FCC RF Test Report

For

Shenzhen Hastech industries Co., Ltd.

Test Standards:	Part 15C Subpart C §15.247
Product Description:	Bluetooth Keyboard
Tested Model:	HB115
Additional Model No.:	N/A
FCC ID:	2AC9LHB115
Classification	Digital Spread Spectrum (DSS)
Report No.:	EC1910023RF01
Tested Date:	2019-10-14 to 2019-11-11
Issued Date:	2019-11-11
Prepared By:	Jerry Wang / Engineer
Approved By:	Bacon Wu / RF Manager

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2019.11.11	Valid	Original Report

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Summary of Test Result

FCC Rule	Description	Limit	Result	Remark
15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.56 dB at 252.13 MHz
15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 30.42 dB at 16.928 MHz

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number:L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number:CN1244 , Test Firm Registration Number:793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Number:4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

2 General Description

2.1 Applicant

Shenzhen Hastech industries Co., Ltd.
G-A1 BLDG, Democracy West Industry Park, Shajing Town, Baoan District,Shenzhen, China

2.2 Manufacturer

Shenzhen Hastech industries Co., Ltd.
G-A1 BLDG, Democracy West Industry Park, Shajing Town, Baoan District,Shenzhen, China

2.3 General Description Of EUT

Product	Bluetooth Keyboard
Model No.	HB115
Additional No.	N/A
Difference Description	N/A
FCC ID	2AC9LHB115
Power Supply	5Vdc (From adapter or host equipment) 3.7Vdc (Li-ion, polymer)
Modulation Technology	FHSS
Modulation Type	GFSK
Bluetooth Version	V 3.0
Operating Frequency	2402MHz~2480MHz
Number Of Channel	79
Max. Output Power	Bluetooth BR(1Mbps) : -4.81 dBm (0.0003W)
Antenna Type	PCB Antenna type with 0dBi gain
I/O Ports	Refer to user's manual
Cable Supplied	N/A

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

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 C63.10-2013
- KDB 558074 D01 15.247 Meas Guidance v05r02

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

The transmitter has a maximum peak conducted output power as follows:

Channel	Frequency	Mode	Bluetooth RF Output Power
Ch00	2402MHz	GFSK	-4.81
Ch39	2441MHz	GFSK	-4.91
Ch78	2480MHz	GFSK	-5.51

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.

a. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

b. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

3.2 Test Mode

3.2.1 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2402 MHz

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.2 Radiated Emission Test (Above 1GHz)

Radiated Test Cases	Bluetooth BR 1Mbps GFSK
	Mode 1: CH00_2402 MHz
	Mode 2: CH39_2441 MHz
	Mode 3: CH78_2480 MHz

Note : 1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Zorientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

3.2.3 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : Bluetooth Link + USB Cable (Charging from Adapter)

3.3 Support Equipment

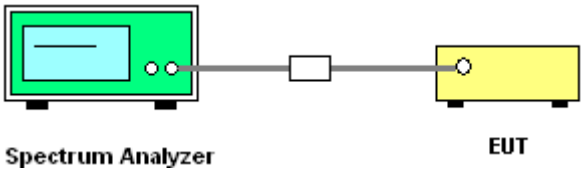
Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	AC Adapter	HUAWEI	HW-059200CHQ	FCC DOC	N/A	N/A
2.	MicroUSB Cable	N/A	N/A	N/A	N/A	unshielded 0.8m with magnetic ring
3.	Notebook	Lenovo	E470C	FCC DoC	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m

3.4 Test Setup

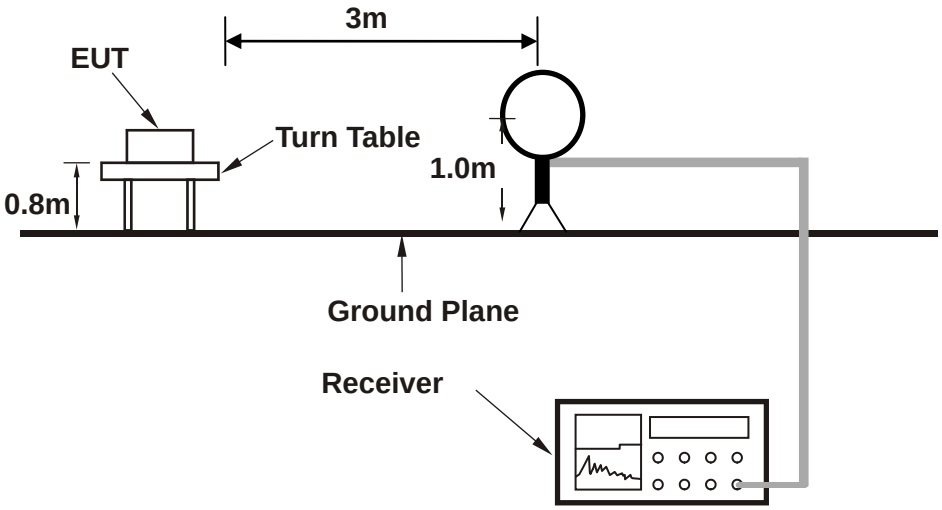
The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

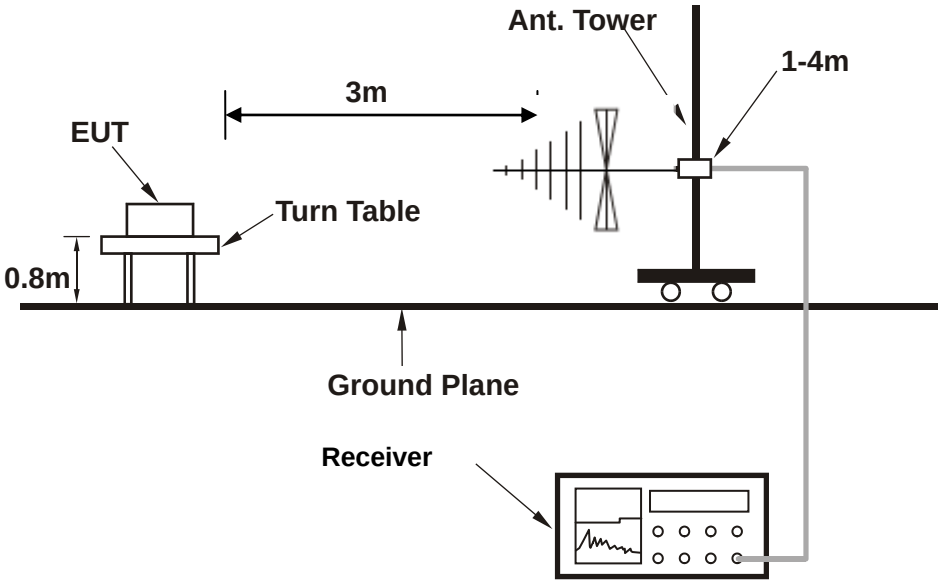
Setup diagram for Conducted Test



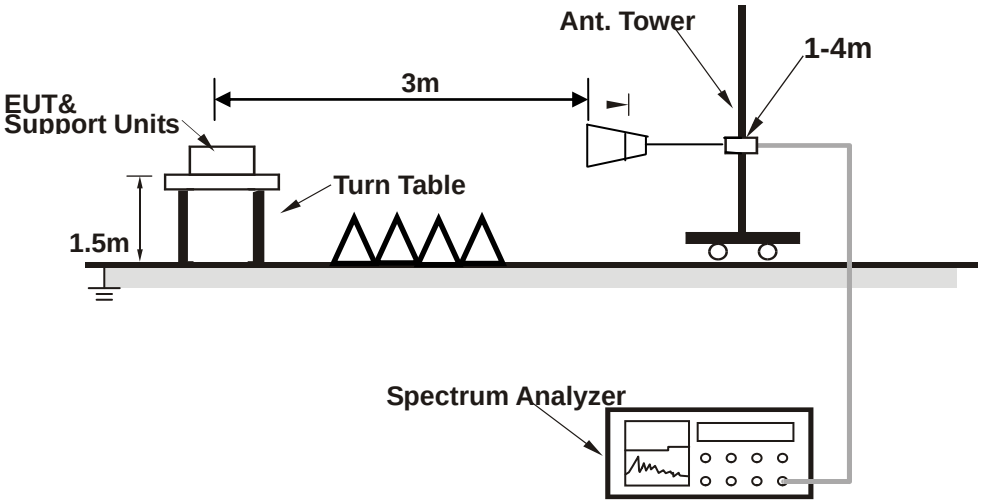
Setup diagram for Radiation(9KHz~30MHz) Test



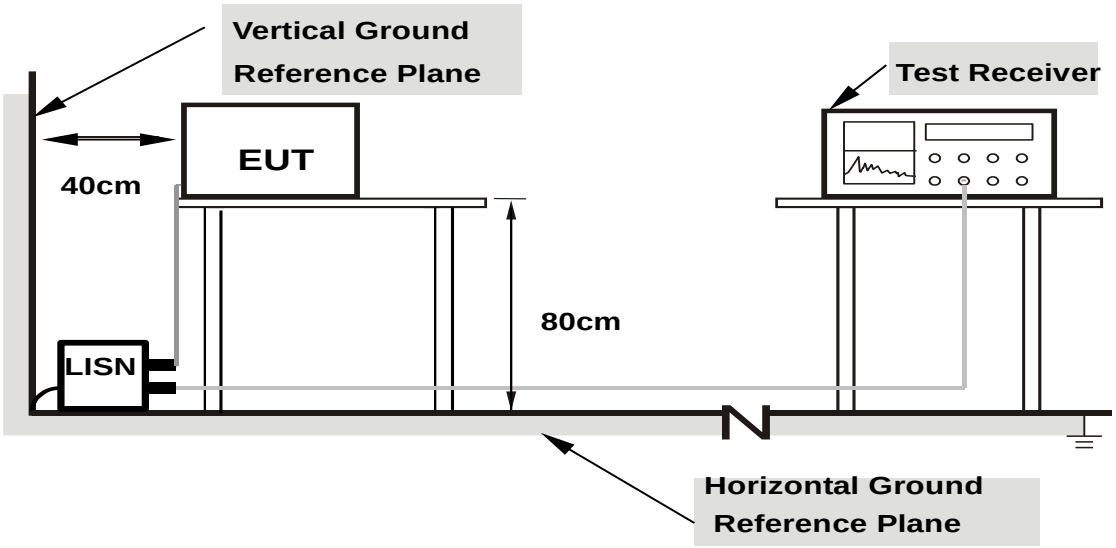
Setup diagram for Radiation(Below 1G) Test



Setup diagram for Radiation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 5 + 10 = 15 (dB)

For all radiated test items:

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

4 Test Result

4.1 Conducted Spurious Emission Measurement

4.1.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

4.1.2 Test Procedure

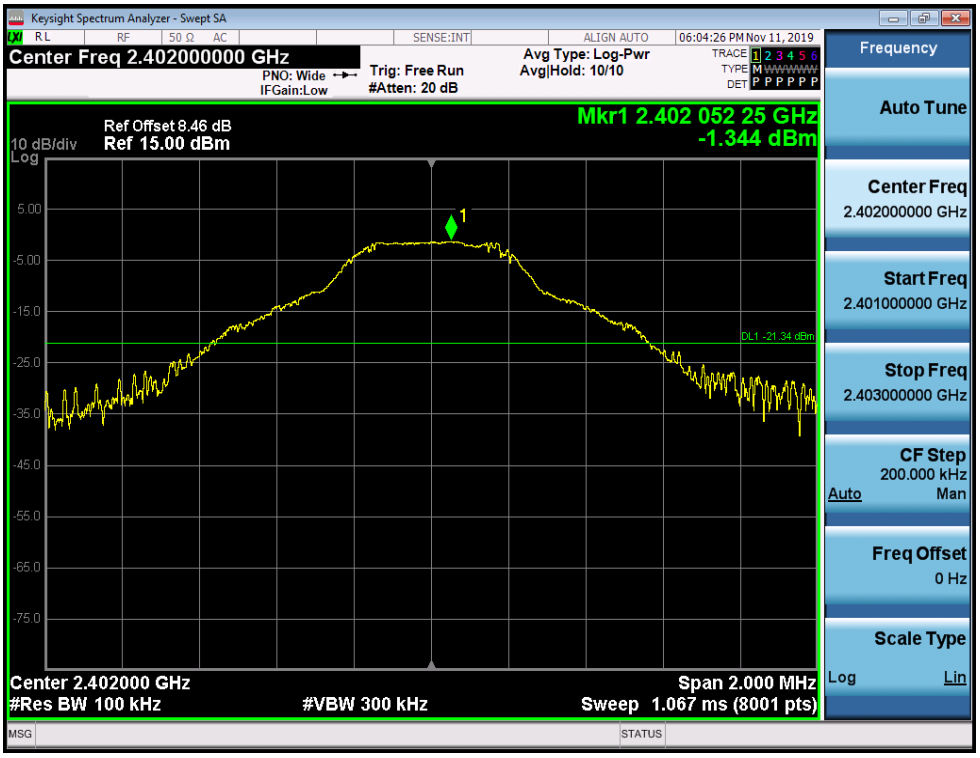
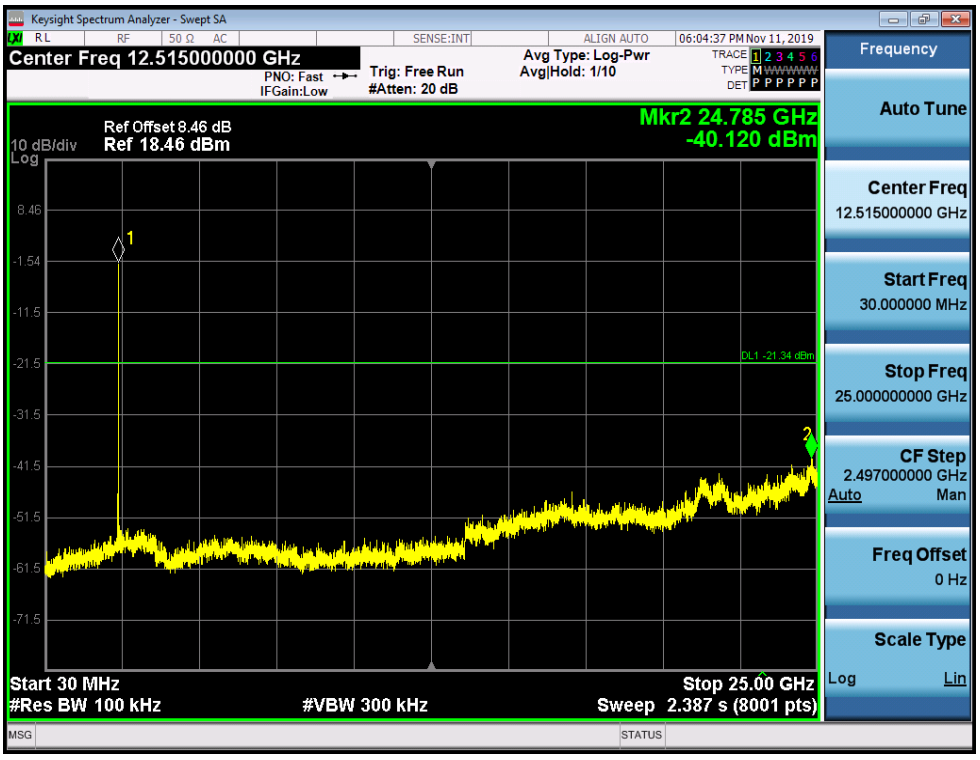
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

