FCC TEST REPORT

Test report
On Behalf of
Pilotfly GmbH
For
Follow FOCUS
Model No.: PFY-FF-01,PFY-FF-XX
(X represents the number from 0 to 9)

FCC ID: 2ATHA-FF-01

Prepared for :	**Pilotfly GmbH** **Biberkopfstr.9 86163 Augsburg Germany**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Apr. 29, 2018 ~ May. 09, 2019**
Date of Report:	**May. 09, 2019**
Report Number:	**HK1904300958-E**

TEST RESULT CERTIFICATION

Applicant's name ..... : Pilotfly GmbH

Address ..... : Biberkopfstr.9 86163 Augsburg Germany

Manufacture's Name ..... : Pilotfly GmbH

Address ..... : Biberkopfstr.9 86163 Augsburg Germany

Product description

Trade Mark: PFY

Product name..... : Follow FOCUS

Model and/or type reference : PFY-FF-01,PFY-FF-XX (X represents the number from 0 to 9)

Standards ..... : FCC Rules and Regulations Part 15 Subpart C Section 15.249
ANSI C63.10: 2013

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Date of Test ..... :

Date (s) of performance of tests..... : **Apr. 29, 2018 ~ May. 09, 2019**

Date of Issue..... : **May. 09, 2019**

Test Result..... : **Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

Table of Contents **Page**

1 . TEST SUMMARY 4

2 . GENERAL INFORMATION 5

2.1 GENERAL DESCRIPTION OF EUT 5

2.2 Carrier Frequency of Channels 6

2.3 Operation of EUT during testing 6

2.4 DESCRIPTION OF TEST SETUP 6

2.5 MEASUREMENT INSTRUMENTS LIST 7

3 . CONDUCTED EMISSIONS TEST 8

3.1 Conducted Power Line Emission Limit 8

3.2 Test Setup 8

3.3 Test Procedure 8

3.4 Test Result 8

4 RADIATED EMISSION TEST 9

4.1 Radiation Limit 9

4.2 Test Setup 9

4.3 Test Procedure 10

4.4 Test Result 10

5 BAND EDGE 16

5.1 Limits 16

5.2 Test Procedure 16

5.3 Test Result 16

6 OCCUPIED BANDWIDTH MEASUREMENT 20

6.1 Test Setup 20

6.2 Test Procedure 20

6.3 Measurement Equipment Used 20

6.4 Test Result 20

7 ANTENNA REQUIREMENT 22

8 PHOTOGRAPH OF TEST 24

Radiated Emission 24

1. TEST SUMMARY

1.1TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT
CONDUCTED EMISSIONS TEST	COMPLIANT
RADIATED EMISSION TEST	COMPLIANT
BAND EDGE	COMPLIANT
OCCUPIED BANDWIDTH MEASUREMENT	COMPLIANT
ANTENNA REQUIREMENT	COMPLIANT

1.2 TEST FACILITY

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

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.3 MEASUREMENT UNCERTAINTY

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

2.1GENERAL DESCRIPTION OF EUT

Equipment	Follow FOCUS
Model Name	PFY-FF-01,PFY-FF-XX (X represents the number from 0 to 9)
Serial No.	N/A
Trade Mark	PFY
Model Difference	All models are identical except use different.
FCC ID	**2ATHA-FF-01**
Antenna Type	FCB Antenna
Antenna Gain	0dBi
Operation frequency	2402-2480MHz
Number of Channels	40CH
Modulation Type	GFSK
PowerSource	DC3.7V Battery
Power Rating	DC3.7V Battery

2.2 Carrier Frequency of Channels

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

2.3 Operation of EUT during testing

Operating Mode
The mode is used: **Transmitting mode**
Low Channel: 2402MHz
Middle Channel: 2440MHz
High Channel: 2480MHz

2.4DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:

Operation of EUT during Radiation and Above1GHz Radiation testing:

2.5MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 28, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 28, 2018	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2018	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2018	3 Year

3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

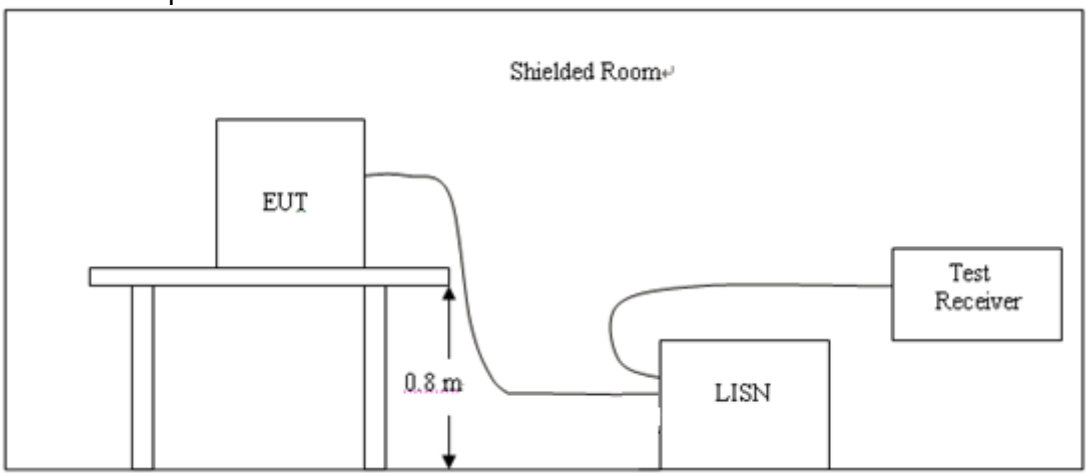
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	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'smanual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed onthe 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/60Hzpower through a Line Impedance Stabilization Network (LISN) which supplied power source and wasgrounded 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 EUTusing a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has twomonitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1connected 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*****

NOTE：RF function is not available when charging.

