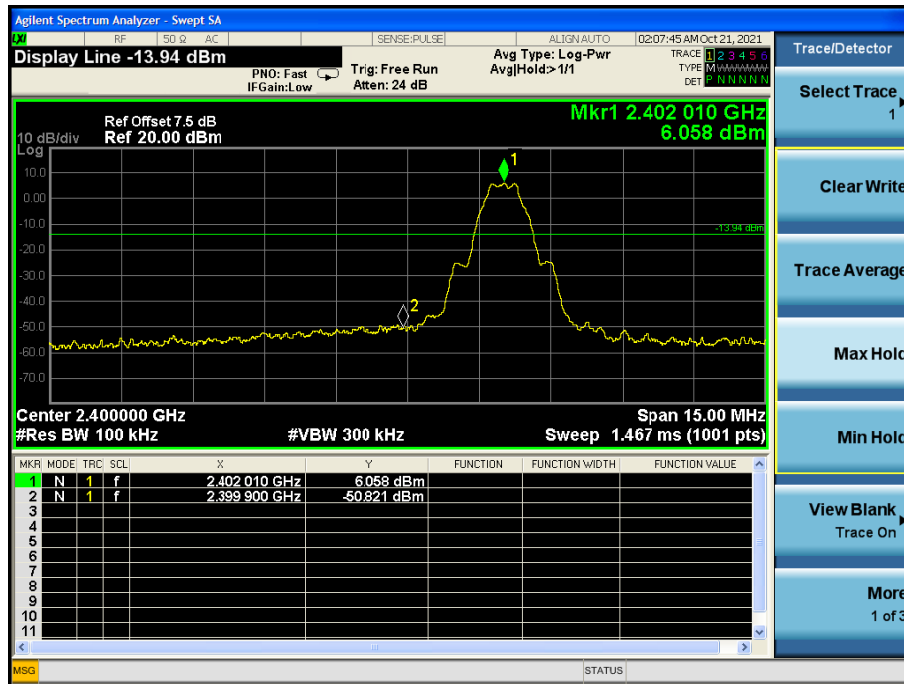
### 8.3 TEST PROCEDURE

1. Set EUT as TX operation and connect directly to the spectrum analyzer.
2. Based on FCC Part15 C Section 15.247: RBW=100kHz, VBW=300kHz.
3. Set detected by the spectrum analyzer with peak detector.

### 8.4 TEST RESULT

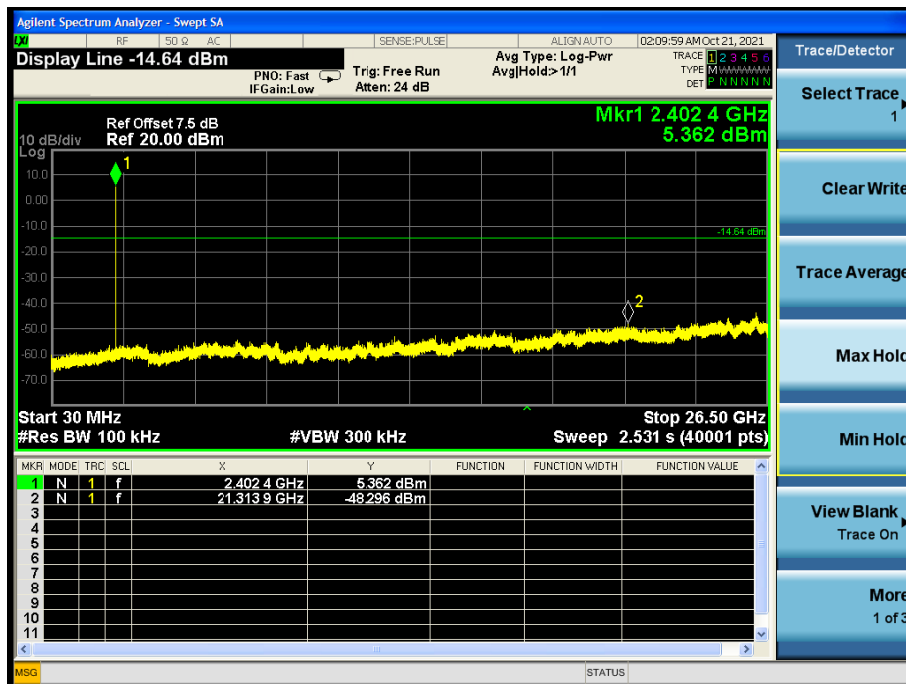
PASS

Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
2400	56.879	20	Pass
2483.5	61.512	20	Pass