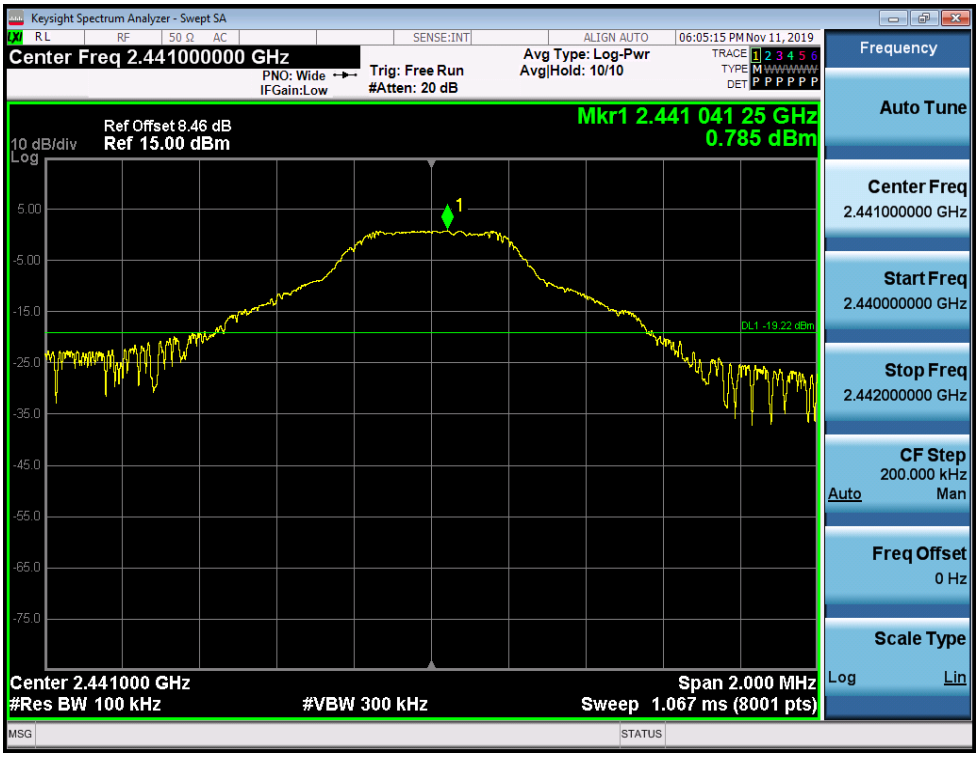
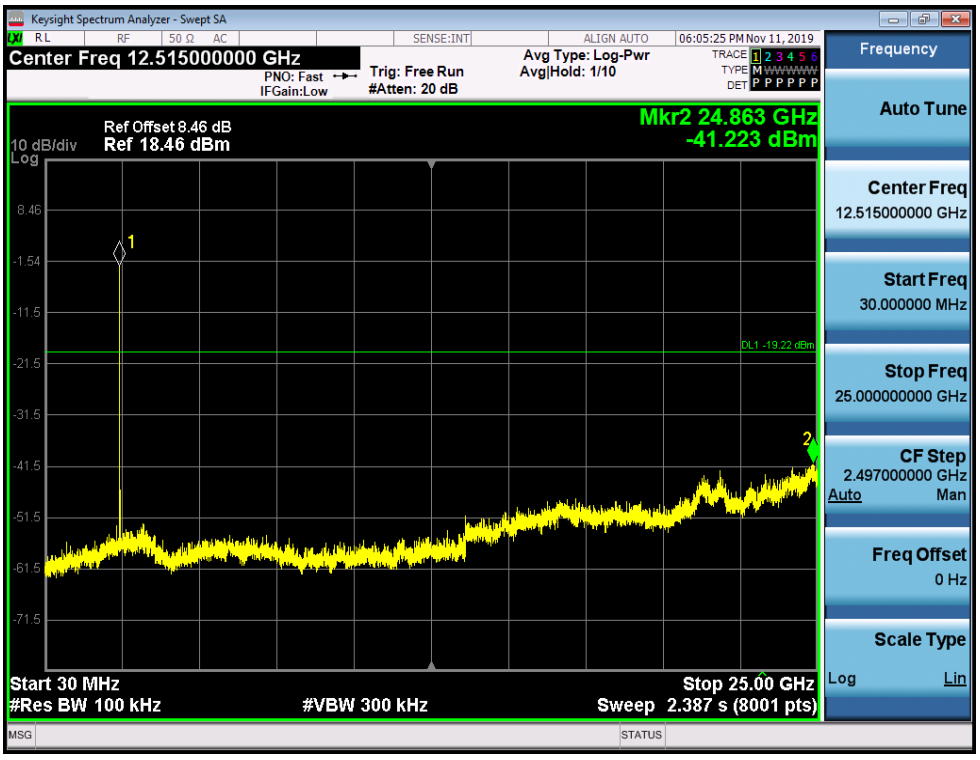
4.1.3 Test Result of Conducted Spurious Emission

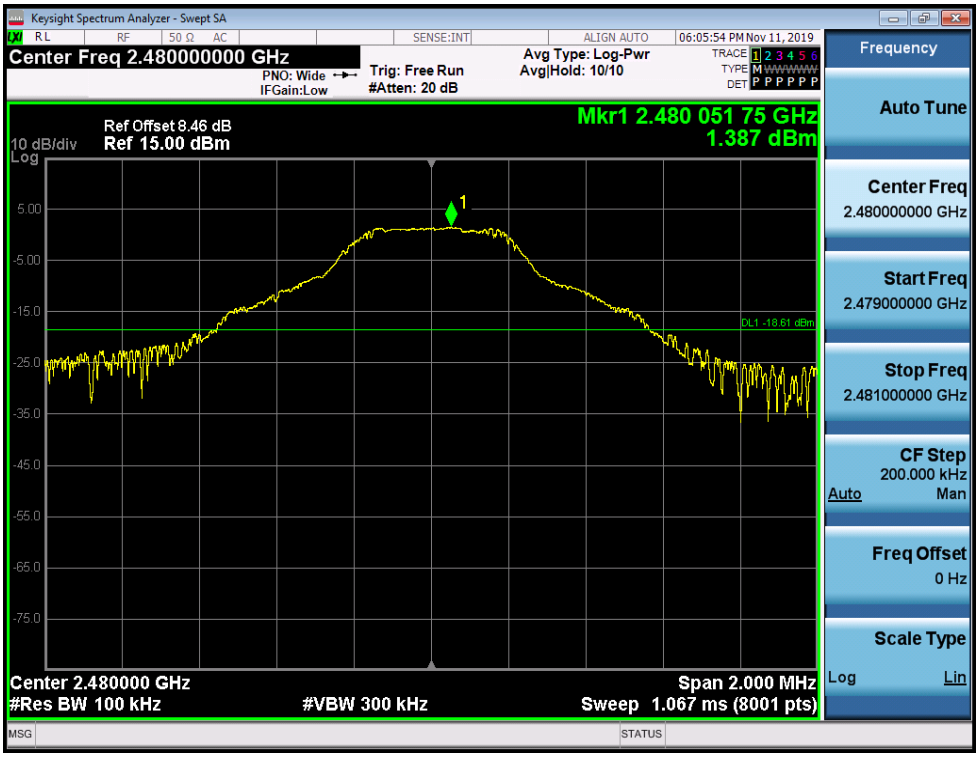
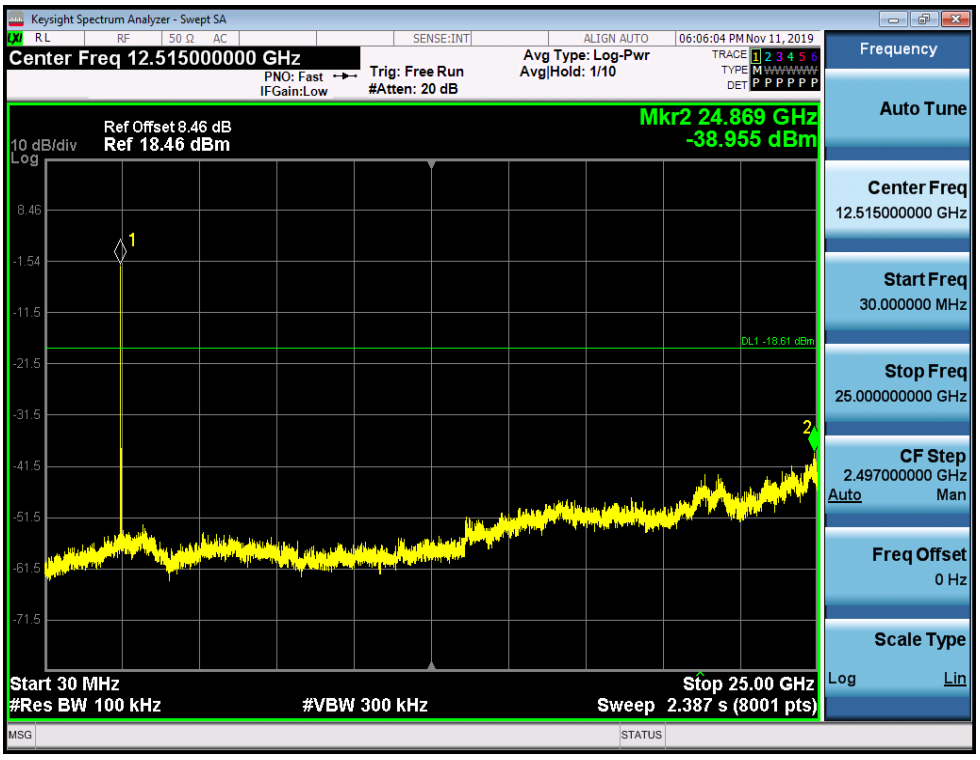
Test Mode :	Transmitting	**Temperature :**	24~26℃
Test Engineer :	Victorique Gao	**Relative Humidity :**	50~53%

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	-1.344	<Limit	PASS
GFSK	MCH	0.785	<Limit	PASS
GFSK	HCH	1.387	<Limit	PASS

Conducted Spurious Emission Polt

GFSK_LCH_Graphs	
Pref	
Puw	

GFSK_MCH_Graphs	
Pref	
Puw	

GFSK_HCH_Graphs	
Pref	
Puw	

4.2 Radiated Band Edges and Spurious Emission Measurement

4.2.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

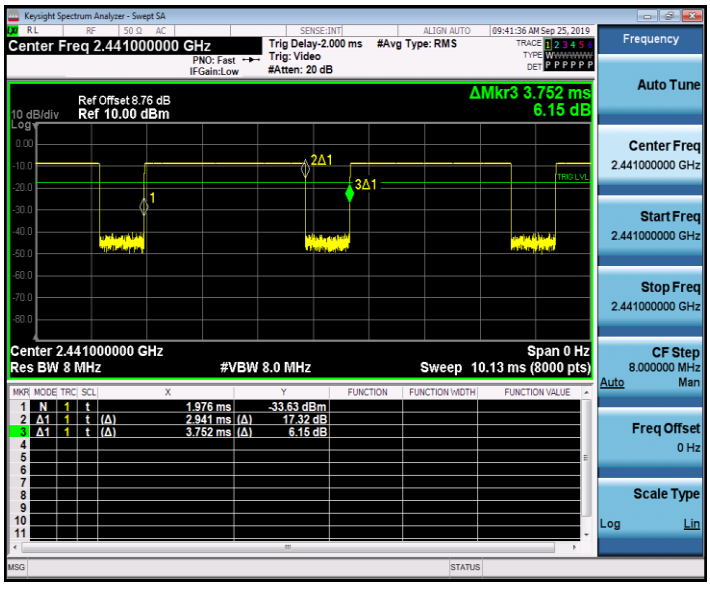
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Note: The frequency range from 9KHz to 10th harmonic (25GHz) are checked, and no any emissions were found from 18GHz to 25GHz, So the radiated emissions from 18GHz to 25GHz were not record.

4.2.2 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The measurement distance is 3 meter.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f<1 GHz, RBW=1MHz for f>1GHz ; VBW =3 * RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement:
   VBW = 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1Mbps	78.39	2.94	0.340	1kHz



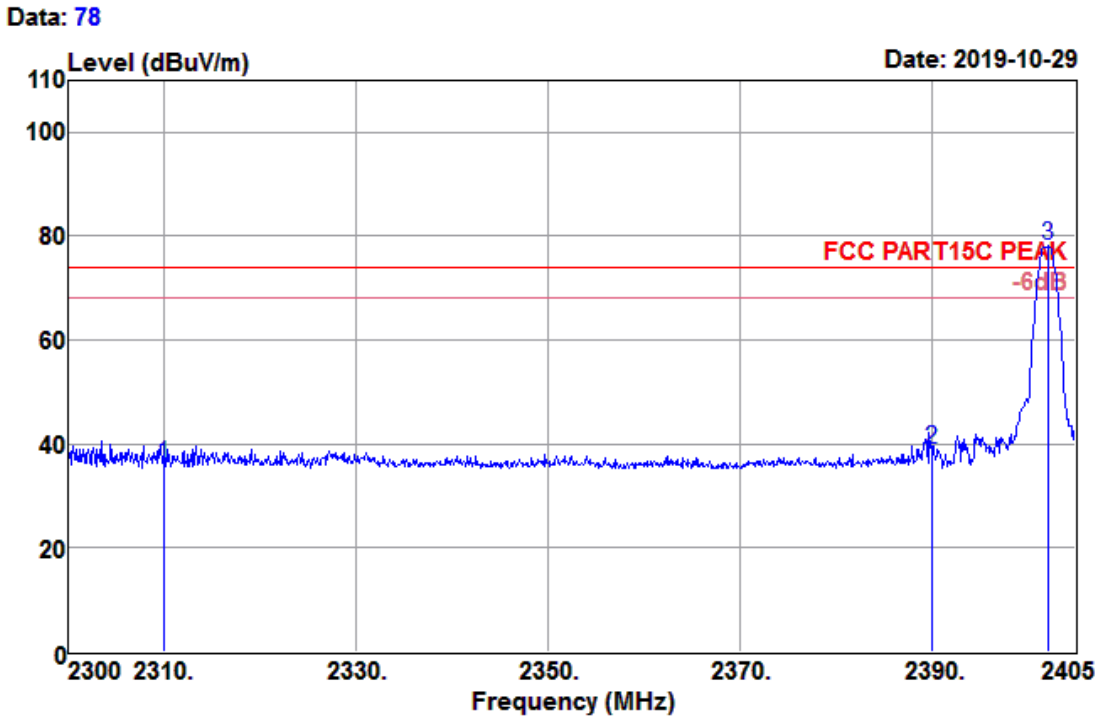
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

