REPORT No.: SZ17050133W13A

FCC RF TEST REPORT

APPLICANT	:	Pycom Ltd
PRODUCT NAME	:	Triple Network (LoRa, WiFi and Bluetooth) IoT development Module powered by MicroPython.
MODEL NAME	:	L01 1.0
TRADE NAME	:	LoPy OEM
BRAND NAME	:	Pycom
FCC ID	:	2AJMTLOPY01R
STANDARD(S)	:	47 CFR Part 15 Subpart C
ISSUE DATE	:	2017-09-21

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

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Change History		
Issue	Date	Reason for change
1.0	2017-09-21	First edition

TEST REPORT DECLARATION

Applicant	Pycom Ltd
Applicant Address	Highpoint, 9 Sydenham Road, GU1 3RX Guildford, Surrey UK
Manufacturer	In-Tech Electronics Ltd
Manufacturer Address	2/F Rhythm Home,119 ShazuiRoad, Futian, Shenzhen, Guangdong, P.R.China
Product Name	Triple Network (LoRa, WiFi and Bluetooth) IoT development Module powered by MicroPython.
Model Name	L01 1.0
Brand Name	Pycom
HW Version	1.0r
SW Version	1.0
Test Standards	47 CFR Part 15 Subpart C
Test Date	2017-07-08 to 2017-08-15
Test Result	PASS

Tested by : Tu Ya'nan

Tu Ya'nan (Test Engineer)

Approved by : Andy Yeh

Andy Yeh (Supervisor)

1. TECHNICAL INFORMATION

Note: Provide by applicant.

1.1 Applicant Information

Company:	Pycom Ltd
Address:	Highpoint, 9 Sydenham Road, GU1 3RX Guildford, Surrey UK

1.2 Equipment under Test (EUT) Description

Brand Name:	Pycom
Trade Name:	LoPy OEM
Model Name:	L01 1.0
Frequency Range:	The frequency range used is 2402MHz - 2480MHz (40 channels, at intervals of 2MHz);
Modulation Type:	GFSK
Bluetooth Version:	Bluetooth 4.0 BLE
Antenna 1 Type:	Ceramic Antenna
Antenna 1Gain:	-0.5dBi
Antenna 2 Type:	External Antenna
Antenna 2Gain:	2.0dBi

NOTE:

The EUT is a Triple Network (LoRa, WiFi and Bluetooth) IoT development Module powered by MicroPython. It contain Bluetooth 4.0 LE Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth 4.0 LE is F(MHz)=2402+2*n (0<=n<=39). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 19 (2440MHz) and 39 (2480MHz).

The EUT connected to the serial port of the computer with a serial communication cable, we use the dedicated software to control the EUT continuous transmission.

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

1.2.1 Identification of all used EUTs

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
A01	1.0r	1.0

1.3 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Result
1	15.203	Antenna Requirement	N/A	**PASS**
2	15.247(b)	Peak Output Power	Jul 08, 2017	**PASS**
3	15.247(a)	Bandwidth	Jul 08, 2017	**PASS**
4	15.247(d)	Conducted Spurious Emission and Band Edge	Jul 08, 2017	**PASS**
5	15.247(d)	Restricted Frequency Bands	Aug 10, 2017	**PASS**
6	15.207	Conducted Emission	Aug 15, 2017	**PASS**
7	15.209 ,15.247(d)	Radiated Emission	Aug 09, 2017	**PASS**
8	15.247(e)	Power spectral density (PSD)	Jul 08, 2017	**PASS**

The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013 and KDB558074 D01 v04 (04/05/2017).

1.3.1 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR PART 15C REQUIREMENTS

2.1 Antenna requirement

2.1.1 Applicable Standard

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

2.1.2 Result: Compliant

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

2.2 Peak Output Power

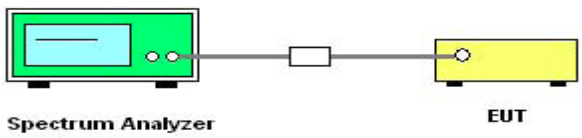
2.2.1 Requirement

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

2.2.2 Test Description

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

A. Test Setup:



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

B. Equipments List:

Please reference ANNEX A (1.5).

2.2.3 Test procedure

The measured output power was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for Peak Output Power test on the spectrum analyzer：

a) Set analyzer center frequency to channel center frequency.

b)Set the RBW to1MHz

c) Set VBW to 3MHz

d) Set span to 3MHz

e) Sweep time to auto couple.

f) Detector = peak.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use peak marker function to determine the peak amplitude level.