4 RADIATED EMISSION TEST

4.1 Radiation Limit

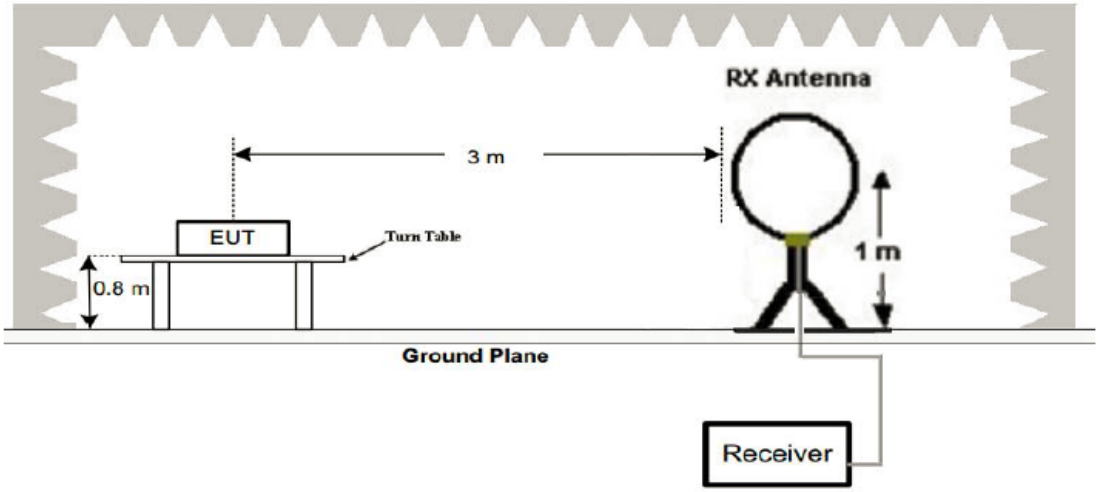
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength ofradiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the followingvalues：

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30-88	3	40	100
88-216	3	43.5	150
216-960	3	46	200
Above 960	3	54	500

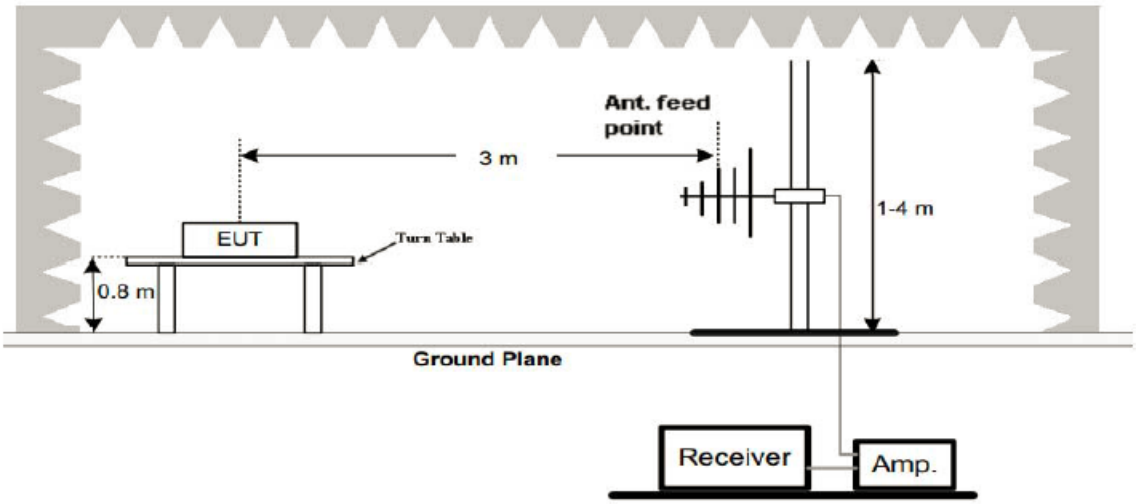
For intentional device, according to § 15.209(a), the general requirement of field strength of radiatedemissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

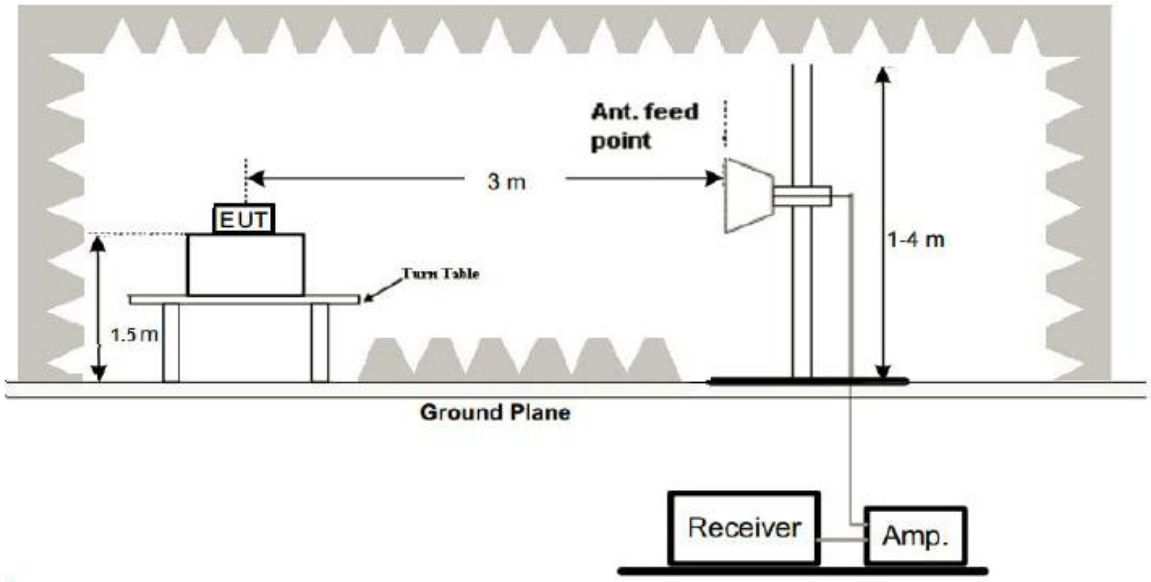
（1）Radiated Emission Test-Up Frequency Below 30MHz



（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 highestemissions.
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 bothhorizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to25GHz per FCC PART 15.33(a).