4.2.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

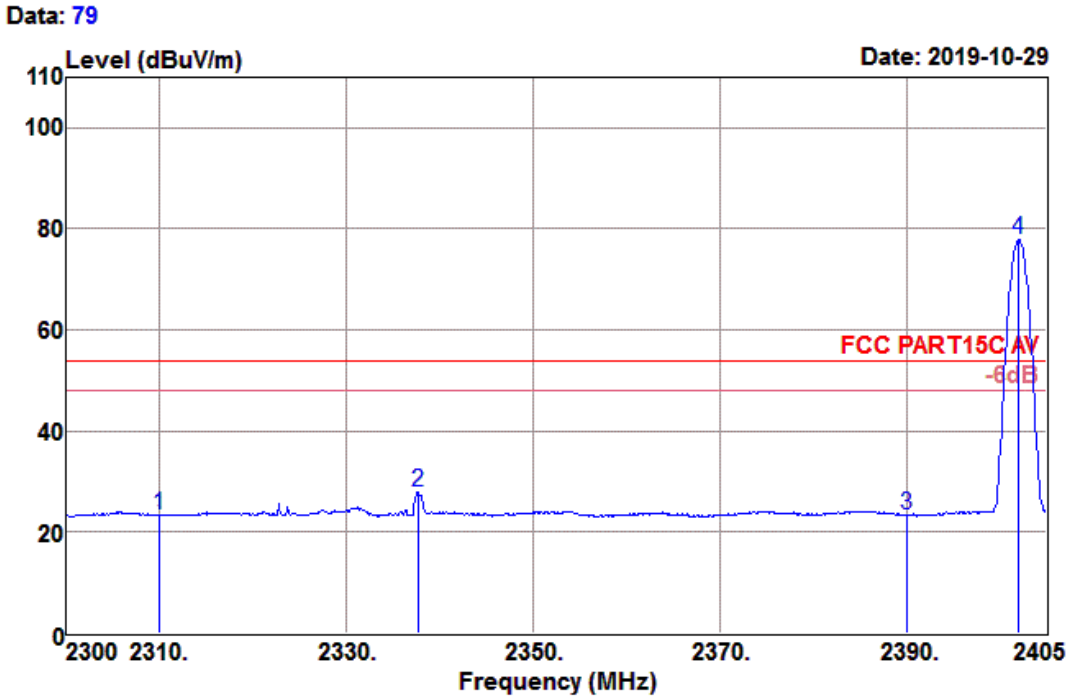
4.2.4 Test Result of Radiated Spurious at Band Edges

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	**Temperature :**	21~23℃
Test Engineer :	Jack Liu	**Relative Humidity :**	63~65%
Frequencey Range	2.3GHz~2.405GHz	**Polarization :**	Horizontal



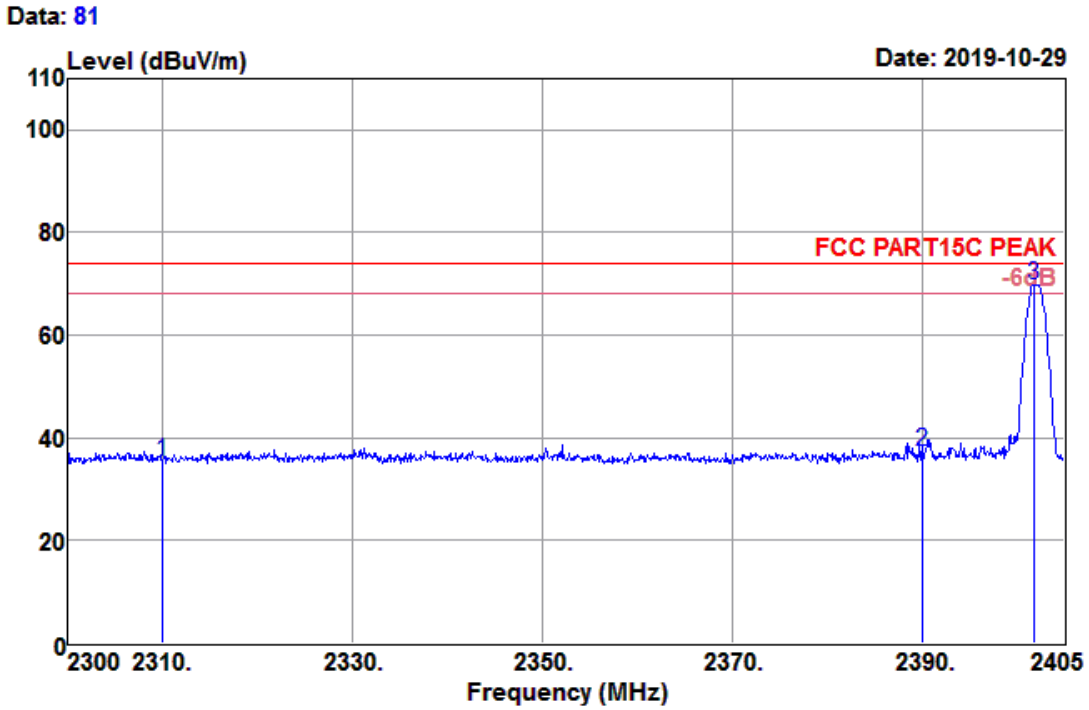
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2310.000	40.95	26.91	3.48	35.43	35.91	74.00	-38.09	Peak
2390.000	43.78	27.11	3.53	35.55	38.87	74.00	-35.13	Peak
2402.270	82.95	27.15	3.54	35.56	78.08	74.00	4.08	Peak

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jerry Wang	Relative Humidity :	63~65%
Frequencey Range	2.3GHz~2.405GHz	Polarization :	Horizontal



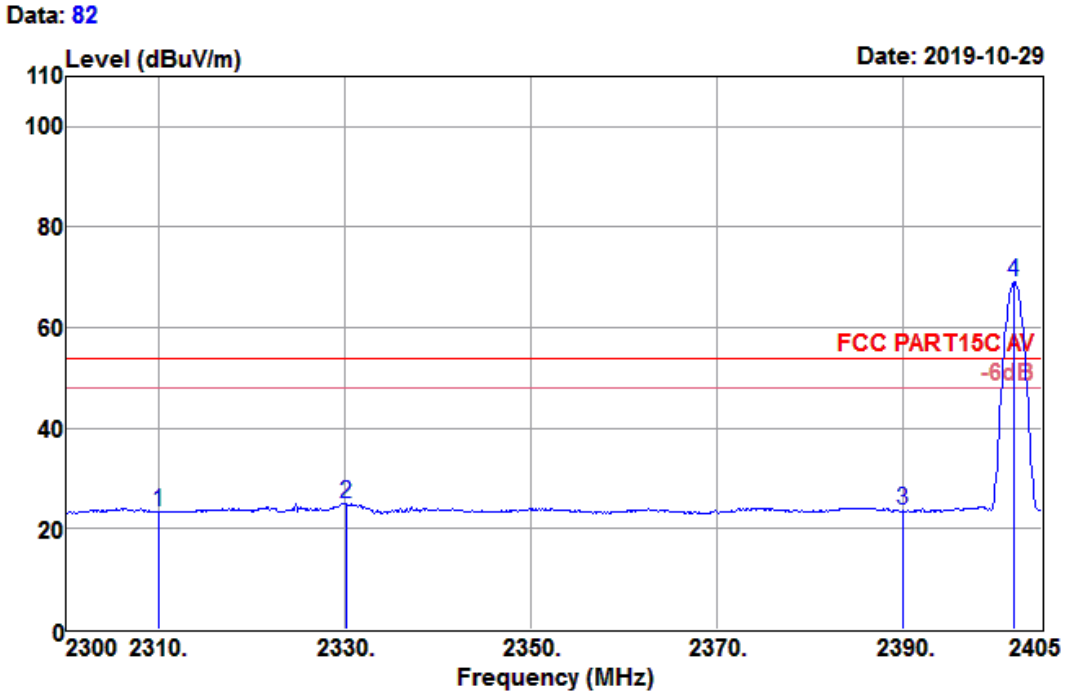
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2310.000	28.41	26.91	3.48	35.43	23.37	54.00	-30.63	Average
2337.695	33.05	26.98	3.50	35.47	28.06	54.00	-25.94	Average
2390.000	28.29	27.11	3.53	35.55	23.38	54.00	-30.62	Average
2402.060	82.72	27.15	3.54	35.56	77.85	54.00	23.85	Average

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.3GHz~2.405GHz	Polarization :	Vertical



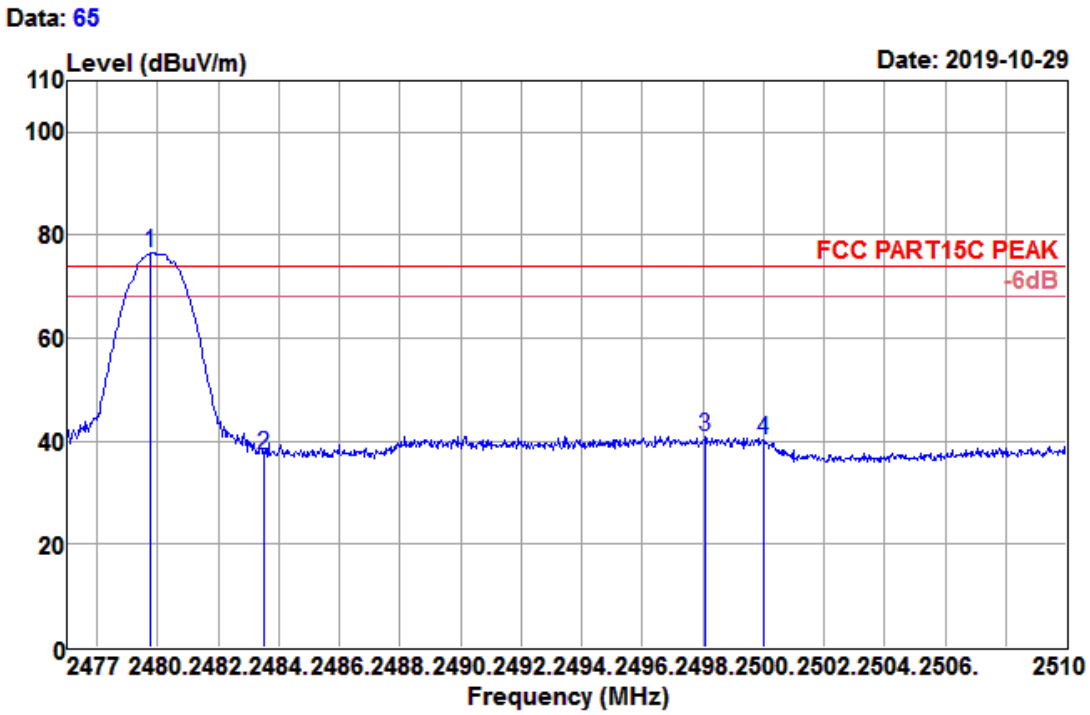
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2310.000	40.54	26.91	3.48	35.43	35.50	74.00	-38.50	Peak
2390.000	42.24	27.11	3.53	35.55	37.33	74.00	-36.67	Peak
2401.850	74.80	27.14	3.54	35.56	69.92	74.00	-4.08	Peak

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.3GHz~2.405GHz	Polarization :	Vertical



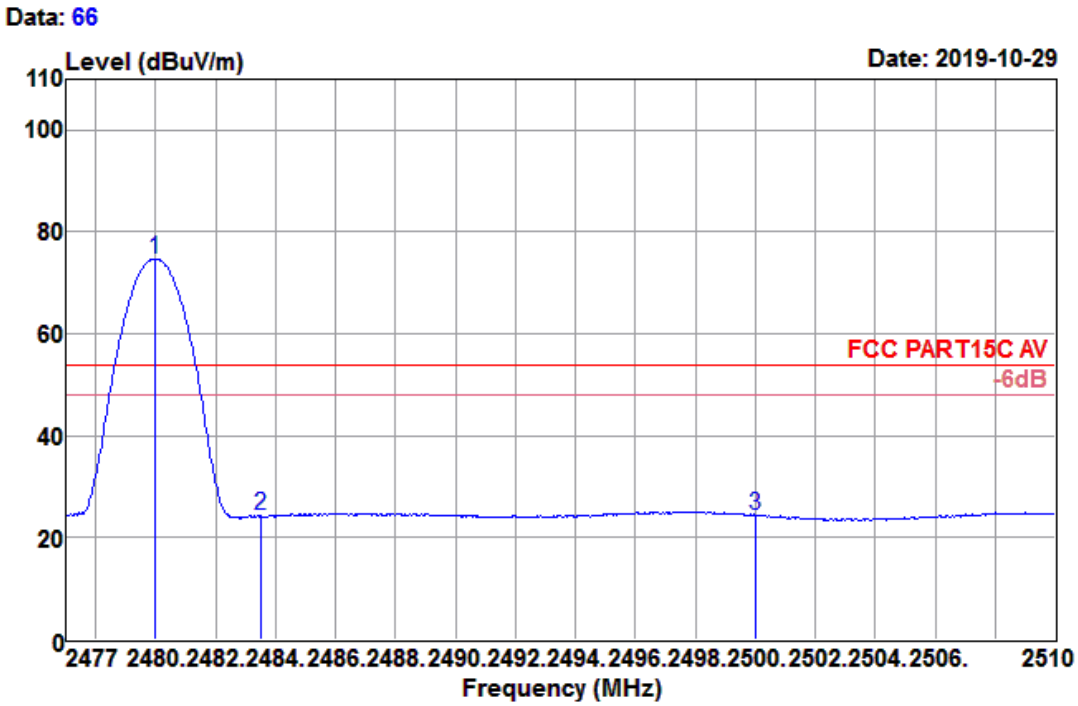
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2310.000	28.45	26.91	3.48	35.43	23.41	54.00	-30.59	Average
2330.135	30.08	26.96	3.49	35.46	25.07	54.00	-28.93	Average
2390.000	28.48	27.11	3.53	35.55	23.57	54.00	-30.43	Average
2402.060	73.97	27.15	3.54	35.56	69.10	54.00	15.10	Average

Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.477GHz~2.510GHz	Polarization :	Horizontal



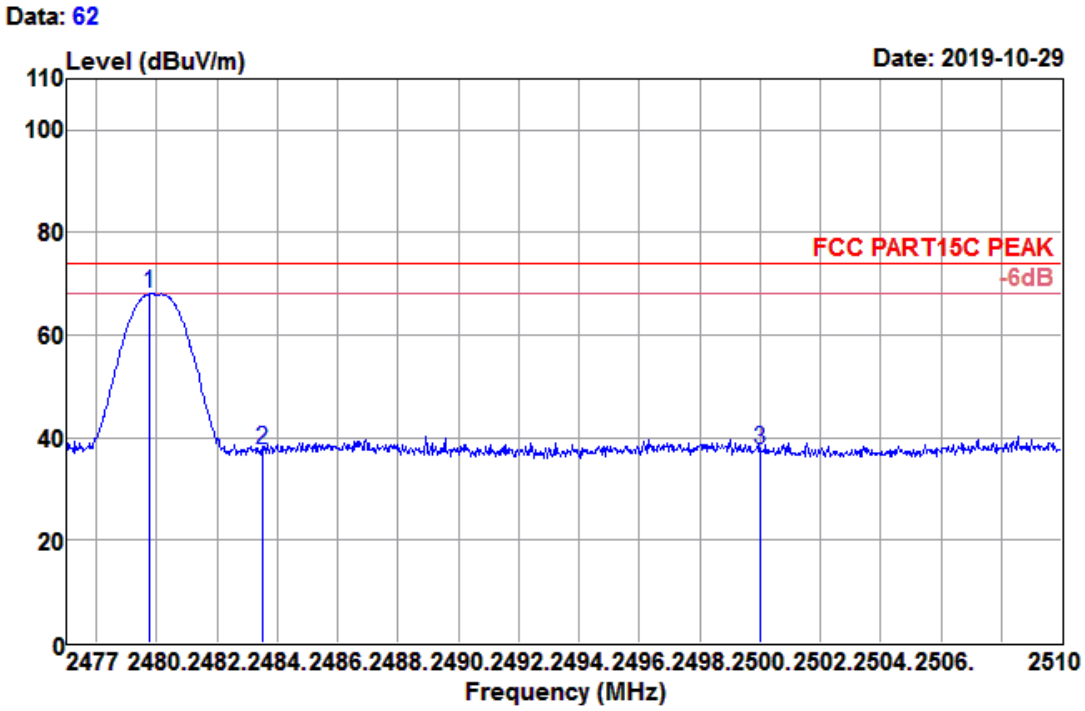
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2479.772	81.20	27.35	3.59	35.67	76.47	74.00	2.47	Peak
2483.500	42.17	27.36	3.59	35.68	37.44	74.00	-36.56	Peak
2498.087	45.74	27.40	3.60	35.70	41.04	74.00	-32.96	Peak
2500.000	45.01	27.40	3.60	35.70	40.31	74.00	-33.69	Peak

Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.477GHz~2.510GHz	Polarization :	Horizontal



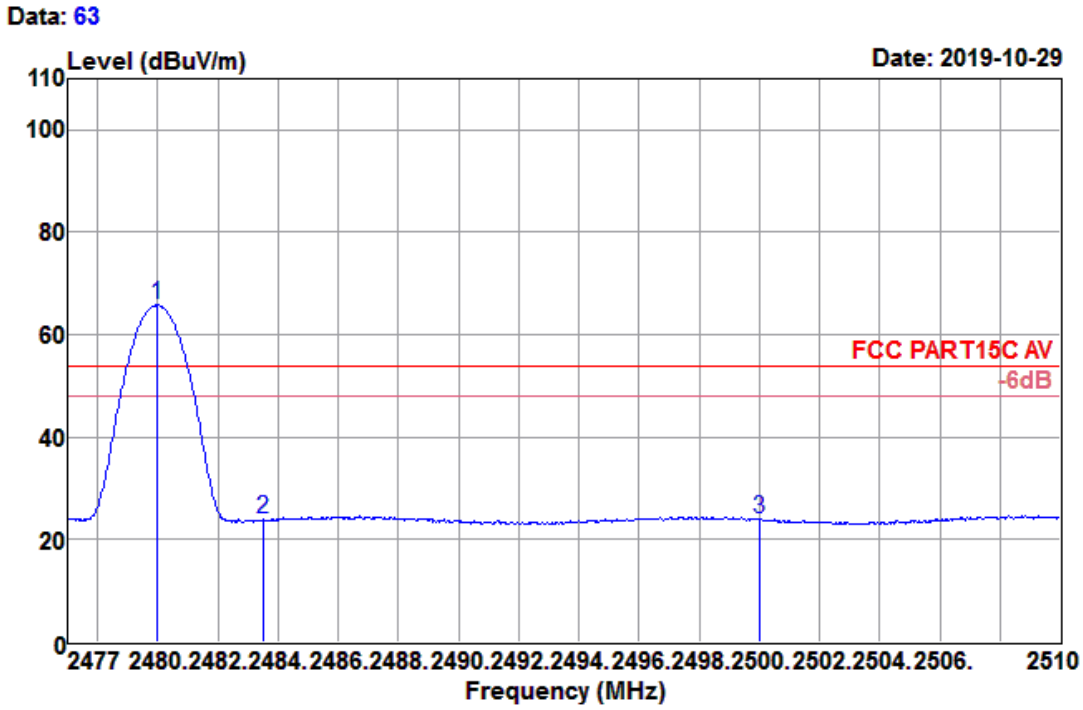
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2480.003	79.47	27.35	3.59	35.67	74.74	54.00	20.74	Average
2483.500	29.03	27.36	3.59	35.68	24.30	54.00	-29.70	Average
2500.000	29.13	27.40	3.60	35.70	24.43	54.00	-29.57	Average

Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.477GHz~2.510GHz	Polarization :	Vertical



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
2479.772	72.77	27.35	3.59	35.67	68.04	74.00	-5.96	Peak
2483.500	42.34	27.36	3.59	35.68	37.61	74.00	-36.39	Peak
2500.000	42.47	27.40	3.60	35.70	37.77	74.00	-36.23	Peak

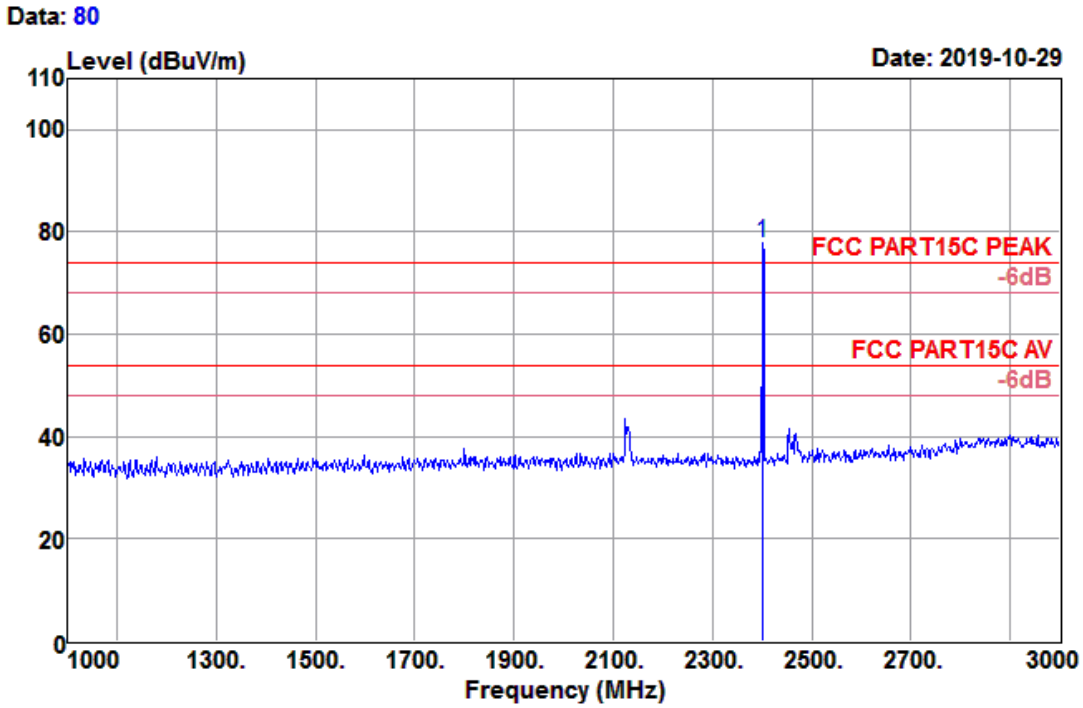
Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	2.477GHz~2.510GHz	Polarization :	Vertical



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2480.003	70.50	27.35	3.59	35.67	65.77	54.00	11.77	Average
2483.500	28.60	27.36	3.59	35.68	23.87	54.00	-30.13	Average
2500.000	28.66	27.40	3.60	35.70	23.96	54.00	-30.04	Average

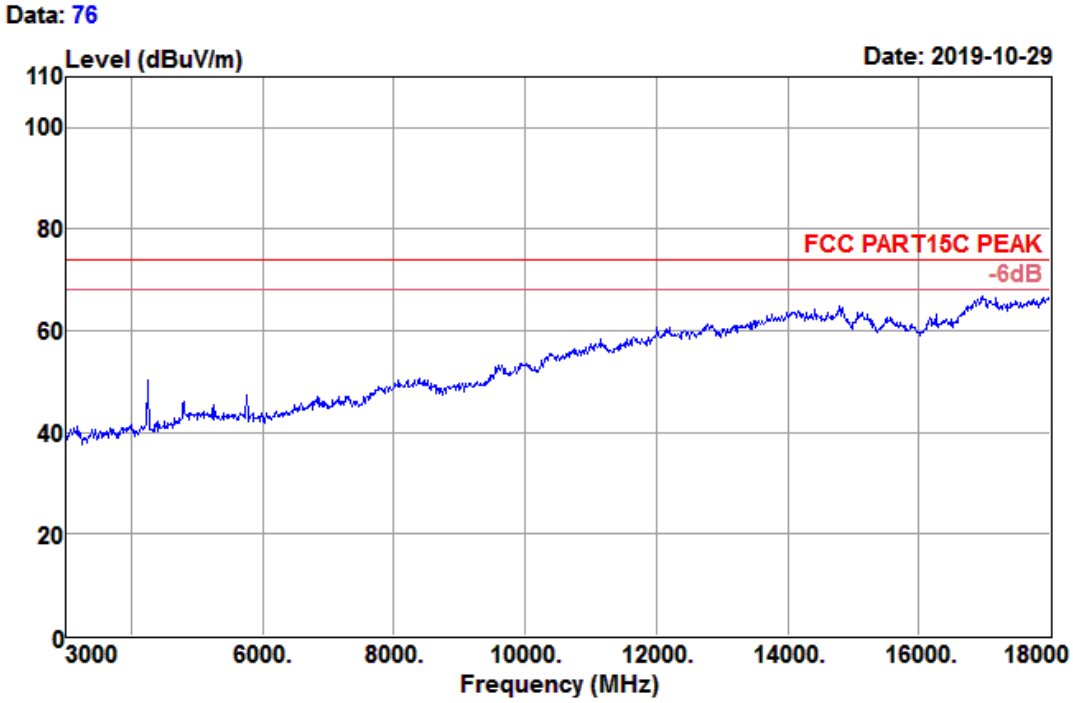
4.2.5 Test Result of Radiated Spurious Emission (1GHz ~ 10th Harmonic)

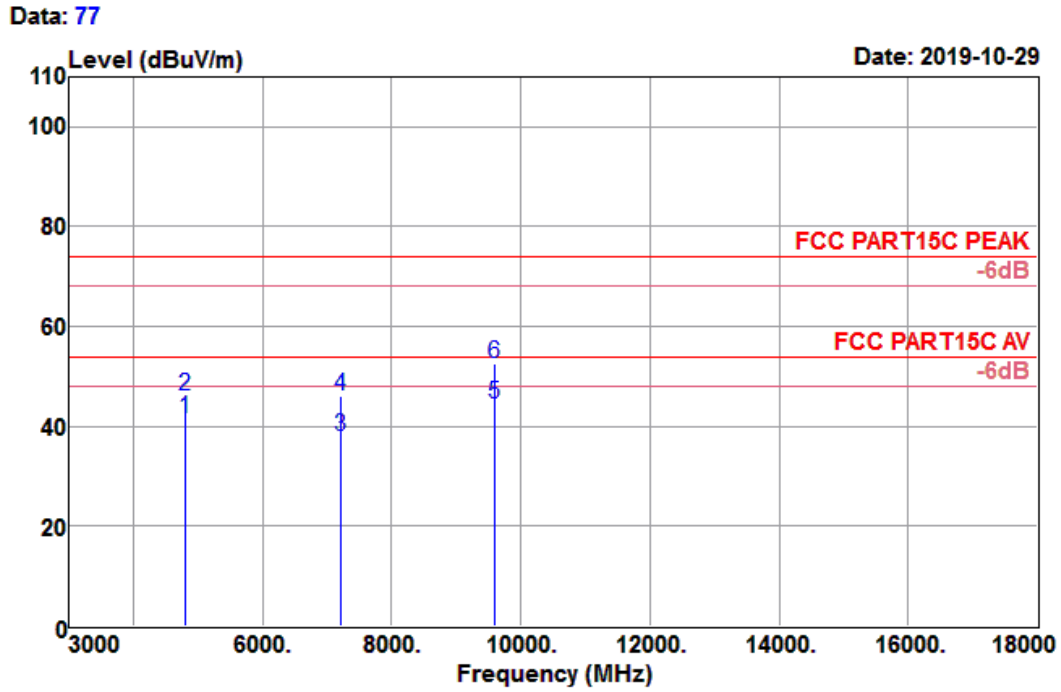
Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	**Temperature :**	21~23℃
Test Engineer :	Jack Liu	**Relative Humidity :**	63~65%
Frequencey Range	1GHz~3GHz	**Polarization :**	Horizontal



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2402.000	82.90	27.15	3.54	35.56	78.03	74.00	4.03	Peak

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Horizontal

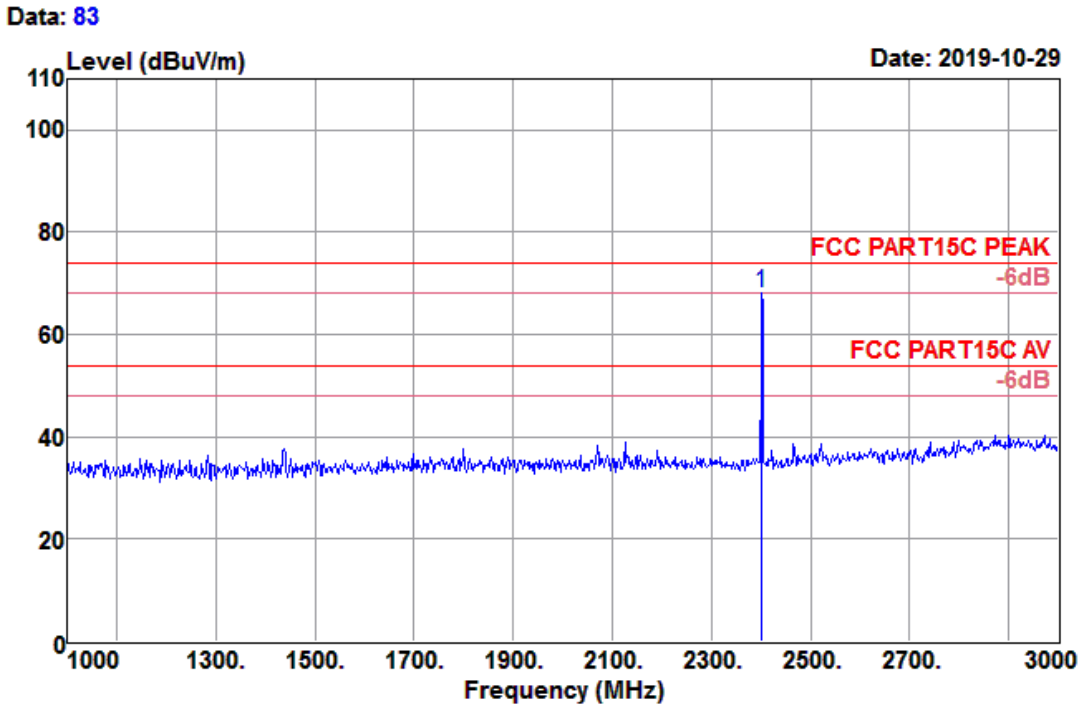




Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4804.000	39.56	31.23	5.57	34.86	41.50	54.00	-12.50	Average
4804.000	44.19	31.23	5.57	34.86	46.13	74.00	-27.87	Peak
7206.000	31.00	35.87	7.63	36.40	38.10	54.00	-15.90	Average
7206.000	39.12	35.87	7.63	36.40	46.22	74.00	-27.78	Peak
9608.000	32.76	37.79	10.29	36.40	44.44	54.00	-9.56	Average
9608.000	41.04	37.79	10.29	36.40	52.72	74.00	-21.28	Peak