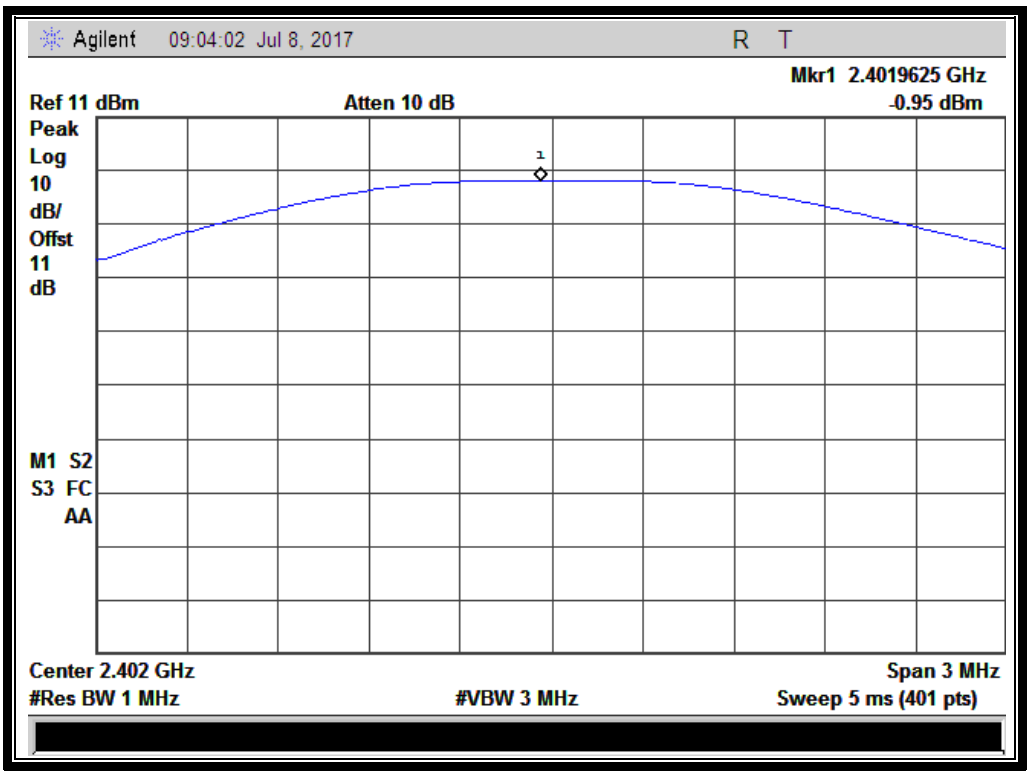
2.2.4 Test Result

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

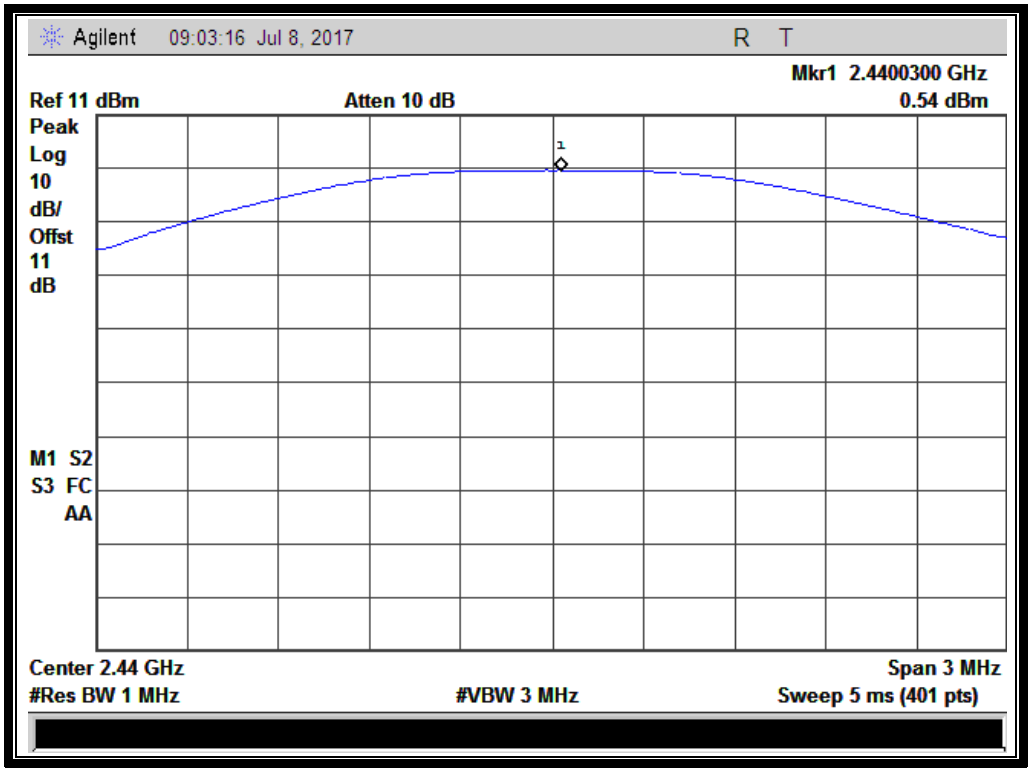
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Refer to Plot	Limit		Verdict
		dBm	W		dBm	W	
0	2402	-0.95	0.00080	Plot A	30	1	PASS
19	2440	0.54	0.00113	Plot B			PASS
39	2480	2.09	0.00162	Plot C			PASS

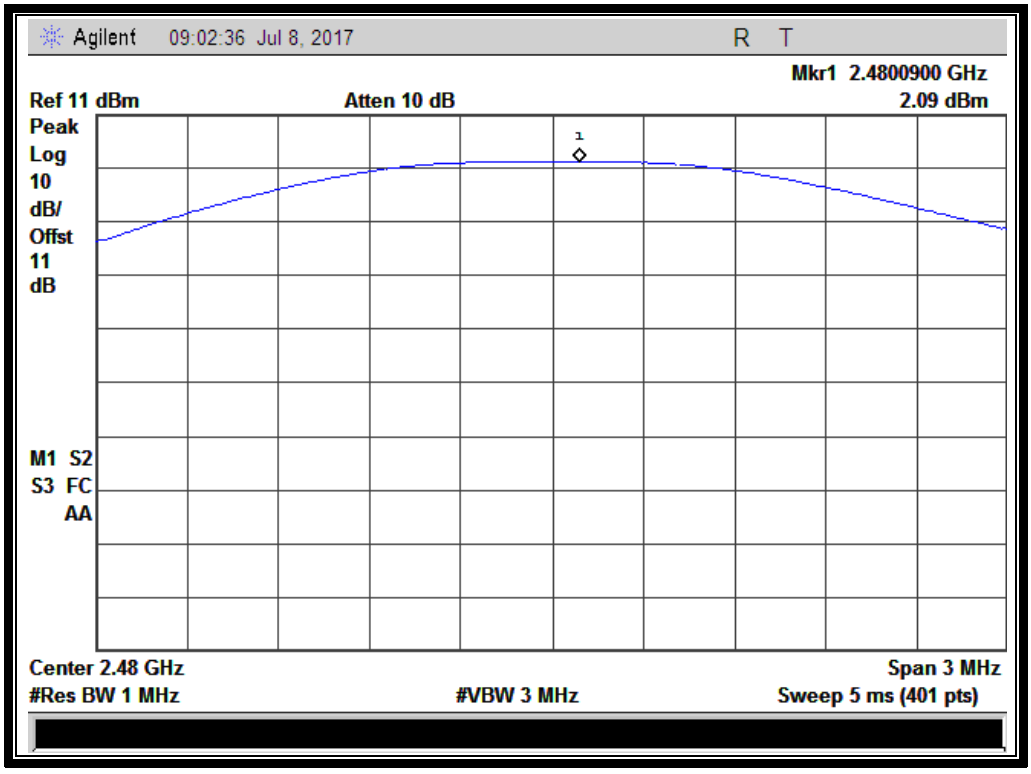
B. Test Plots:



(Plot A: Channel 0: 2402MHz)



(Plot B: Channel 19: 2440MHz)



(Plot C: Channel 39: 2480MHz)

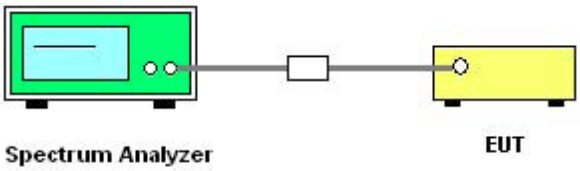
2.3 6dB Bandwidth

2.3.1 Requirement

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

2.3.2 Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

B. Equipments List:

Please reference ANNEX A(1.5).