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

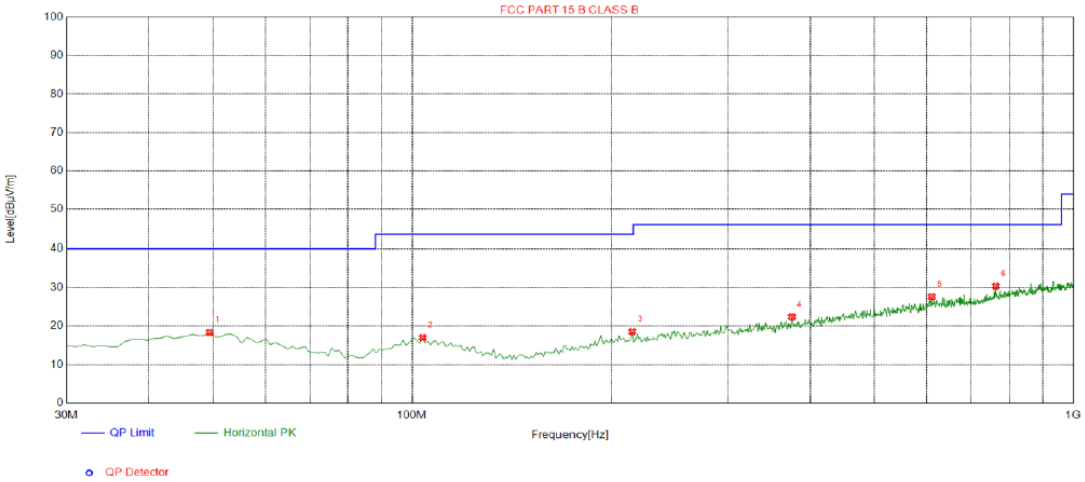
4.4 Test Result

PASS
All the test modes completed for test. The worst case of Radiated Emission is CH 2402; the test data of this mode was reported.

Below 1GHz Test Results:

Antenna polarity: H

Test Graph



Suspected List

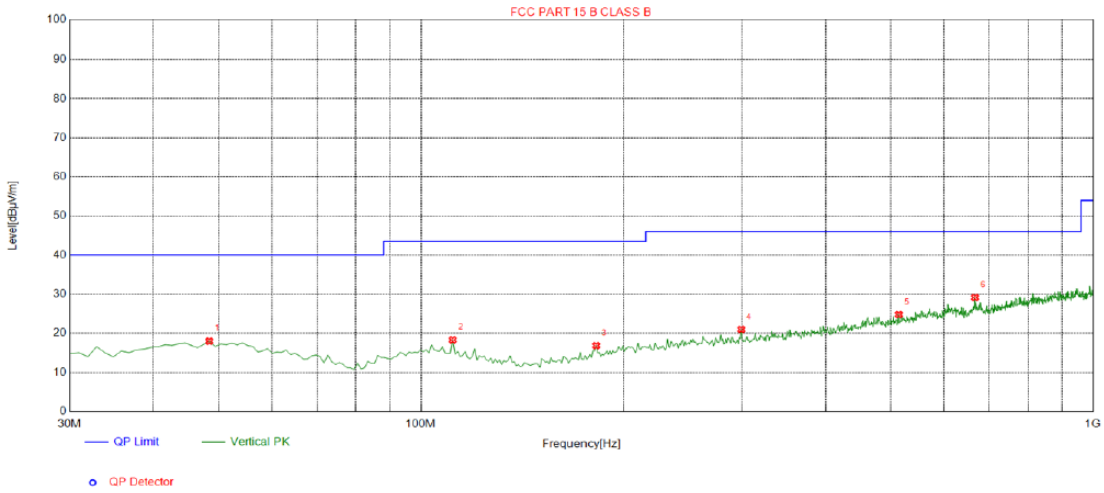
Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.4000	18.31	-13.65	40.00	21.69	100	133	Horizontal
2	103.720	16.94	-15.41	43.50	26.56	100	338	Horizontal
3	215.270	18.54	-14.67	43.50	24.96	100	345	Horizontal
4	375.320	22.35	-10.91	46.00	23.65	100	42	Horizontal
5	611.030	27.60	-5.56	46.00	18.40	100	45	Horizontal
6	763.320	30.38	-3.41	46.00	15.62	100	155	Horizontal

Final Data List

Remark: Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

Antenna polarity: V

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	17.97	-13.65	40.00	22.03	100	69	Vertical
2	111.480	18.29	-15.68	43.50	25.21	100	15	Vertical
3	182.290	16.82	-16.66	43.50	26.68	100	82	Vertical
4	299.660	20.97	-12.74	46.00	25.03	100	21	Vertical
5	514.030	24.77	-7.90	46.00	21.23	100	12	Vertical
6	667.290	29.15	-4.73	46.00	16.85	100	126	Vertical

Final Data List

Remark: Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHzwas 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.

Above 1 GHz Test Results:

CH Low (2402MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	107.46	-5.84	101.62	114	-12.38	peak
2402	84.15	-5.84	78.31	94	-15.69	AVG
4804	56.27	-3.64	52.63	74	-21.37	peak
4804	43.18	-3.64	39.54	54	-14.46	AVG
7206	55.29	-0.95	54.34	74	-19.66	peak
7206	41.73	-0.95	40.78	54	-13.22	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	106.49	-5.84	100.65	114	-13.35	peak
2402	84.36	-5.84	78.52	94	-15.48	AVG
4804	53.17	-3.64	49.53	74	-24.47	peak
4804	43.96	-3.64	40.32	54	-13.68	AVG
7206	54.81	-0.95	53.86	74	-20.14	peak
7206	42.07	-0.95	41.12	54	-12.88	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH Middle (2440MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440	106.38	-5.71	100.67	114	-13.33	peak
2440	82.19	-5.71	76.48	94	-17.52	AVG
4880	56.84	-3.51	53.33	74	-20.67	peak
4880	45.13	-3.51	41.62	54	-12.38	AVG
7320	57.28	-0.82	56.46	74	-17.54	peak
7320	41.06	-0.82	40.24	54	-13.76	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440	106.85	-5.71	101.14	114	-12.86	peak
2440	85.27	-5.71	79.56	94	-14.44	AVG
4880	57.86	-3.51	54.35	74	-19.65	peak
4880	45.29	-3.51	41.78	54	-12.22	AVG
7320	56.17	-0.82	55.35	74	-18.65	peak
7320	42.66	-0.82	41.84	54	-12.16	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH High (2480MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	106.34	-5.65	100.69	114	-13.31	peak
2480	84.66	-5.65	79.01	94	-14.99	AVG
4960	59.73	-3.43	56.3	74	-17.7	peak
4960	46.28	-3.43	42.85	54	-11.15	AVG
7440	58.13	-0.75	57.38	74	-16.62	peak
7440	44.07	-0.75	43.32	54	-10.68	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	108.24	-5.65	102.59	114	-11.41	peak
2480	83.56	-5.65	77.91	94	-16.09	AVG
4960	56.43	-3.43	53	74	-21	peak
4960	45.72	-3.43	42.29	54	-11.71	AVG
7440	55.28	-0.75	54.53	74	-19.47	peak
7440	42.37	-0.75	41.62	54	-12.38	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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 1MHzand video bandwidth is 3MHz for peak measurement with peak detectorat frequency above 1GHz.The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand 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.
(7)All modes of operation were investigated and the worst-case emissions are reported.