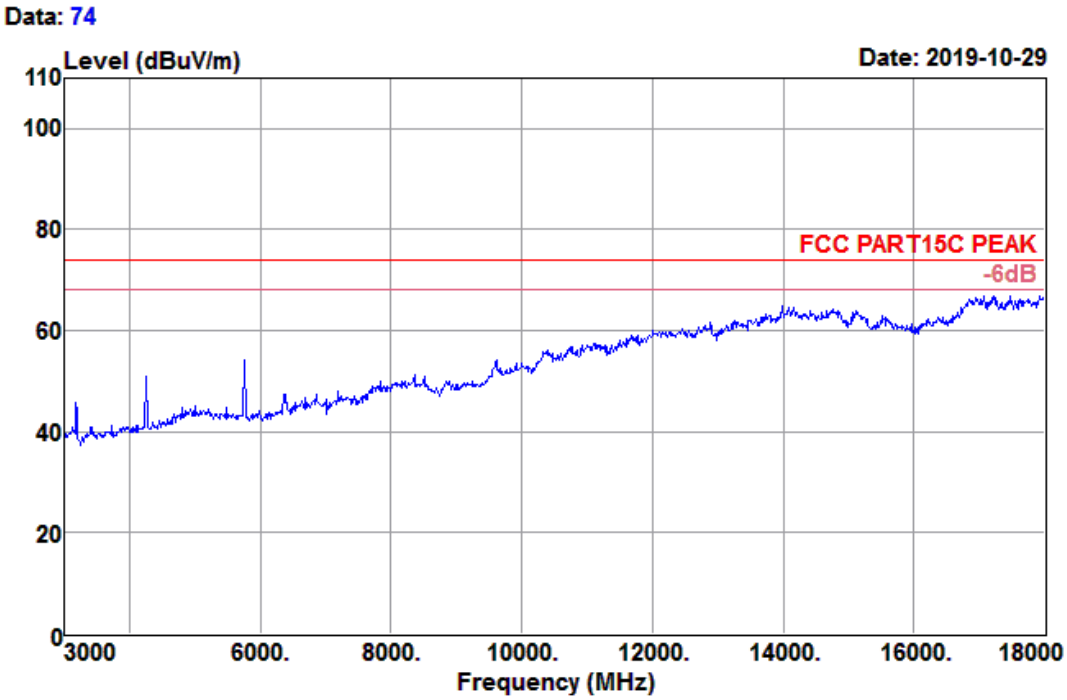
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

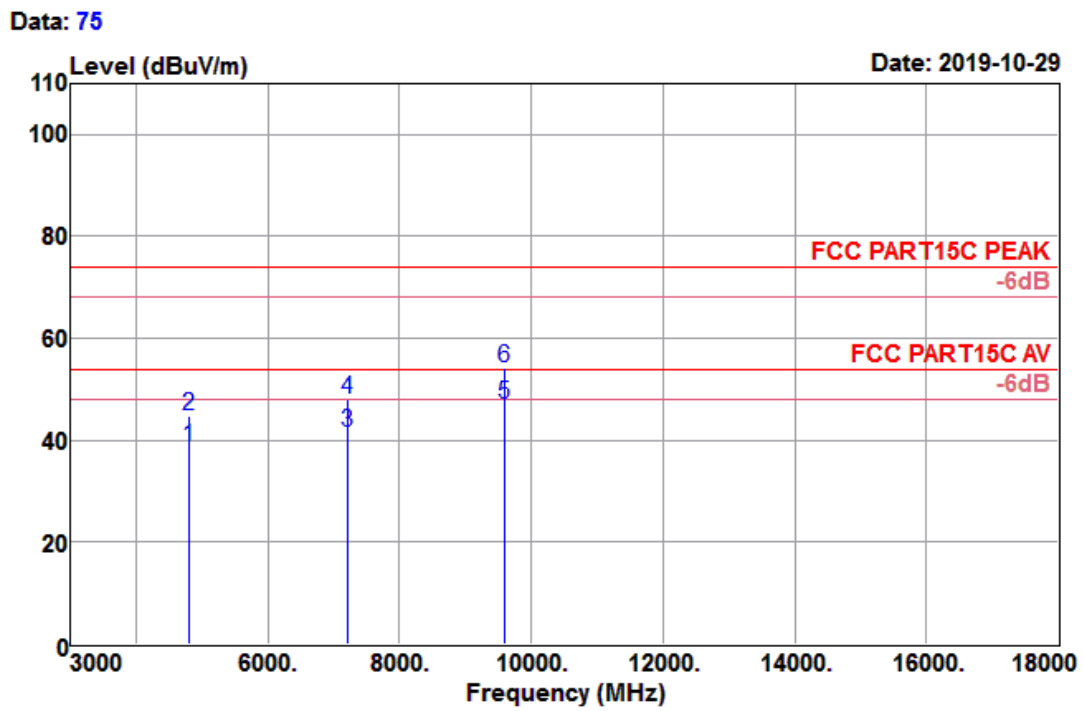
Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	1GHz~3GHz	Polarization :	Vertical



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2402.000	72.95	27.15	3.54	35.56	68.08	74.00	-5.92	Peak

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Vertical

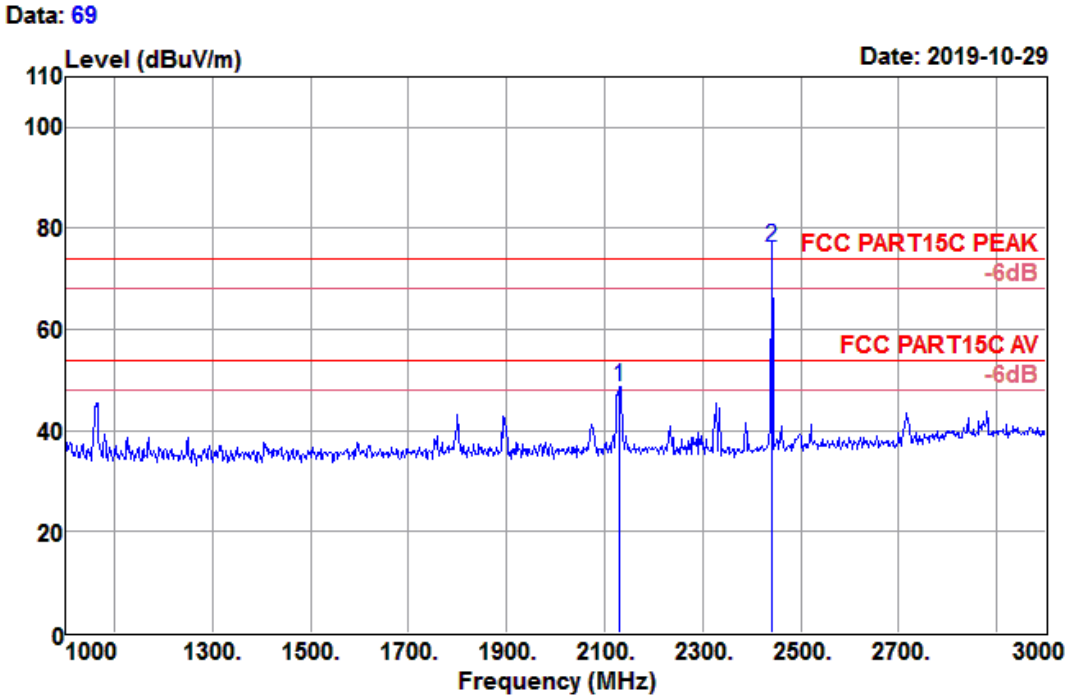




Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4804.000	36.66	31.23	5.57	34.86	38.60	54.00	-15.40	Average
4804.000	42.97	31.23	5.57	34.86	44.91	74.00	-29.09	Peak
7206.000	34.32	35.87	7.63	36.40	41.42	54.00	-12.58	Average
7206.000	40.86	35.87	7.63	36.40	47.96	74.00	-26.04	Peak
9608.000	35.37	37.79	10.29	36.40	47.05	54.00	-6.95	Average
9608.000	42.41	37.79	10.29	36.40	54.09	74.00	-19.91	Peak

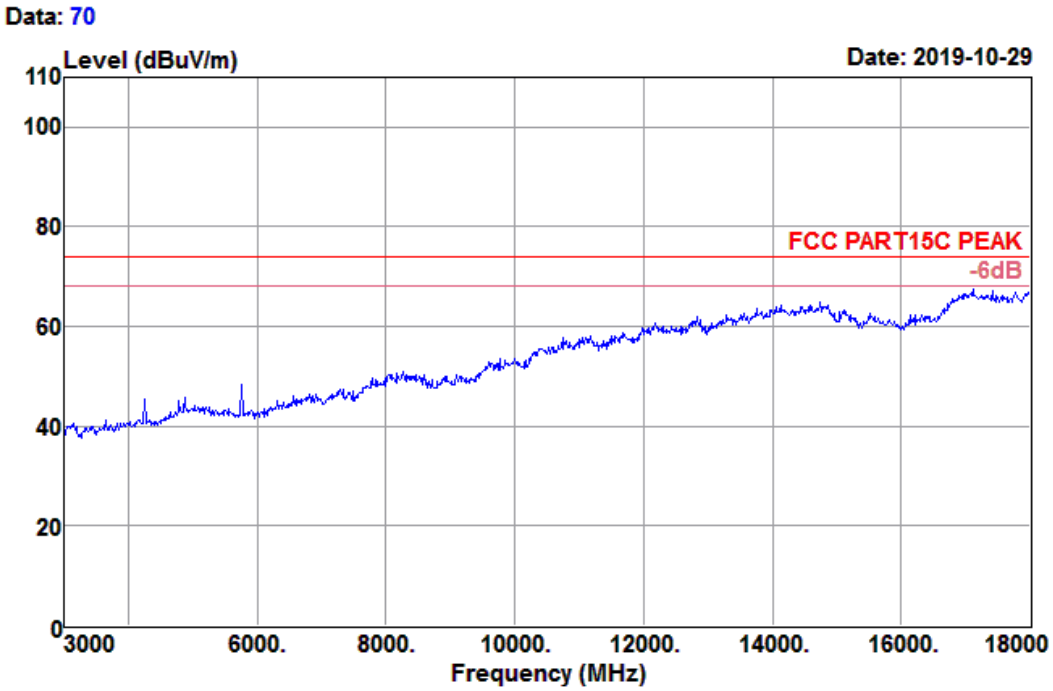
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

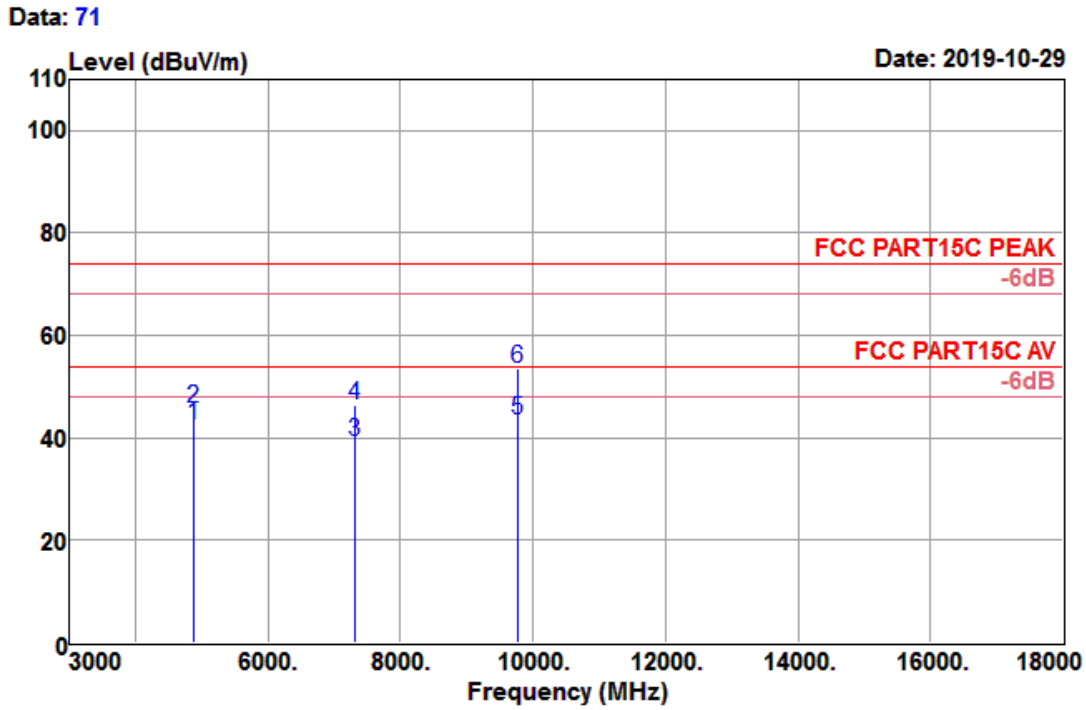
Test Mode :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	1GHz~3GHz	Polarization :	Horizontal



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2130.000	54.23	26.44	3.31	35.18	48.80	74.00	-25.20	Peak
2441.000	80.99	27.25	3.56	35.62	76.18	74.00	2.18	Peak

Test Mode :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Horizontal

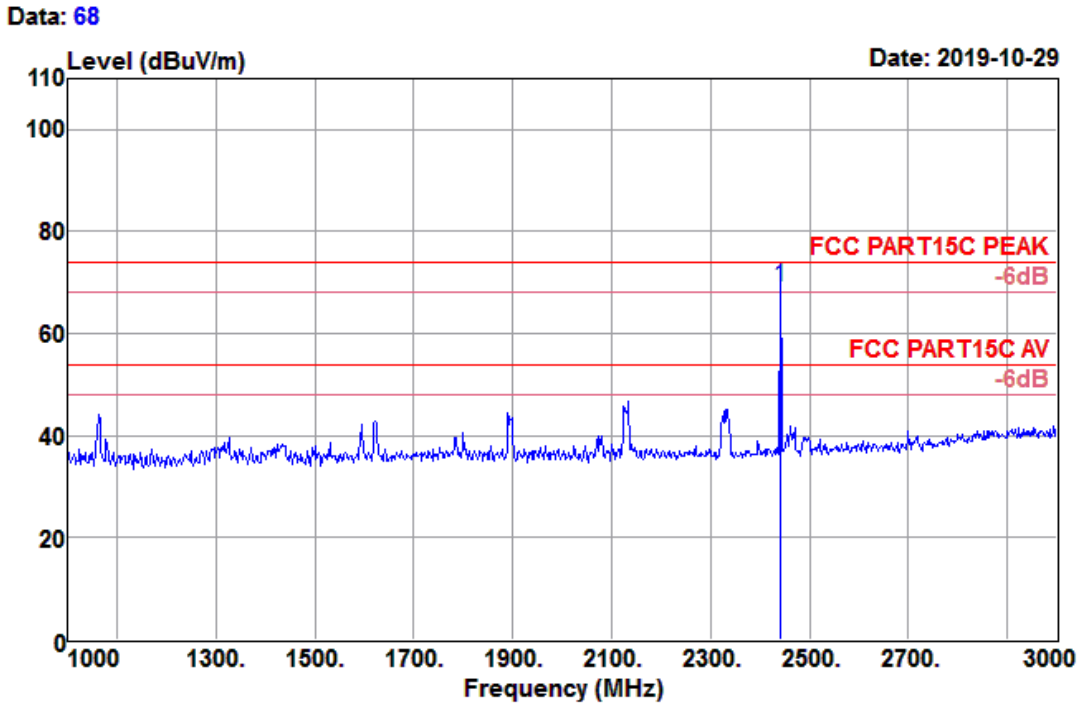




Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4882.000	40.25	31.42	5.55	34.79	42.43	54.00	-11.57	Average
4882.000	43.59	31.42	5.55	34.79	45.77	74.00	-28.23	Peak
7323.000	32.00	36.14	7.52	36.40	39.26	54.00	-14.74	Average
7323.000	39.23	36.14	7.52	36.40	46.49	74.00	-27.51	Peak
9764.000	31.07	38.08	10.75	36.40	43.50	54.00	-10.50	Average
9764.000	41.01	38.08	10.75	36.40	53.44	74.00	-20.56	Peak