2.3.3 Test procedure

The steps for the first option are as follows:

（1）Set analyzer center frequency to channel center frequency.

a) Set RBW = 100 kHz.

b) Set the VBW=300 kHz.

c) Detector = peak.

d) Trace mode = max hold.

e) Sweep = auto couple

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

（2）The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz,VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that

might be ≥6 dB.

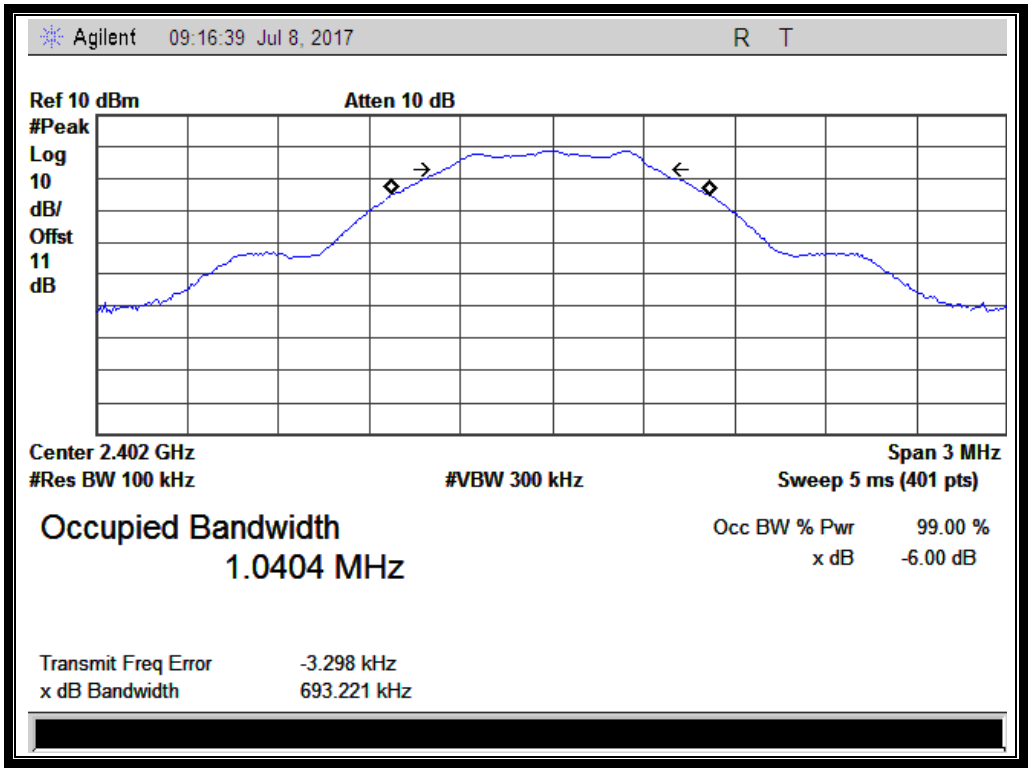
2.3.4 Test Result

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

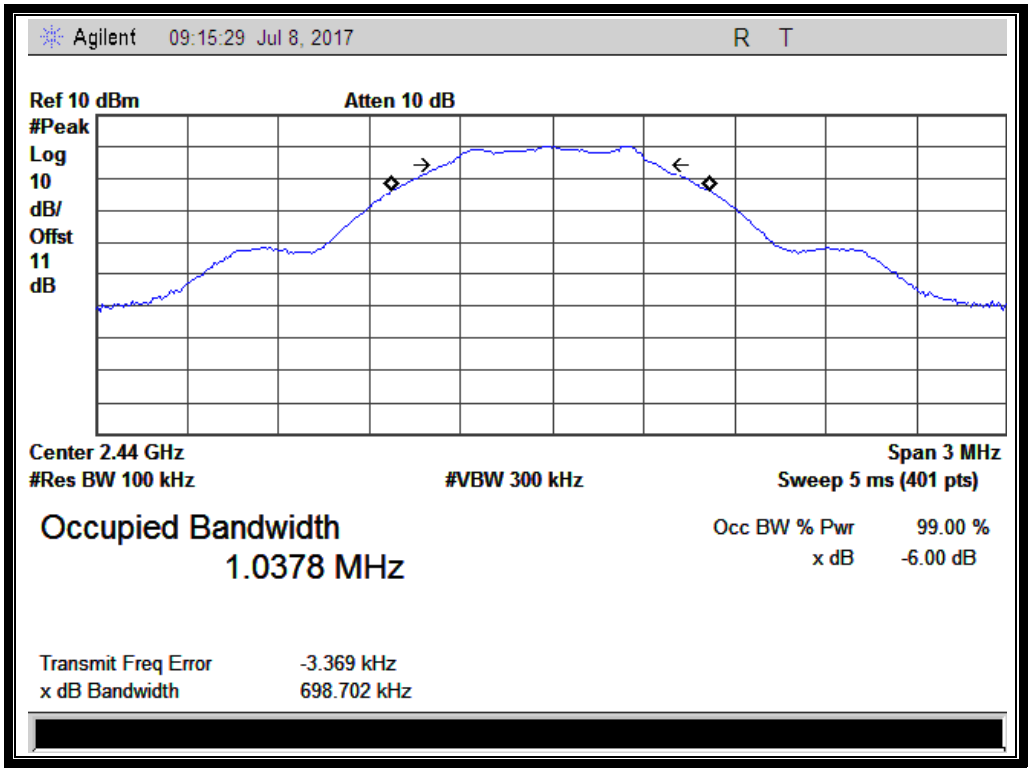
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits(kHz)	Result
0	2402	0.6932	Plot A	≥500	PASS
19	2440	0.6987	Plot B	≥500	PASS
39	2480	0.7009	Plot C	≥500	PASS