5 BAND EDGE

5.1 Limits

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics,shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emissionlimits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSIC63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT issituated in three orthogonal planes (if appropriate), adjusting the measurement antenna height andpolarization etc. Set RBW to 100KHz and VBM to 300KHz to measure the peak field strength and setRBW to 1MHz and VBW to 10Hz to measure the average radiated field strength.The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz,to measure the conducted peak band edge.

5.3 Test Result

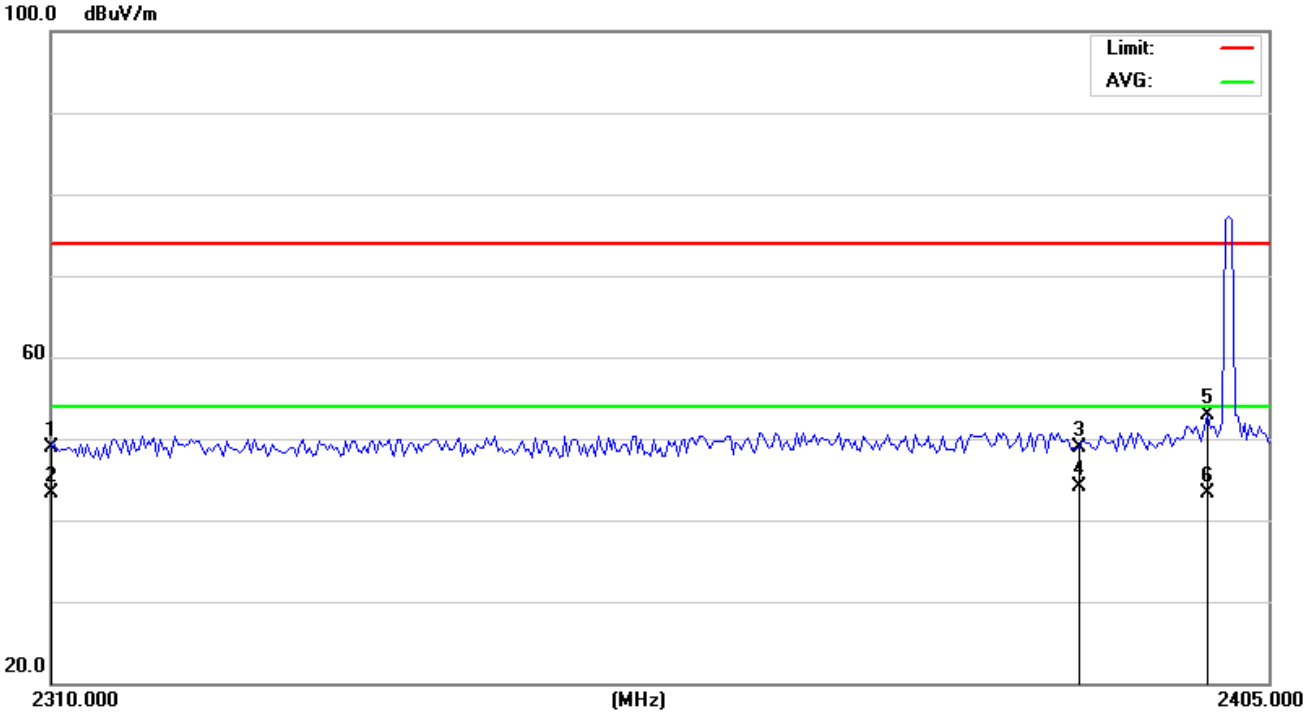
PASS

Radiated Band Edge Test:

Operation Mode: TX CH Low (2402MHz)