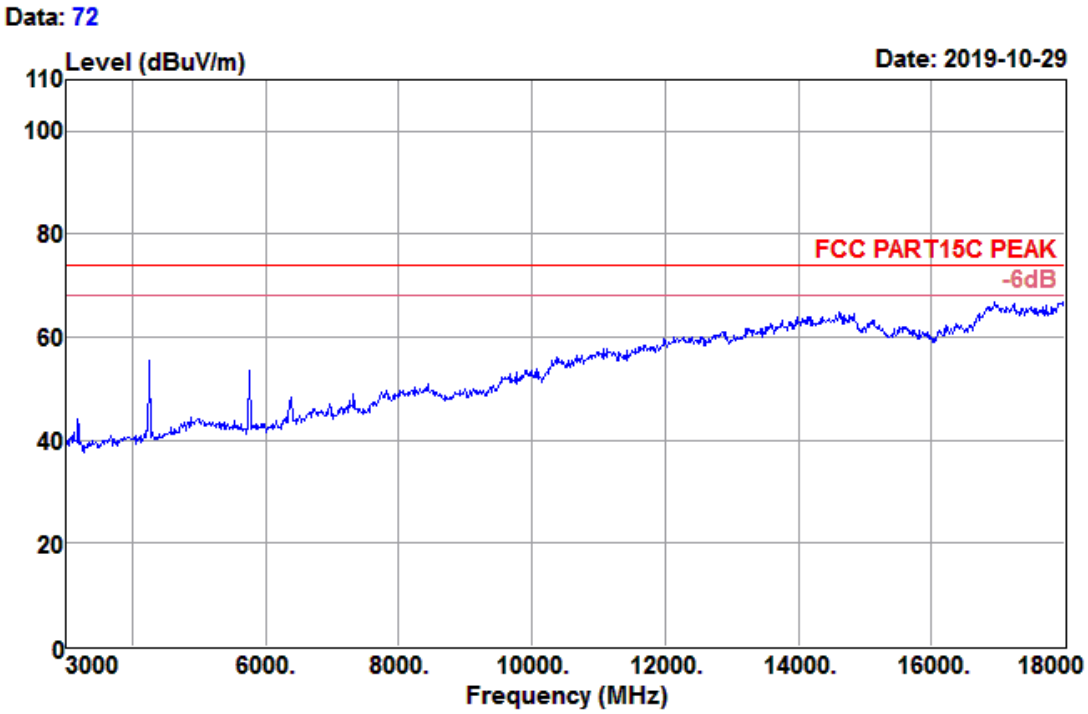
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

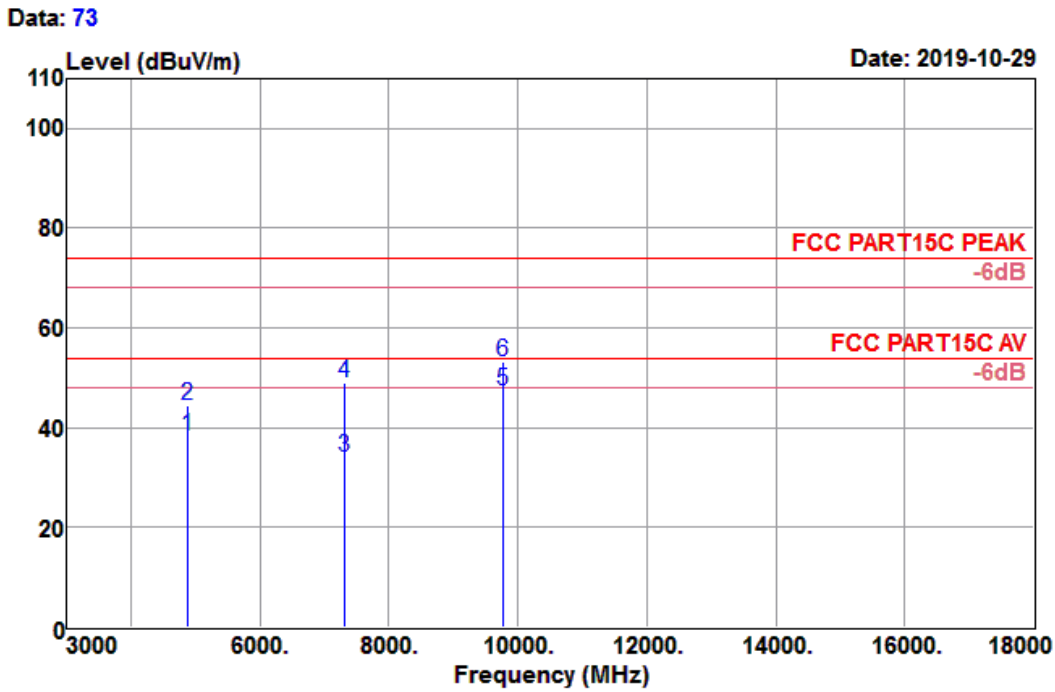
Test Mode :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	1GHz~3GHz	Polarization :	Vertical



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2441.000	73.97	27.25	3.56	35.62	69.16	74.00	-4.84	Peak

Test Mode :	Bluetooth (1Mbps) CH39 (2441MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Vertical

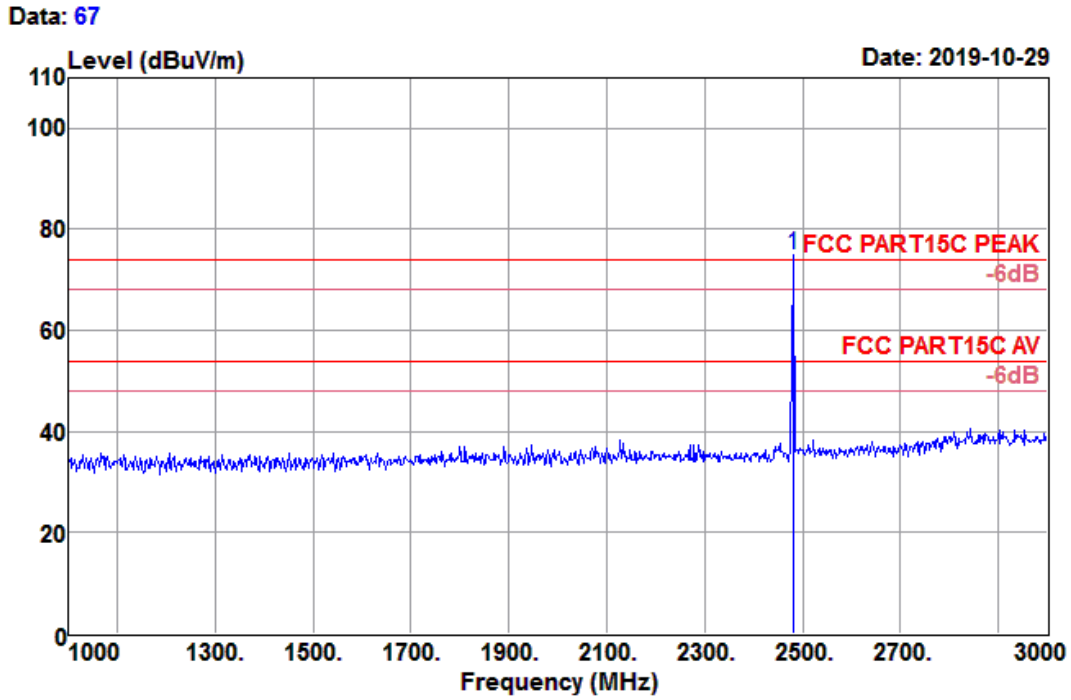




Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4882.000	36.25	31.42	5.55	34.79	38.43	54.00	-15.57	Average
4882.000	42.15	31.42	5.55	34.79	44.33	74.00	-29.67	Peak
7323.000	26.94	36.14	7.52	36.40	34.20	54.00	-19.80	Average
7323.000	41.83	36.14	7.52	36.40	49.09	74.00	-24.91	Peak
9764.000	35.04	38.08	10.75	36.40	47.47	54.00	-6.53	Average
9764.000	40.69	38.08	10.75	36.40	53.12	74.00	-20.88	Peak

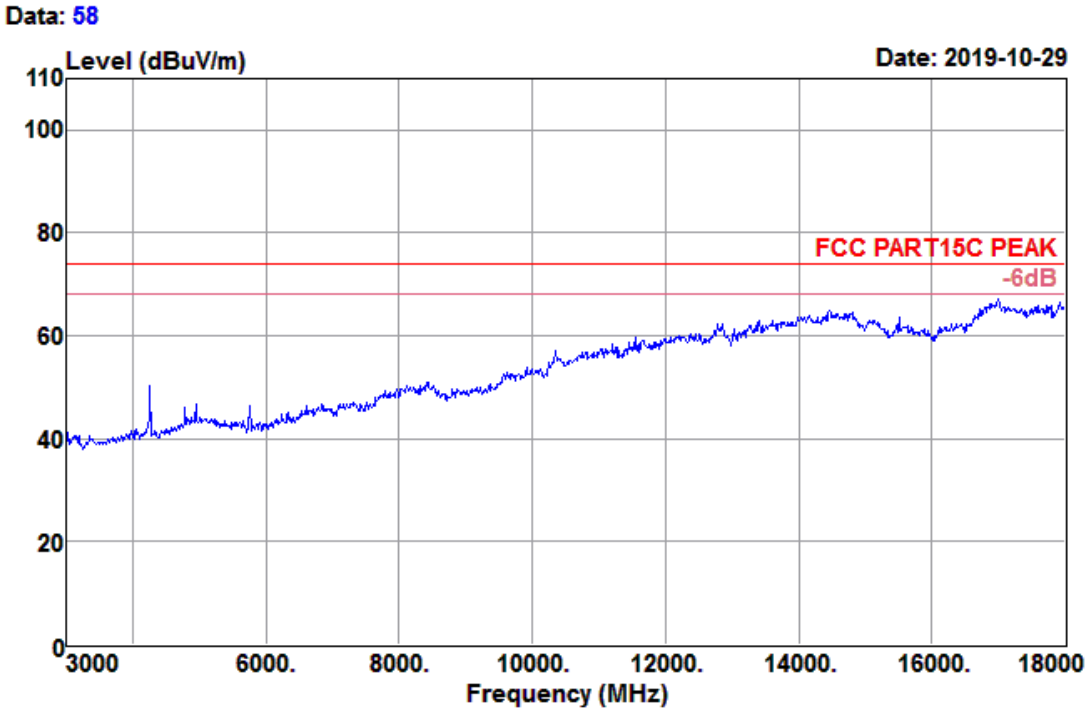
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

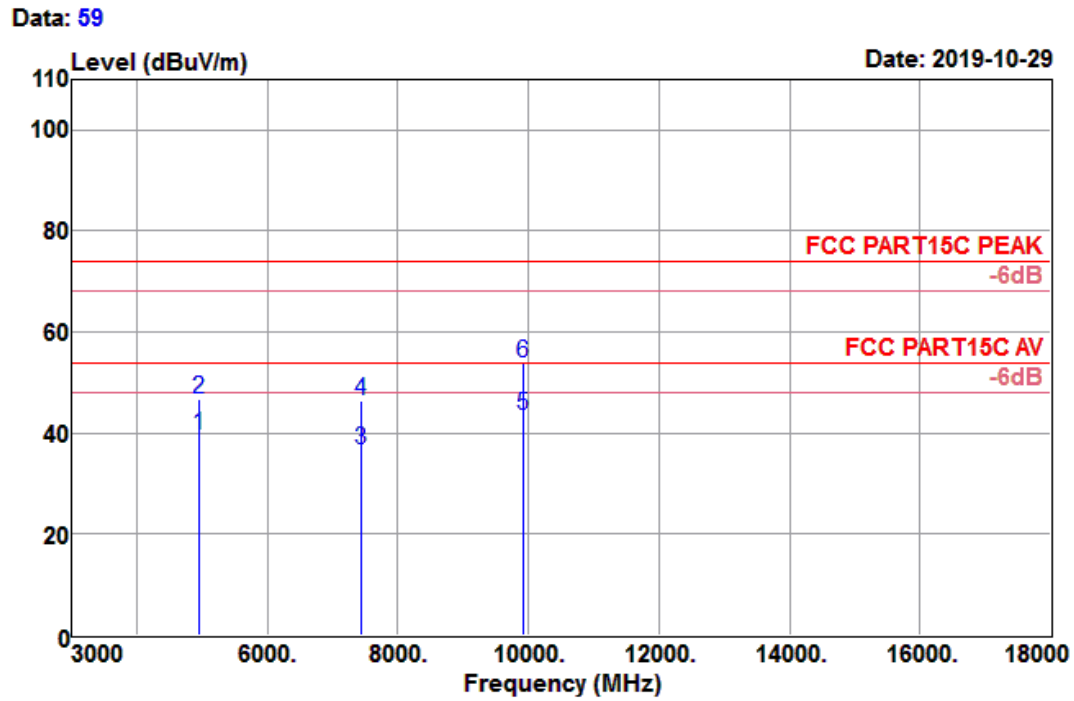
Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	1GHz~3GHz	Polarization :	Horizontal



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2480.000	79.76	27.35	3.59	35.67	75.03	74.00	1.03	Peak

Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Horizontal

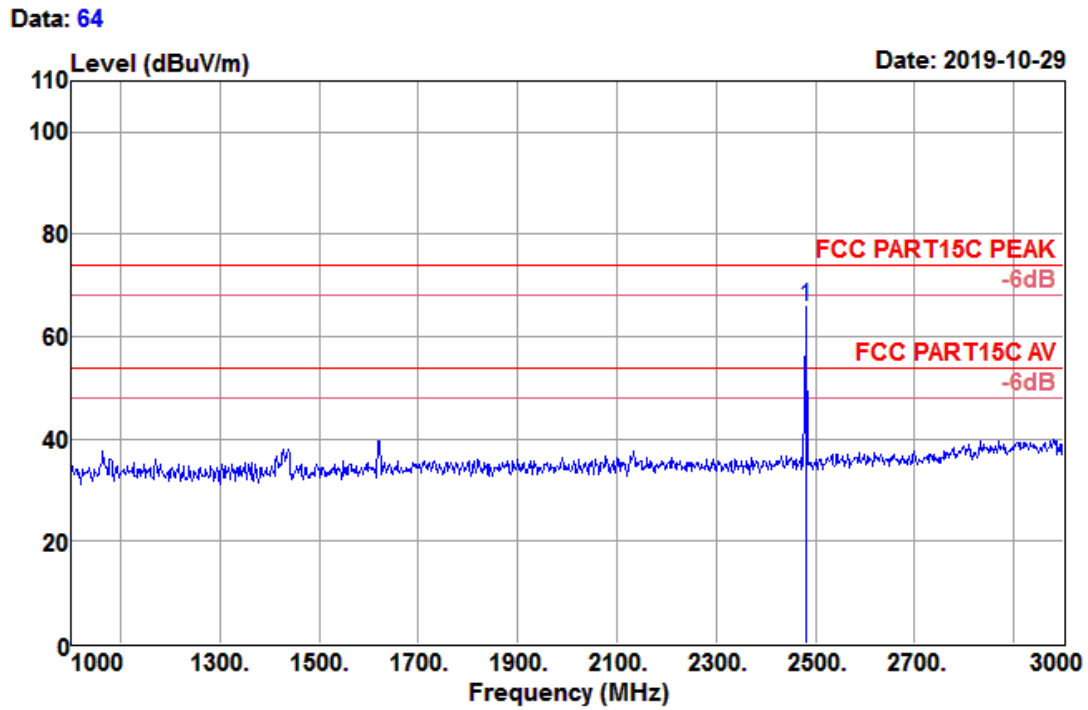




Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4960.000	37.36	31.60	5.52	34.73	39.75	54.00	-14.25	Average
4960.000	44.23	31.60	5.52	34.73	46.62	74.00	-27.38	Peak
7440.000	29.24	36.41	7.56	36.40	36.81	54.00	-17.19	Average
7440.000	38.82	36.41	7.56	36.40	46.39	74.00	-27.61	Peak
9920.000	30.36	38.36	11.17	36.40	43.49	54.00	-10.51	Average
9920.000	40.90	38.36	11.17	36.40	54.03	74.00	-19.97	Peak