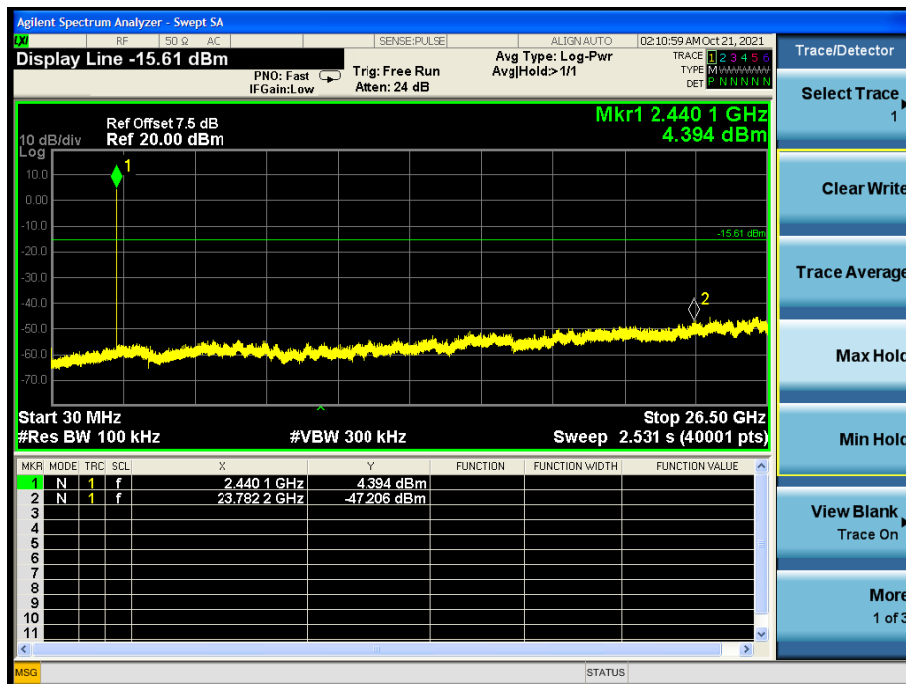




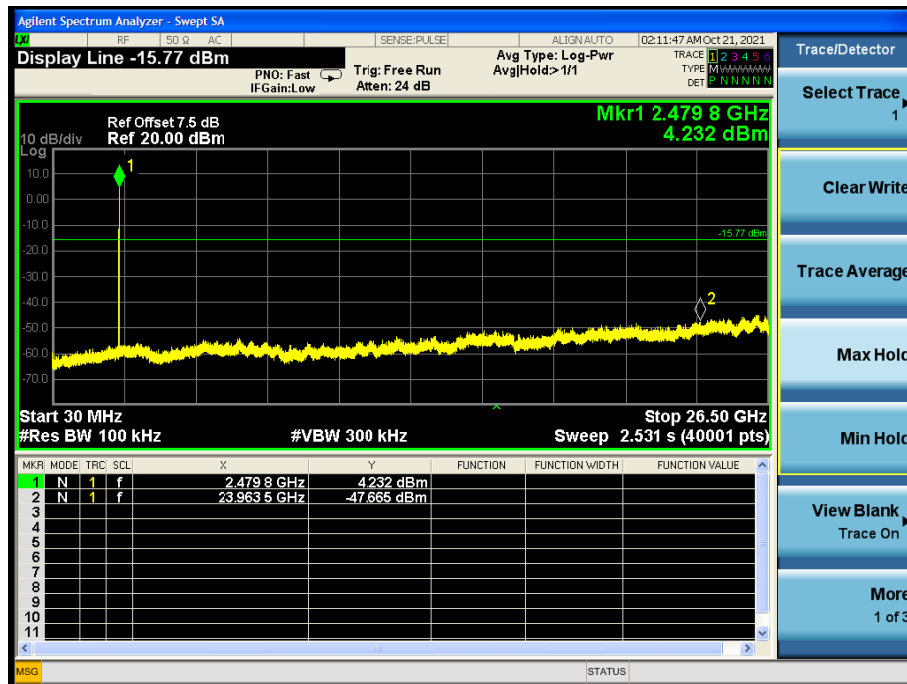
## 2402MHz



## 2440MHz



2480MHz



## 9 ANTENNA REQUIREMENT

Standard Applicable:

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.

Antenna Connected Construction

The antenna used in this product is a PCB Antenna, The directional gains of antenna used for transmitting is 1.0dBi.

ANTENNA:



## 10 PHOTO OF TEST

### 10.1 RADIATED EMISSION



\*\*\*End of Report\*\*\*