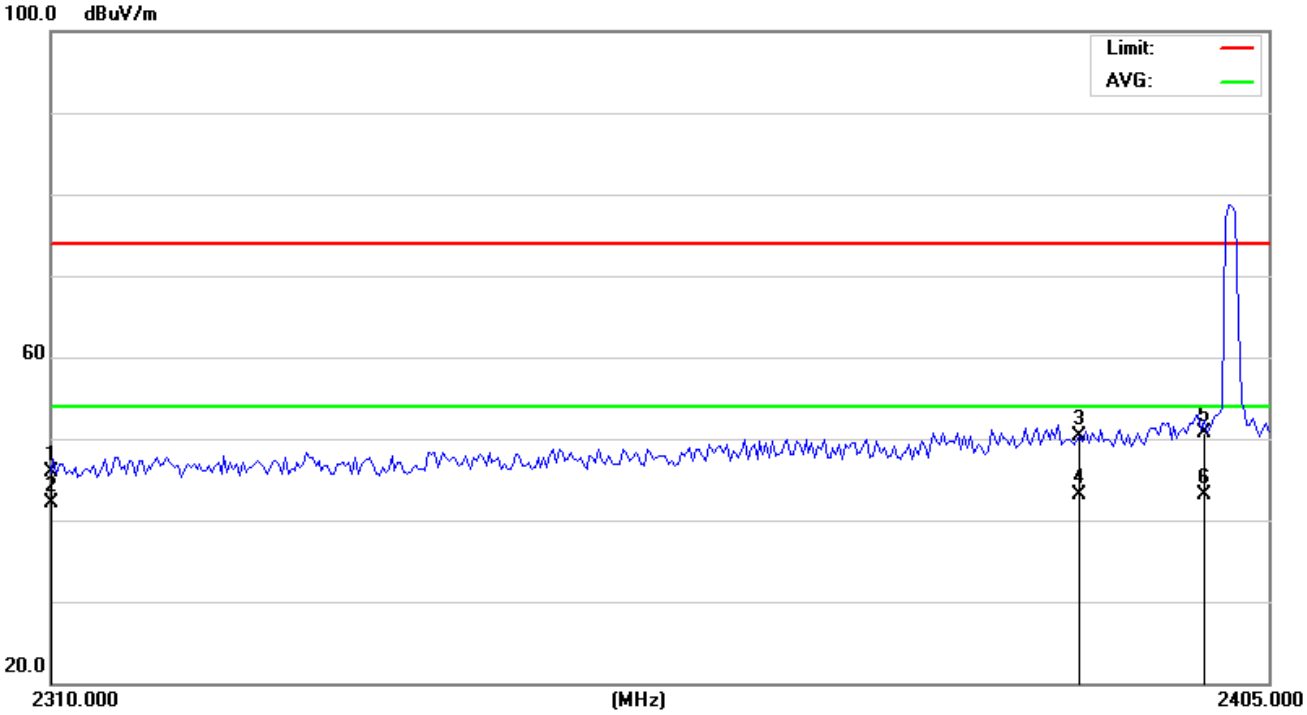
Horizontal (Worst case)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	42.64	6.36	49.00	74.00	-25.00	QP			
2		2310.000	36.92	6.36	43.28	54.00	-10.72	AVG			
3		2390.000	42.39	6.51	48.90	74.00	-25.10	QP			
4	*	2390.000	37.65	6.51	44.16	54.00	-9.84	AVG			
5		2400.000	46.37	6.53	52.90	74.00	-21.10	QP			
6		2400.000	36.86	6.53	43.39	54.00	-10.61	AVG			



Vertical:

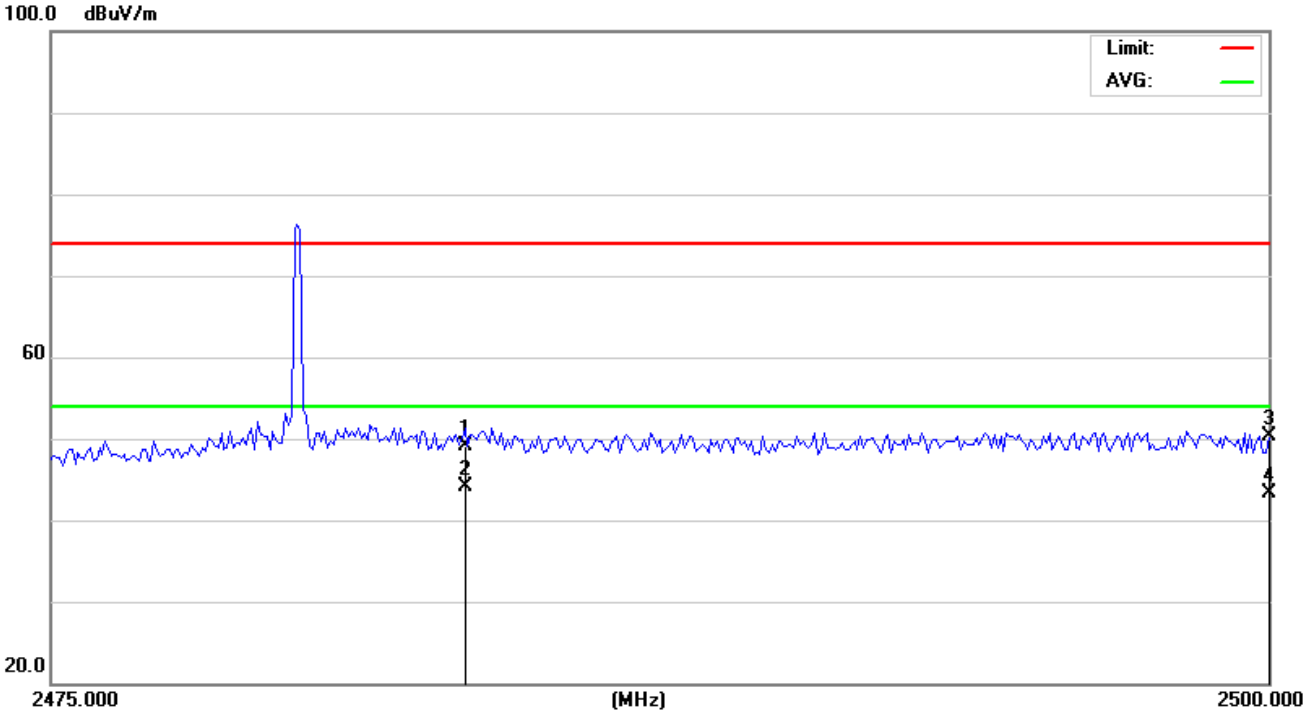
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	39.64	6.36	46.00	74.00	-28.00	QP			
2		2310.000	35.77	6.36	42.13	54.00	-11.87	AVG			
3		2390.000	43.79	6.51	50.30	74.00	-23.70	QP			
4		2390.000	36.64	6.51	43.15	54.00	-10.85	AVG			
5		2400.000	44.17	6.53	50.70	74.00	-23.30	QP			
6	*	2400.000	36.63	6.53	43.16	54.00	-10.84	AVG			



Operation Mode: TX CH High (2480MHz)