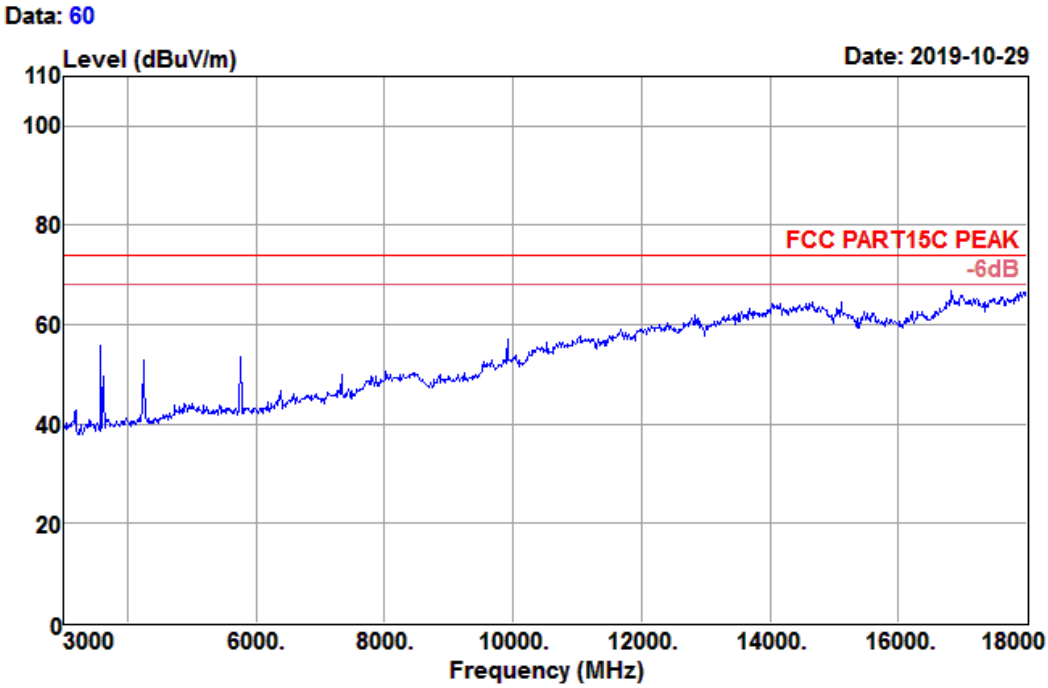
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

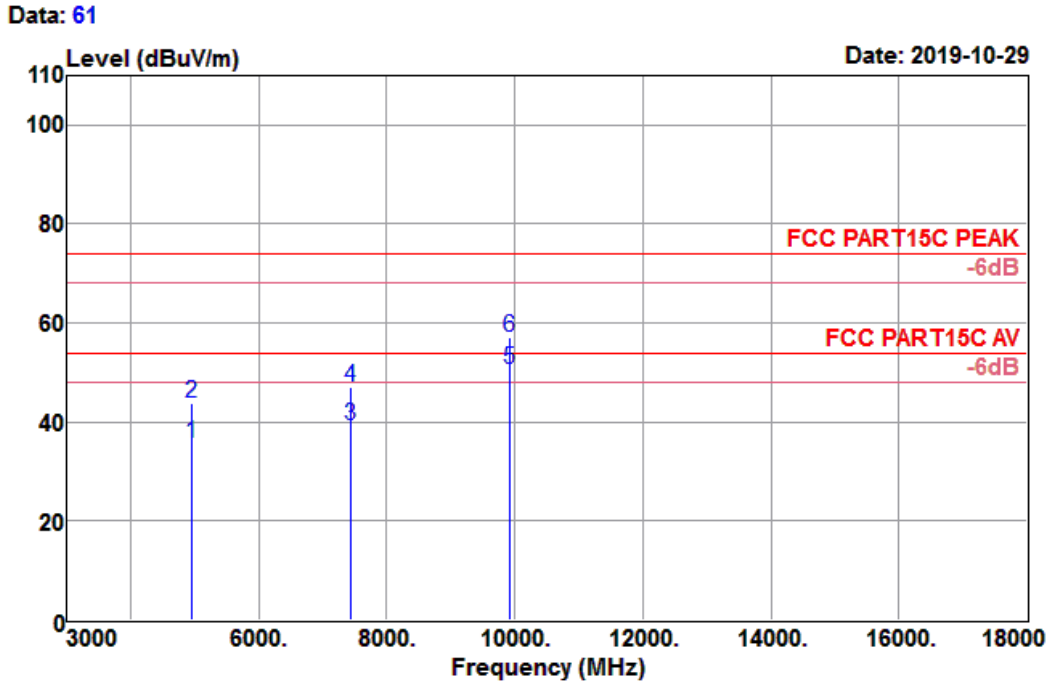
Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	1GHz~3GHz	Polarization :	Vertical



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2480.000	70.64	27.35	3.59	35.67	65.91	74.00	-8.09	Peak

Test Mode :	Bluetooth (1Mbps) CH78 (2480MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	3GHz~18GHz	Polarization :	Vertical



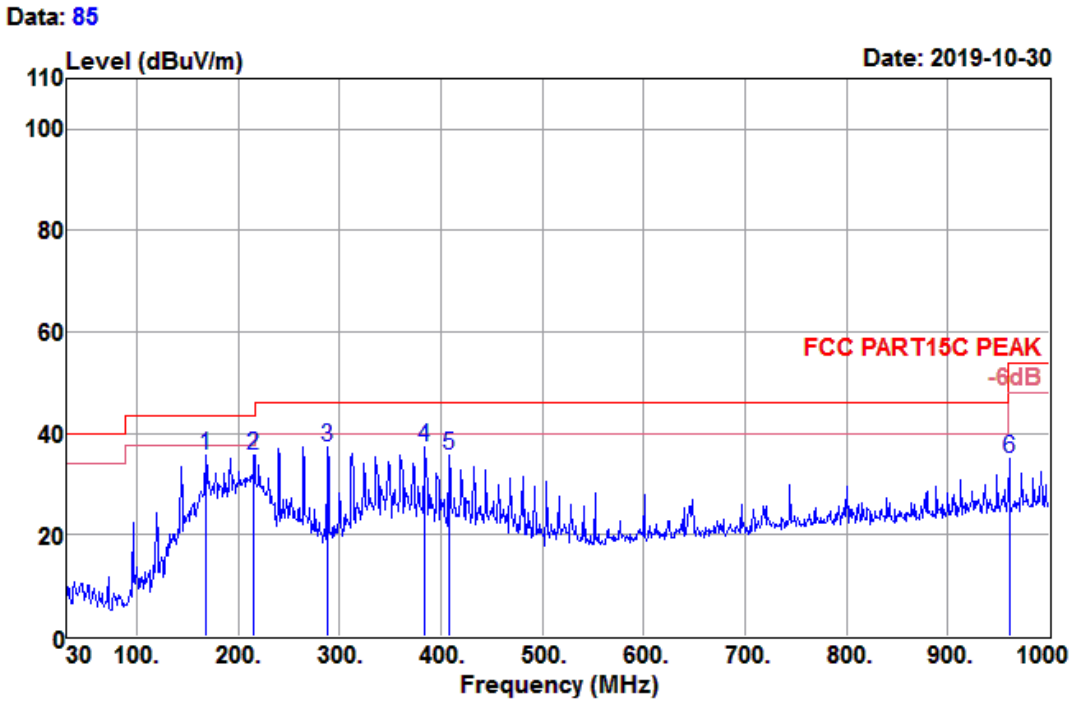


Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
4960.000	33.42	31.60	5.52	34.73	35.81	54.00	-18.19	Average
4960.000	41.49	31.60	5.52	34.73	43.88	74.00	-30.12	Peak
7440.000	31.77	36.41	7.56	36.40	39.34	54.00	-14.66	Average
7440.000	39.57	36.41	7.56	36.40	47.14	74.00	-26.86	Peak
9920.000	37.41	38.36	11.17	36.40	50.54	54.00	-3.46	Average
9920.000	43.84	38.36	11.17	36.40	56.97	74.00	-17.03	Peak

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

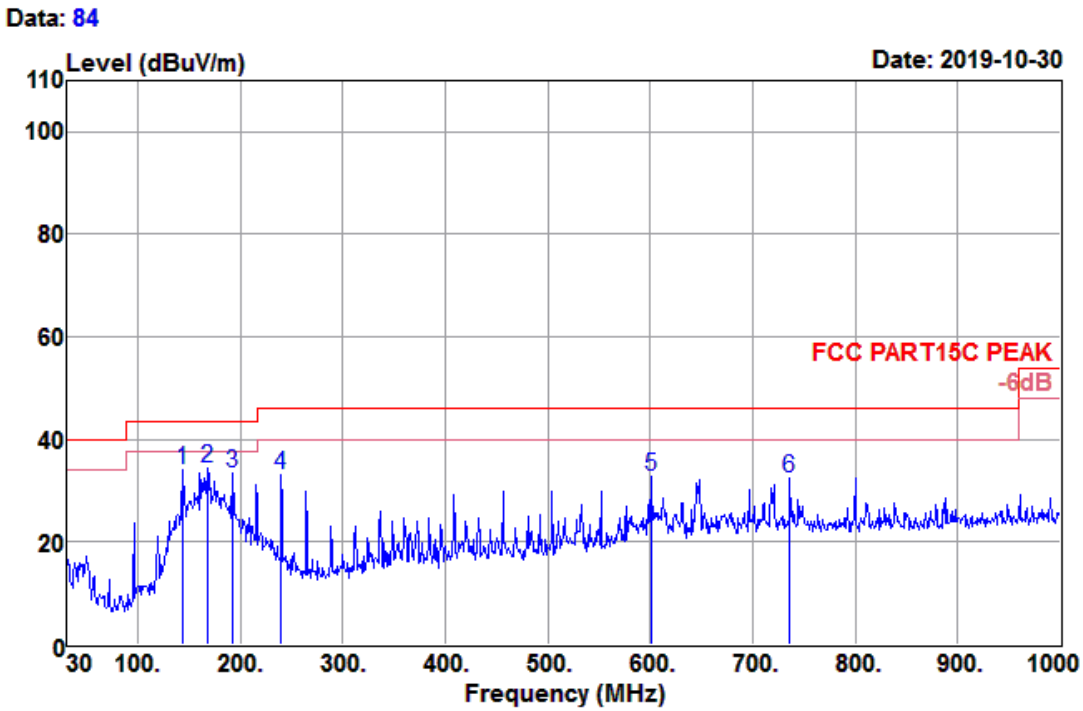
4.2.6 Test Result of Radiated Spurious Emission (30MHz ~ 1GHz)

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	**Temperature :**	21~23℃
Test Engineer :	Jack Liu	**Relative Humidity :**	63~65%
Frequencey Range	30MHz~1GHz	**Polarization :**	Horizontal



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
167.740	52.63	13.41	2.23	32.63	35.64	43.50	-7.86	Peak
215.270	54.73	11.36	2.43	32.66	35.86	43.50	-7.64	Peak
288.020	53.47	13.94	2.74	32.69	37.46	46.00	-8.54	Peak
384.050	51.45	15.48	3.19	32.78	37.34	46.00	-8.66	Peak
408.300	49.34	16.05	3.26	32.81	35.84	46.00	-10.16	Peak
960.230	37.26	24.40	5.17	31.76	35.07	54.00	-18.93	Peak

Test Mode :	Bluetooth (1Mbps) CH00 (2402MHz)	Temperature :	21~23℃
Test Engineer :	Jack Liu	Relative Humidity :	63~65%
Frequencey Range	30MHz~1GHz	Polarization :	Vertical



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
143.490	50.41	14.17	2.13	32.62	34.09	43.50	-9.41	Peak
167.740	51.40	13.41	2.23	32.63	34.41	43.50	-9.09	Peak
191.990	52.77	11.00	2.31	32.65	33.43	43.50	-10.07	Peak
239.520	50.79	12.58	2.50	32.67	33.20	46.00	-12.80	Peak
600.360	41.52	20.01	3.95	32.60	32.88	46.00	-13.12	Peak
736.160	38.26	21.92	4.45	32.19	32.44	46.00	-13.56	Peak

4.3 AC Conducted Emission Measurement

4.3.1 Limit of AC Conducted Emission

For equipment 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

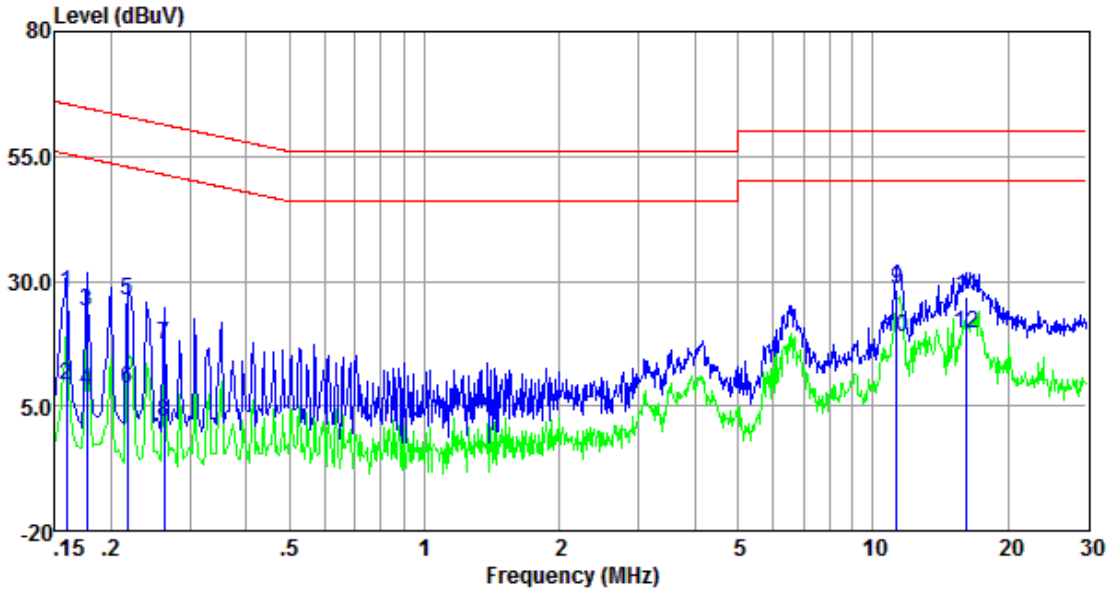
*Decreases with the logarithm of the frequency.