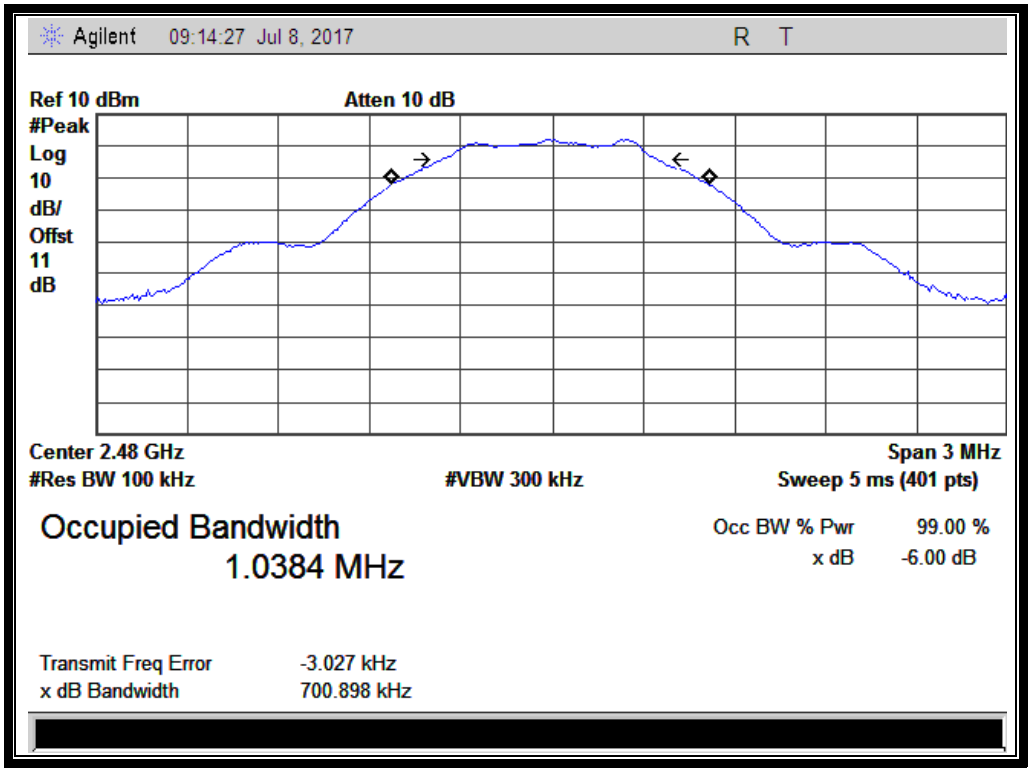
B. Test Plots:



(Plot A: Channel 0: 2402MHz)



(Plot B: Channel 19: 2440 MHz)



(Plot C: Channel 39: 2480MHz)

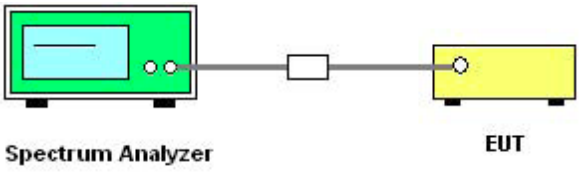
2.4 Conducted Spurious Emissions and Band Edge

2.4.1 Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.4.2 Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

B. Equipments List:

Please reference ANNEX A (1.5).

2.4.3 Test Result

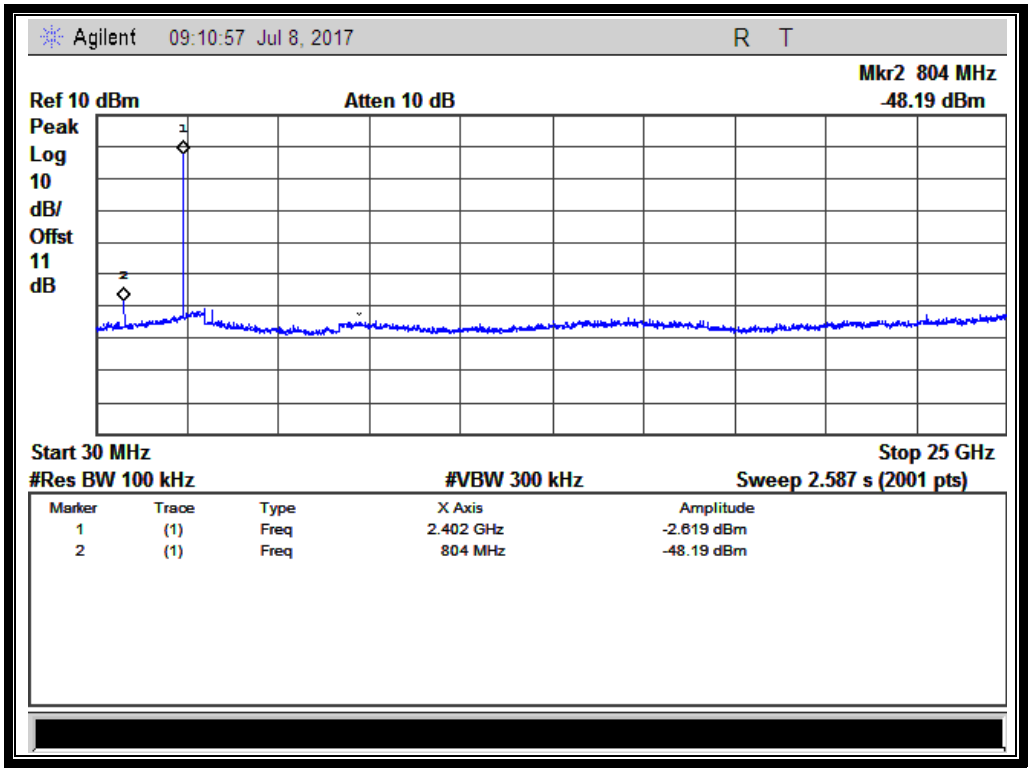
The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