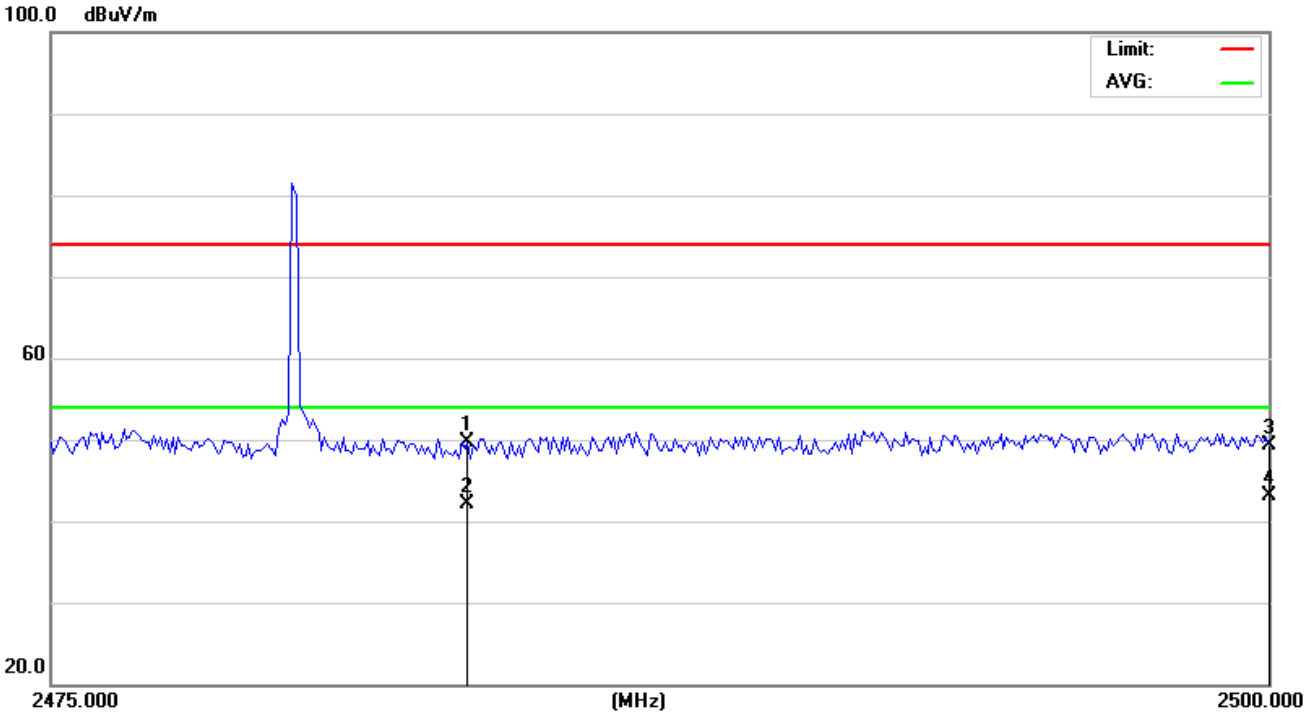
Horizontal (Worst case)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	42.60	6.50	49.10	74.00	-24.90	QP			
2	*	2483.500	37.62	6.50	44.12	54.00	-9.88	AVG			
3		2500.000	43.91	6.49	50.40	74.00	-23.60	QP			
4		2500.000	36.79	6.49	43.28	54.00	-10.72	AVG			



Vertical:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	43.30	6.50	49.80	74.00	-24.20	QP			
2		2483.500	35.66	6.50	42.16	54.00	-11.84	AVG			
3		2500.000	42.91	6.49	49.40	74.00	-24.60	QP			
4	*	2500.000	36.58	6.49	43.07	54.00	-10.93	AVG			



6 OCCUPIED BANDWIDTH MEASUREMENT

6.1 Test Setup

Same asRadiated Emission Measurement

6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW= 30KHz. VBW= 100 KHz, Span=4MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