4.3.2 Test Procedures

7. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
8. Connect EUT to the power mains through a line impedance stabilization network (LISN).
9. All the support units are connecting to the other LISN.
10. The LISN provides 50 ohm coupling impedance for the measuring instrument.
11. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
12. Both sides of AC line were checked for maximum conducted interference.
13. The frequency range from 150 kHz to 30 MHz was searched.
14. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

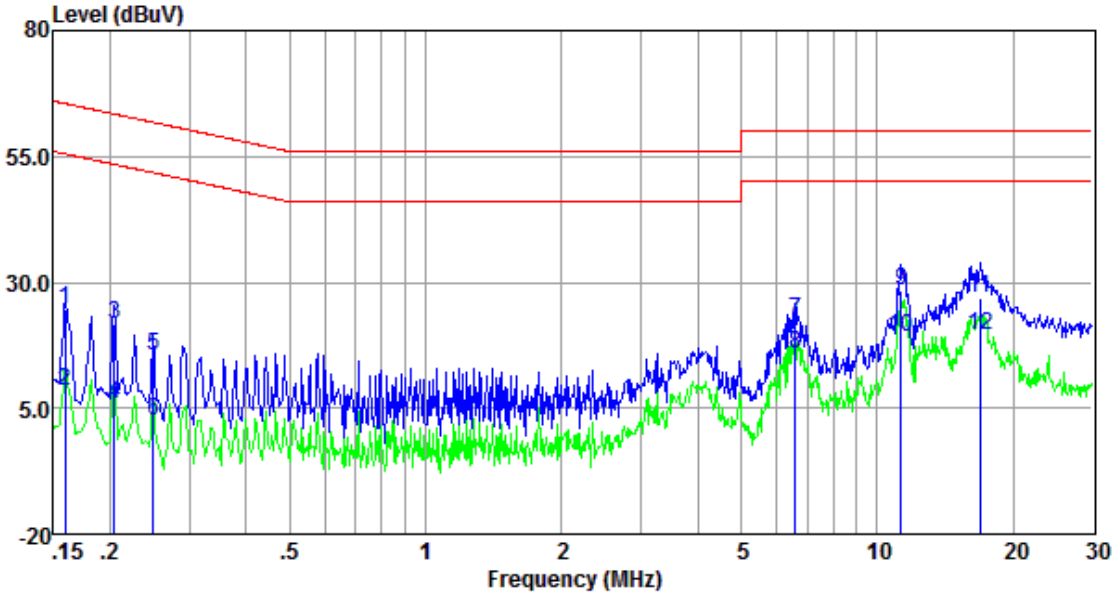
4.3.3 Test Result of AC Conducted Emission

Test Mode :	Mode 1	**Temperature :**	21~23℃
Test Engineer :	Jerry Wang	**Relative Humidity :**	41~43%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	Bluetooth Link + USB Cable (Charging from Adapter)		



Freq	Reading level	LISN/ISN factor	Cable loss	Result level	Limit level	Over limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.159	17.80	9.63	0.04	27.47	65.52	-38.05	QP
0.159	-0.50	9.63	0.04	9.17	55.52	-46.35	Average
0.177	14.40	9.64	0.04	24.08	64.64	-40.56	QP
0.177	-1.60	9.64	0.04	8.08	54.64	-46.56	Average
0.217	16.40	9.65	0.04	26.09	62.92	-36.83	QP
0.217	-1.20	9.65	0.04	8.49	52.92	-44.43	Average
0.263	7.50	9.65	0.04	17.19	61.34	-44.15	QP
0.263	-7.90	9.65	0.04	1.79	51.34	-49.55	Average
11.317	18.20	10.00	0.11	28.31	60.00	-31.69	QP
11.317	8.60	10.00	0.11	18.71	50.00	-31.29	Average
16.226	16.70	10.01	0.14	26.85	60.00	-33.15	QP
16.226	9.40	10.01	0.14	19.55	50.00	-30.45	Average

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Jerry Wang	Relative Humidity :	41~43%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + USB Cable (Charging from Adapter)		



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.159	15.10	9.59	0.04	24.73	65.52	-40.79	QP
0.159	-1.20	9.59	0.04	8.43	55.52	-47.09	Average
0.204	11.90	9.61	0.04	21.55	63.45	-41.90	QP
0.204	-3.70	9.61	0.04	5.95	53.45	-47.50	Average
0.249	5.70	9.62	0.04	15.36	61.78	-46.42	QP
0.249	-7.20	9.62	0.04	2.46	51.78	-49.32	Average
6.592	12.39	9.80	0.09	22.28	60.00	-37.72	QP
6.592	5.89	9.80	0.09	15.78	50.00	-34.22	Average
11.317	18.49	9.88	0.11	28.48	60.00	-31.52	QP
11.317	8.99	9.88	0.11	18.98	50.00	-31.02	Average
16.928	16.90	9.93	0.15	26.98	60.00	-33.02	QP
16.928	9.50	9.93	0.15	19.58	50.00	-30.42	Average

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	Keysight	N9010A	MY56070788	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56510025	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY57030005	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56510018	2019/1/23	2020/1/22	Conducted
Power Sensor	Keysight	U2021XA	MY56480002	2019/1/23	2020/1/22	Conducted
Thermal Chamber	Sanmtest	SMC-408-CD	2435	2019/05/09	2020/5/08	Conducted
Base Station	R&S	CMW 270	101231	2019/1/23	2020/1/22	Conducted
Signal Generator (Blocker)	Keysight	N5171B	MY56200661	2019/1/23	2020/1/22	Conducted

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV 40	101433	2019/2/18	2020/2/17	Radiation
Amplifier	Sonoma	310	363917	2019/1/22	2020/1/21	Radiation
Amplifier	Schwarzbeck	BBV 9718	327	2019/1/22	2020/1/21	Radiation
Amplifier	Narda	TTA1840-35-HG	2034380	2019/05/15	2020/5/14	Radiation
Broadband Antenna	Schwarzbeck	VULB 9168	9168-757	2017-03-03	2020/3/02	Radiation
Horn Antenna	Schwarzbeck	BBHA 9120 D	1677	2017-03-03	2020/3/02	Radiation
Horn Antenna	COM-POWER	AH-1840	101117	2018-06-20	2021/6/19	Radiation
Test Software	Auidx	E3	6.111221a	N/A	N/A	Radiation
Filter	Micro-Tronics	BRM 50702	G266	N/A	N/A	Radiation

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
LISN	R&S	ENV216	102125	2019-01-22	2020-01-21	Conducted
LISN	R&S	ENV432	101327	2019-01-22	2020-01-21	Conducted
EMI Test Receiver	R&S	ESR3	102143	2019-01-23	2020-01-22	Conducted
EMI Test Software	Audix	E3	N/A	N/A	N/A	Conducted

N/A: No Calibration Required

6 Uncertainty of Evaluation

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.60dB
Radiated emission	30MHz ~ 1GMHz	5.05dB
	1GHz ~ 18GHz	5.06 dB
	18GHz ~ 40GHz	3.65dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

APPENDIX A. SETUP PHOTOGRAPHS

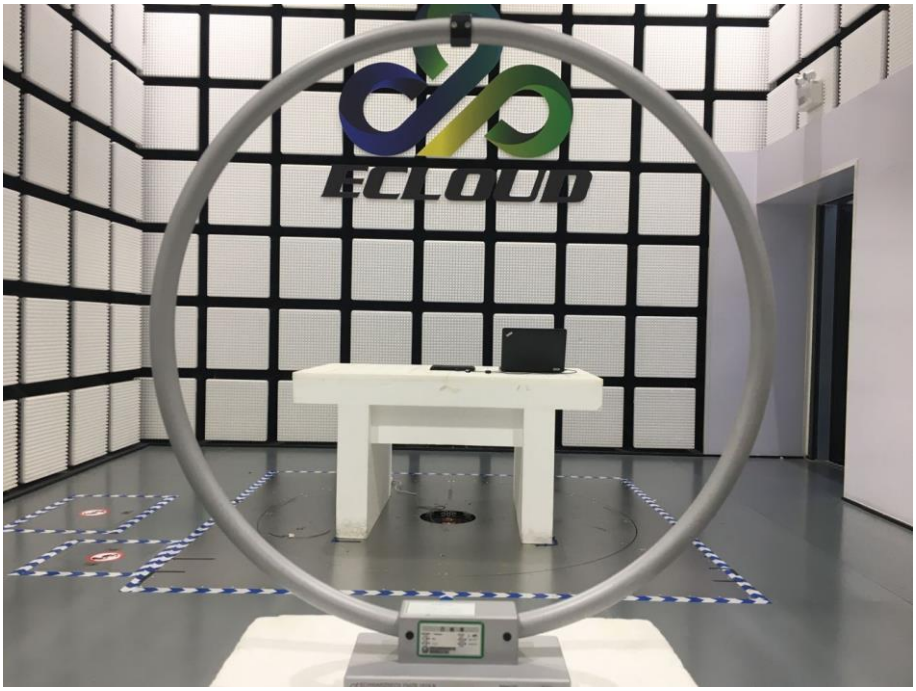


Fig. 1 Radiated emission setup photo(Below 30MHz)

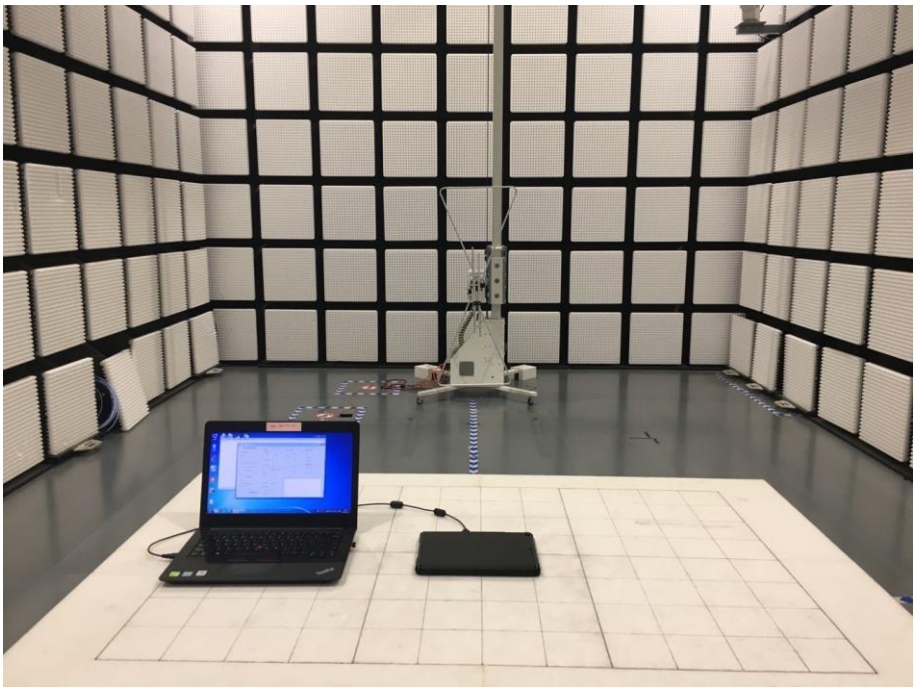


Fig. 2 Radiated emission setup photo(30MHz-1GHz)

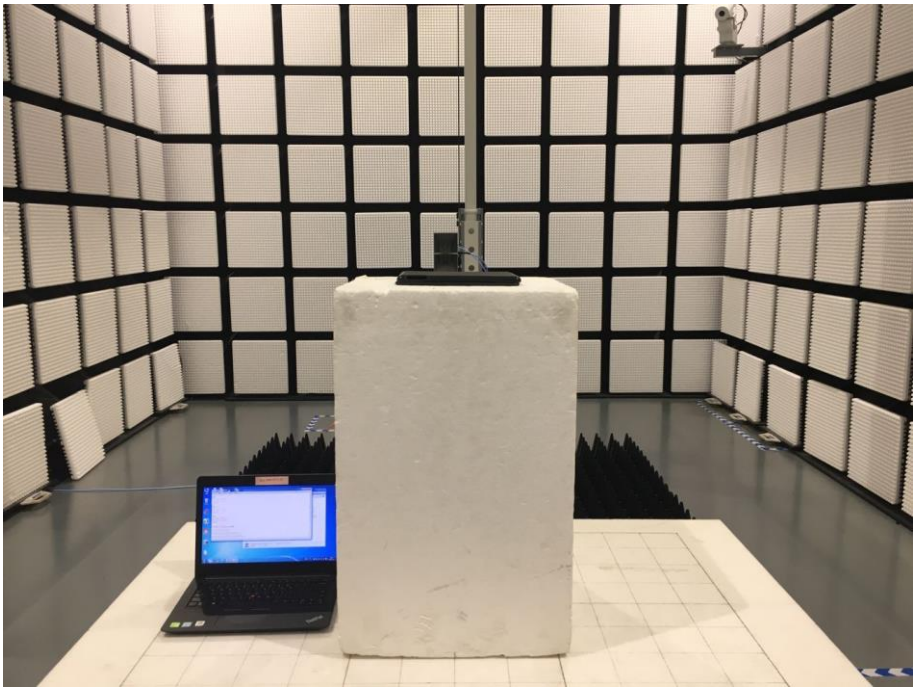


Fig. 3 Radiated emission setup photo(Above 1GHz)

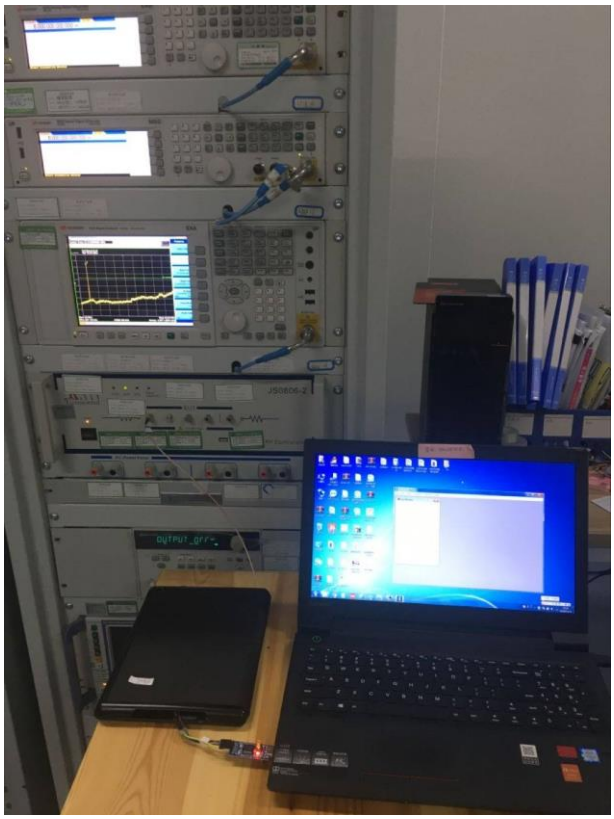


Fig. 4 Conducted emission setup photo

Fig. 5 AC Power Line Conducted emission setup photo