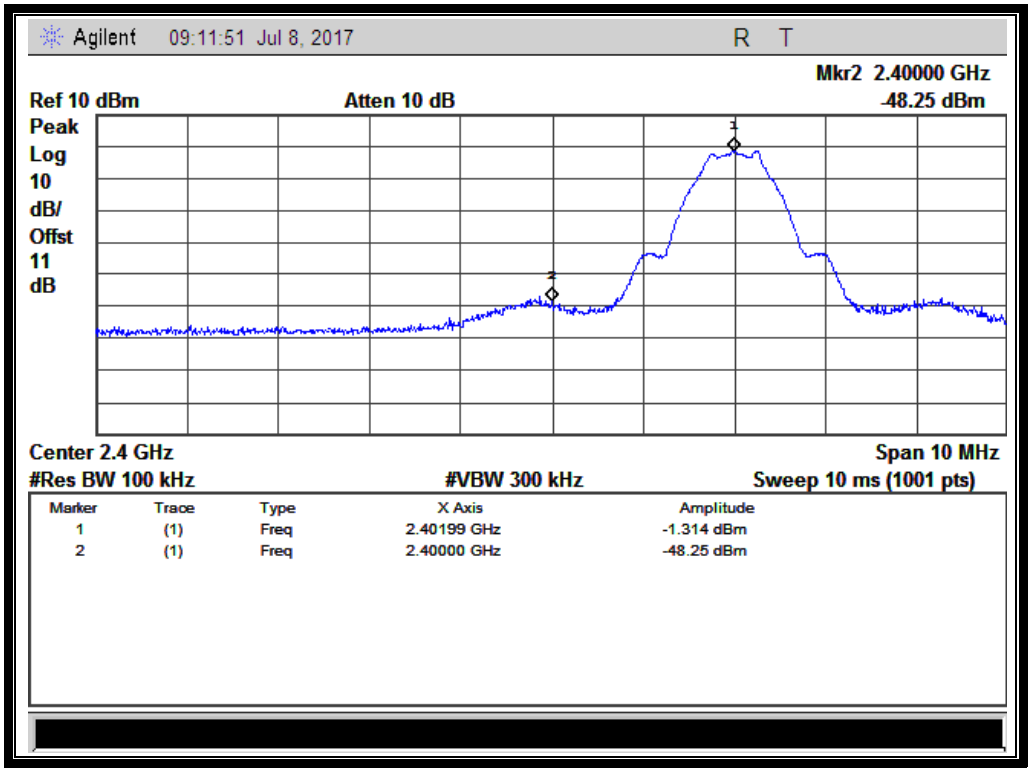
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Refer to Plot	Verdict
			Carrier Level	Calculated -20dBc Limit		
0	2402	-48.19	-2.62	-22.62	Plot A	PASS
19	2440	-46.71	0.34	-19.66	Plot B	PASS
39	2480	-46.52	0.22	-19.78	Plot C	PASS

B. Test Plots:

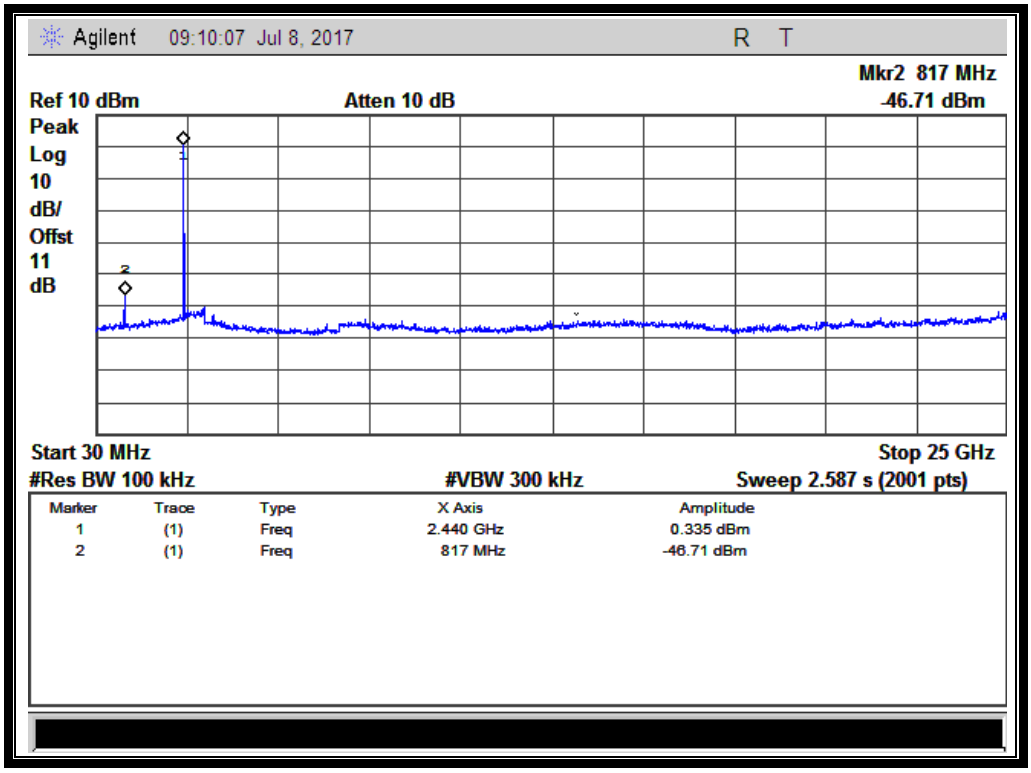
Note: the power of the Module transmitting frequency should be ignored.