6.3 Measurement Equipment Used

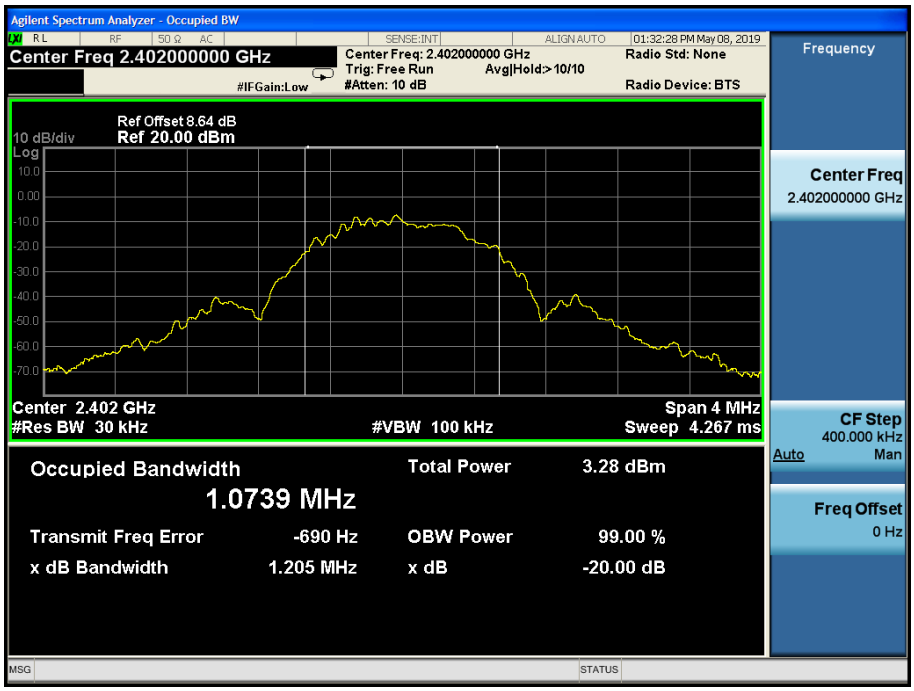
Same asRadiated Emission Measurement

6.4 Test Result

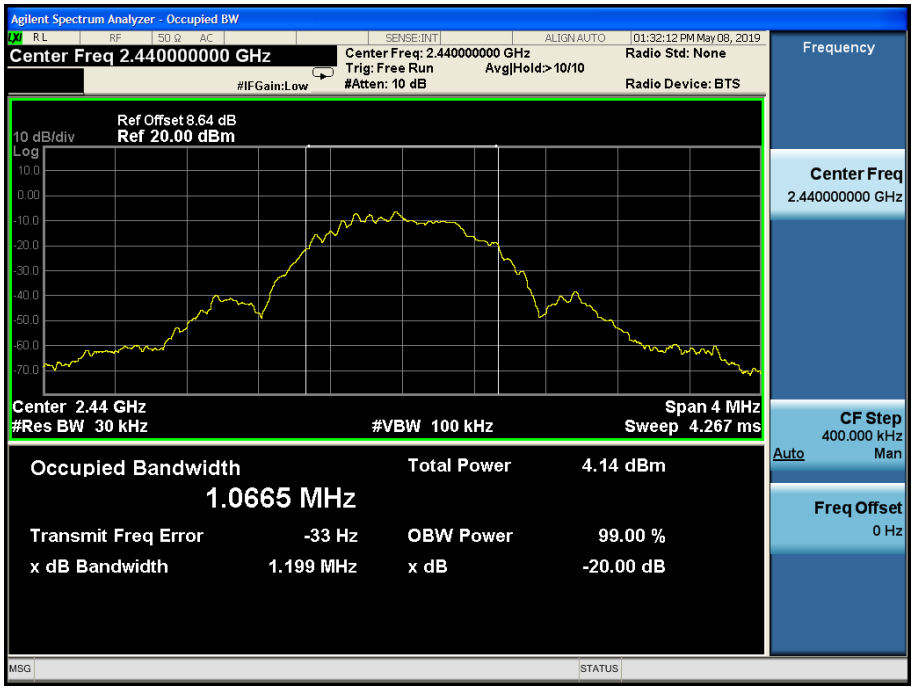
PASS

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.0739	**PASS**
2440 MHz	1.067	**PASS**
2480 MHz	1.064	**PASS**

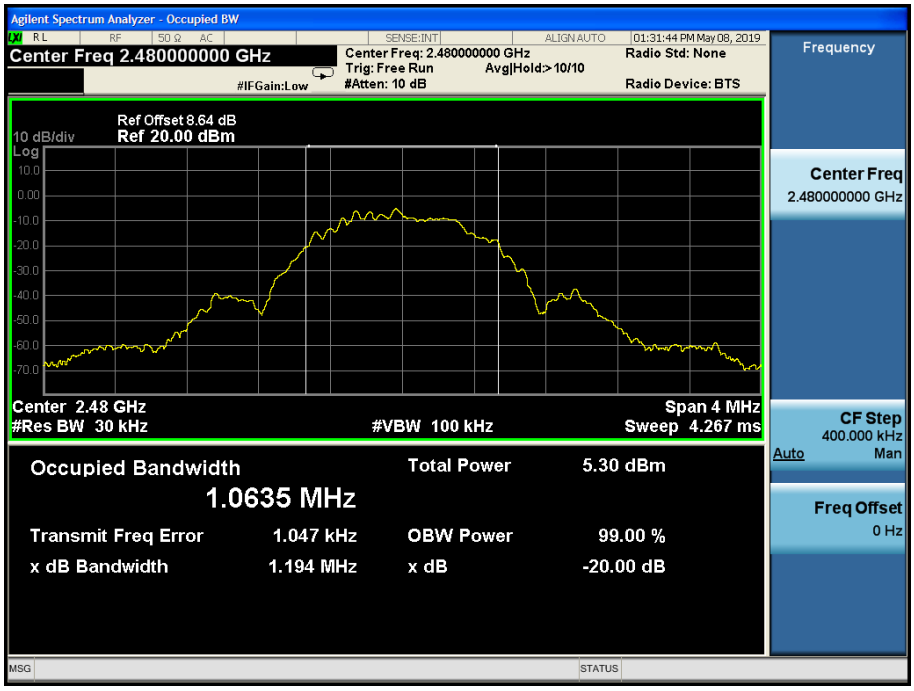
CH: 2402MHz



CH: 2440MHz



CH: 2480MHz



7 ANTENNA REQUIREMENT

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed toensure that no antenna other than that furnished by the responsible party shall be used with the device.And according to FCC 47 CFR Section 15.249, if transmitting antennas of directional gain greater than6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antennaexceeds 6dBi.

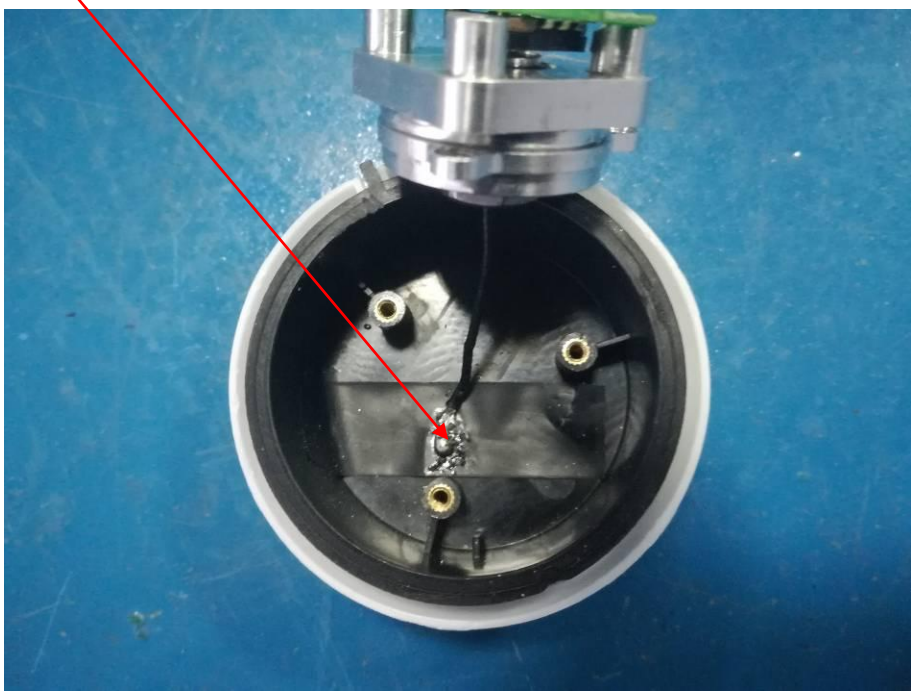
Refer to statement below for compliance.

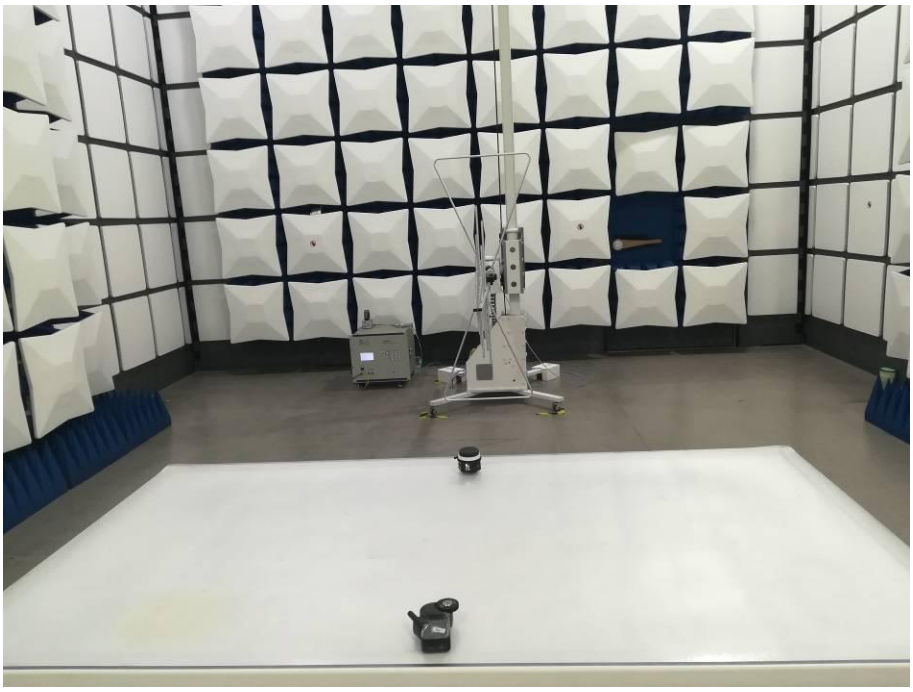
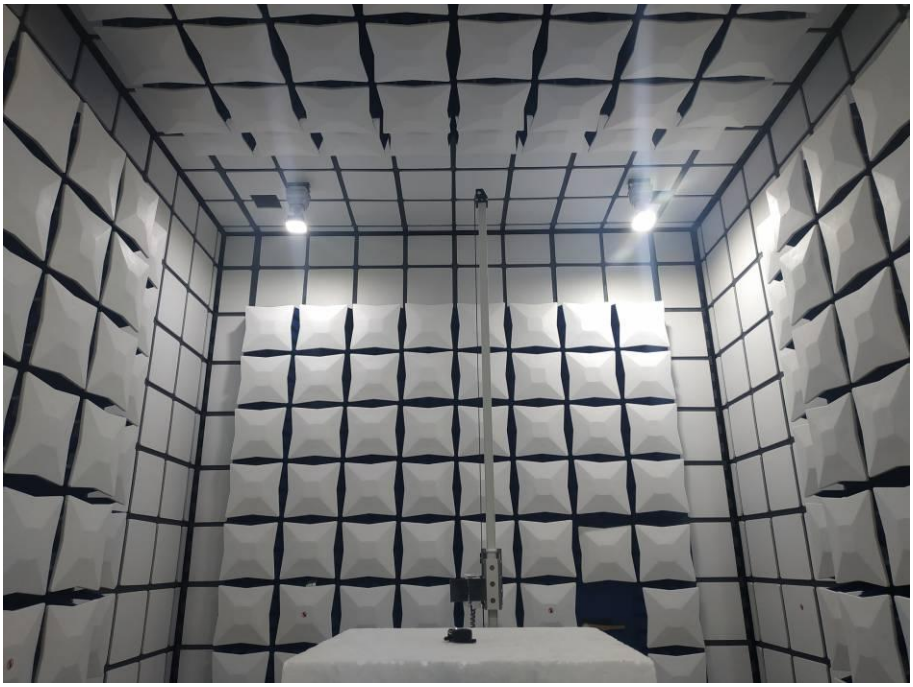
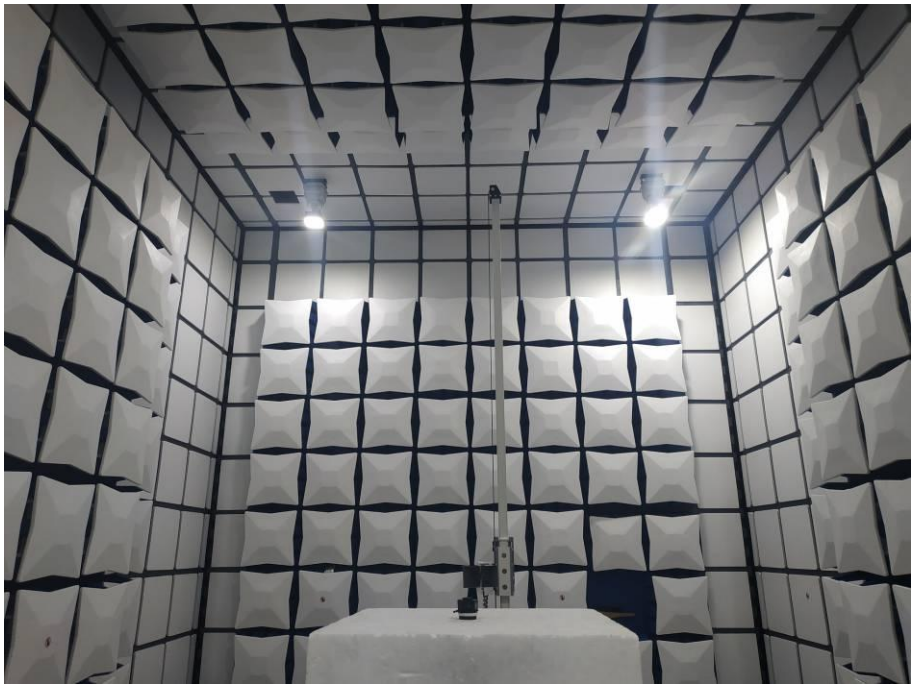
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of astandard antenna jack or electrical connector is prohibited. Further, this requirement does not apply tointentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is a FPC Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA



8 PHOTOGRAPH OF TEST

Radiated Emission