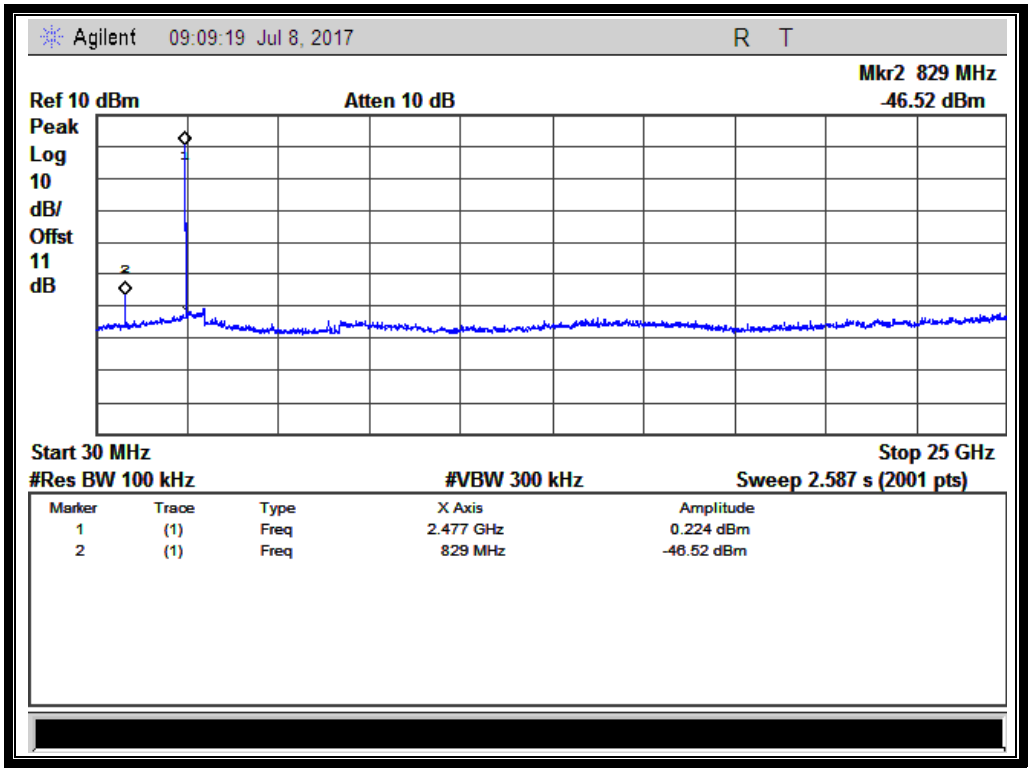
(Plot A: Channel = 0, 30MHz to 25GHz)



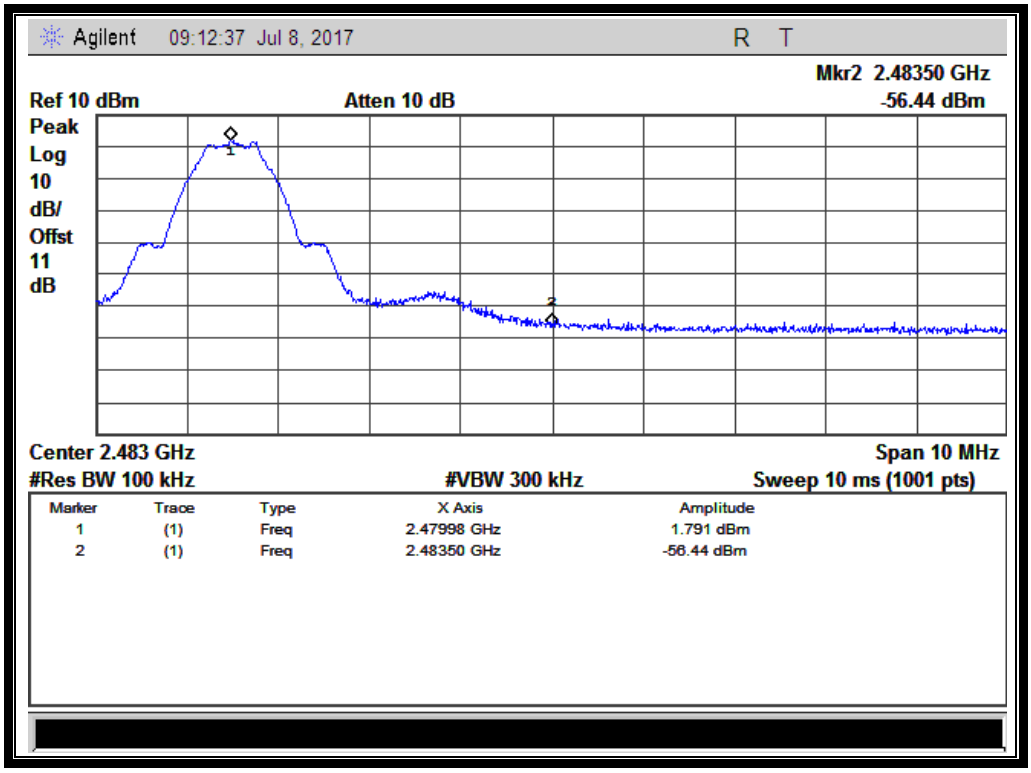
(Band Edge@ Channel = 0)



(Plot B: Channel = 19, 30MHz to 25GHz)



(Plot C: Channel = 39, 30MHz to 25GHz)



(Band Edge@ Channel = 39)

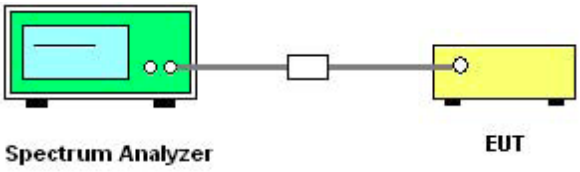
2.5 Power spectral density (PSD)

2.5.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

2.5.2 Test Description

A. Test Set:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Equipments List:

Please reference ANNEX A (1.5).

2.5.3 Test procedure

The measured power spectral density was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for PSD test:

a) Set analyzer center frequency to channel center frequency.
b) Set the span to 3MHz
c) Set the RBW to 3 kHz
d) Set the VBW to 10KHz
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

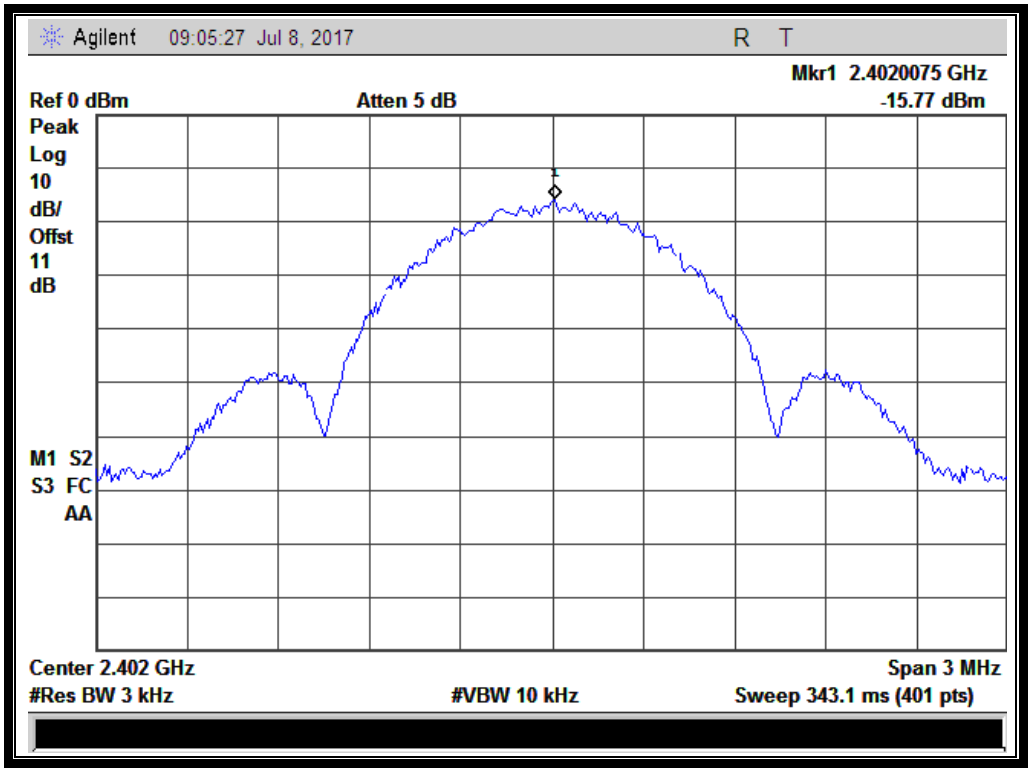
2.5.4 Test Result

The lowest, middle and highest channels are tested.

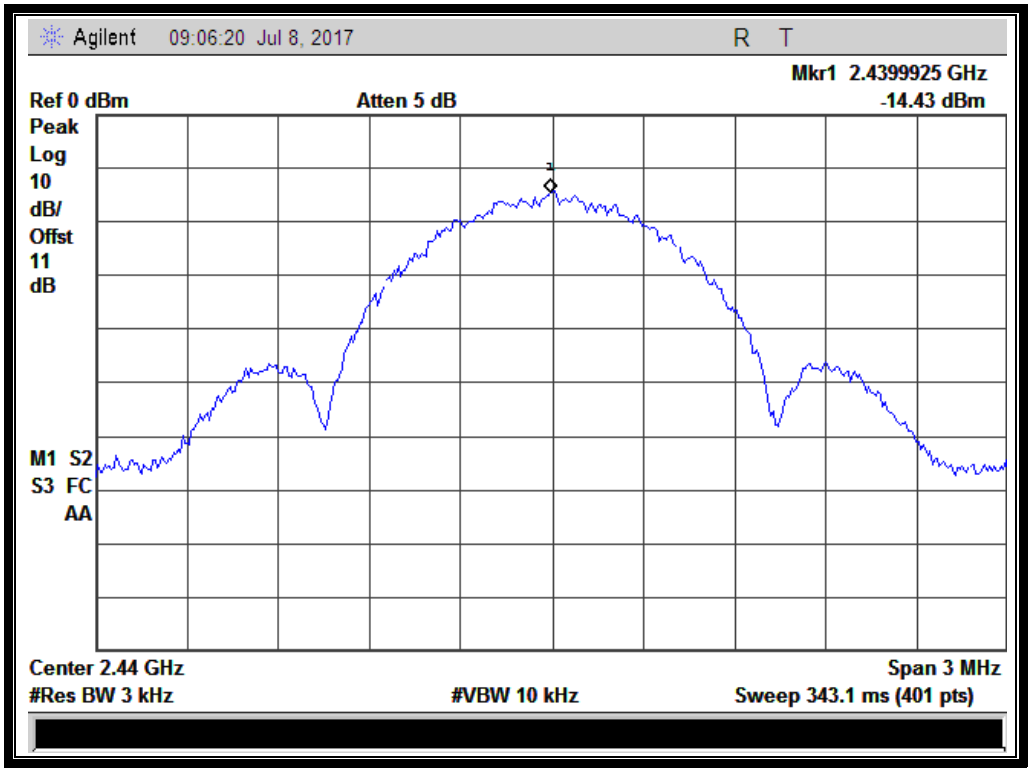
A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
0	2402	-15.77	Plot A	8	PASS
19	2440	-14.43	Plot B	8	PASS
39	2480	-12.73	Plot C	8	PASS
Measurement uncertainty: ±1.3dB					

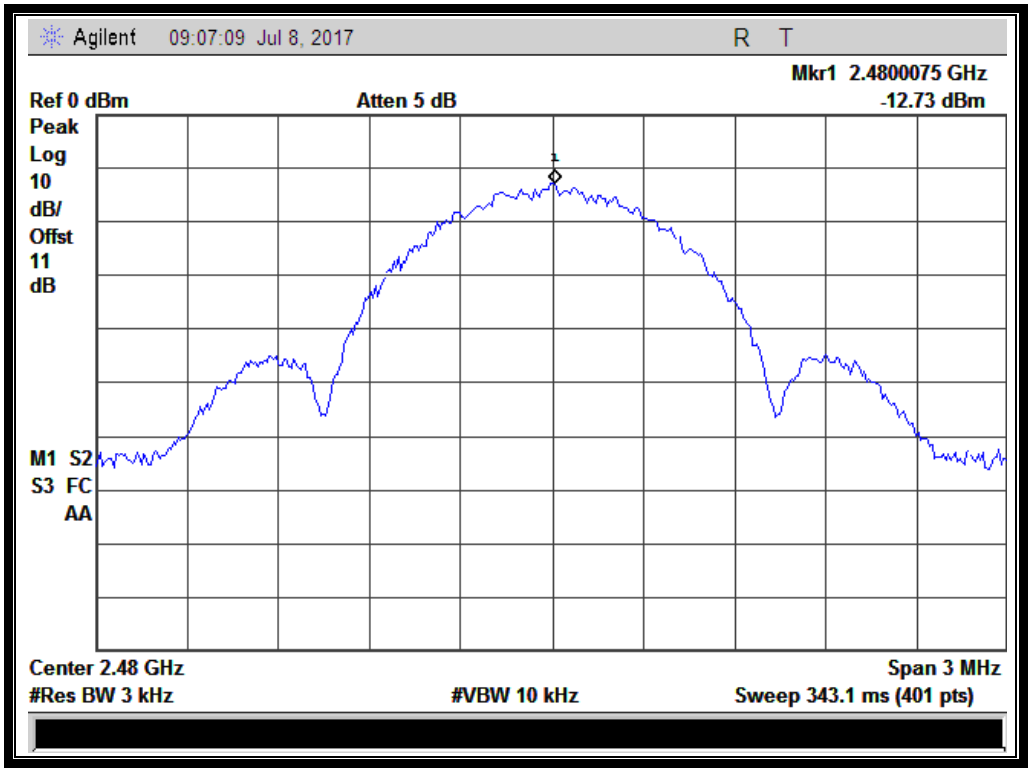
B. Test Plots:



(Plot A: Channel = 0)



(Plot B: Channel = 19)



(Plot C: Channel = 39)

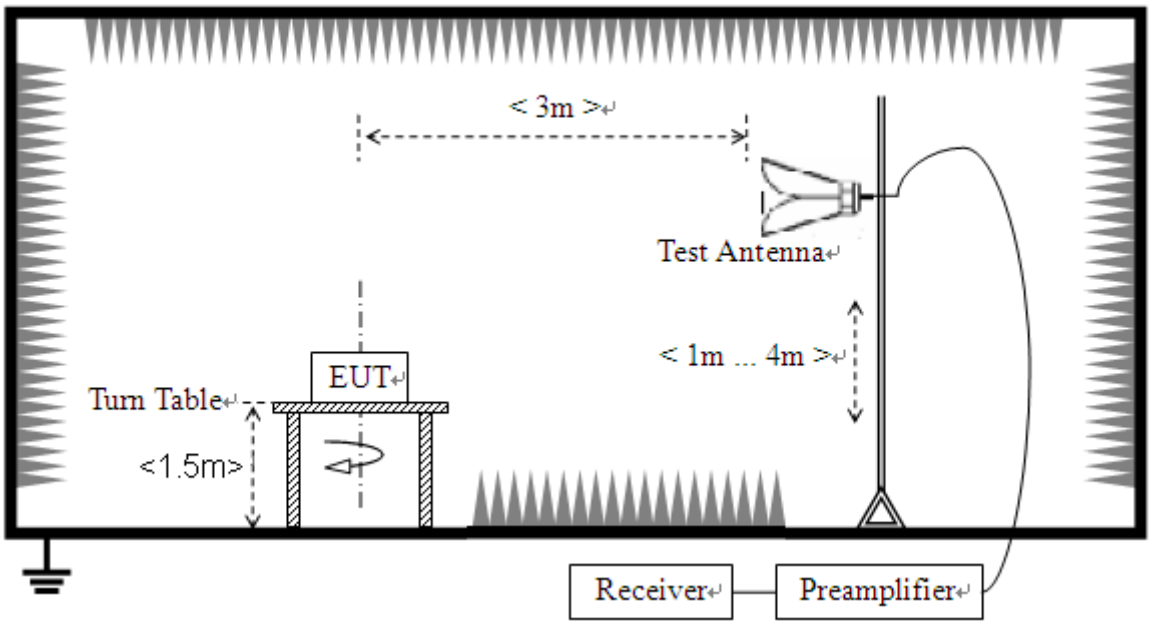
2.6 Restricted Frequency Bands

2.6.1 Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

2.6.2 Test Description

A. Test Setup



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

For the Test Antenna:

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

B. Equipments List:

Please reference ANNEX A(1.5).

2.6.3 Test Result

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

The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

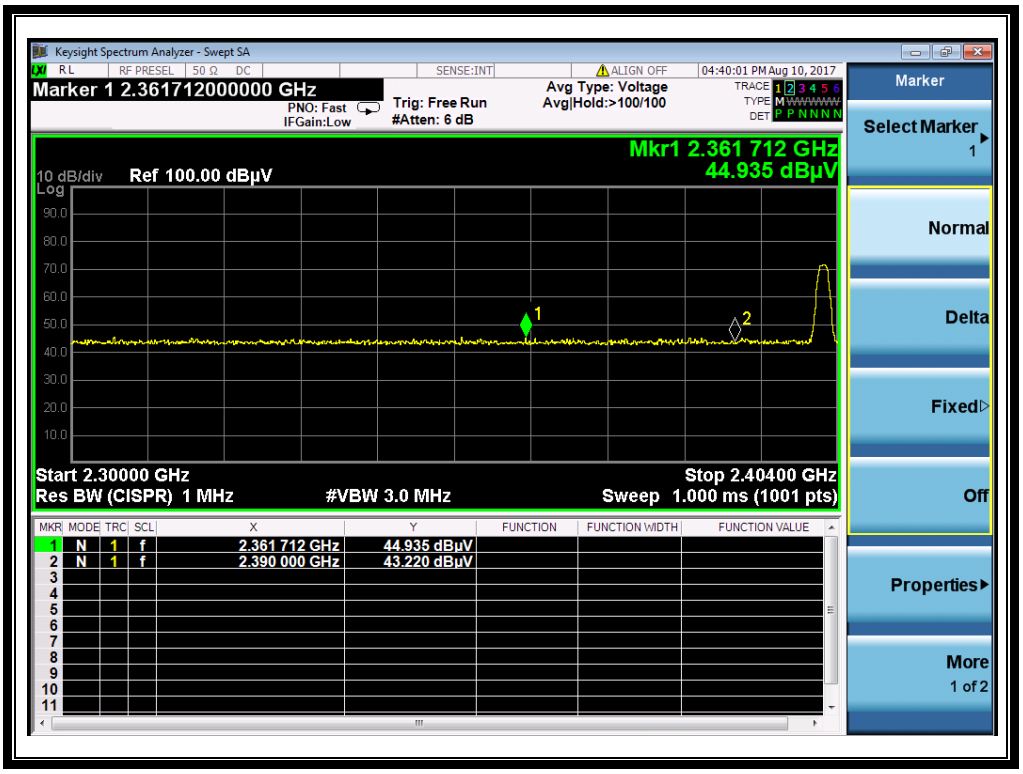
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

Result for Antenna 1

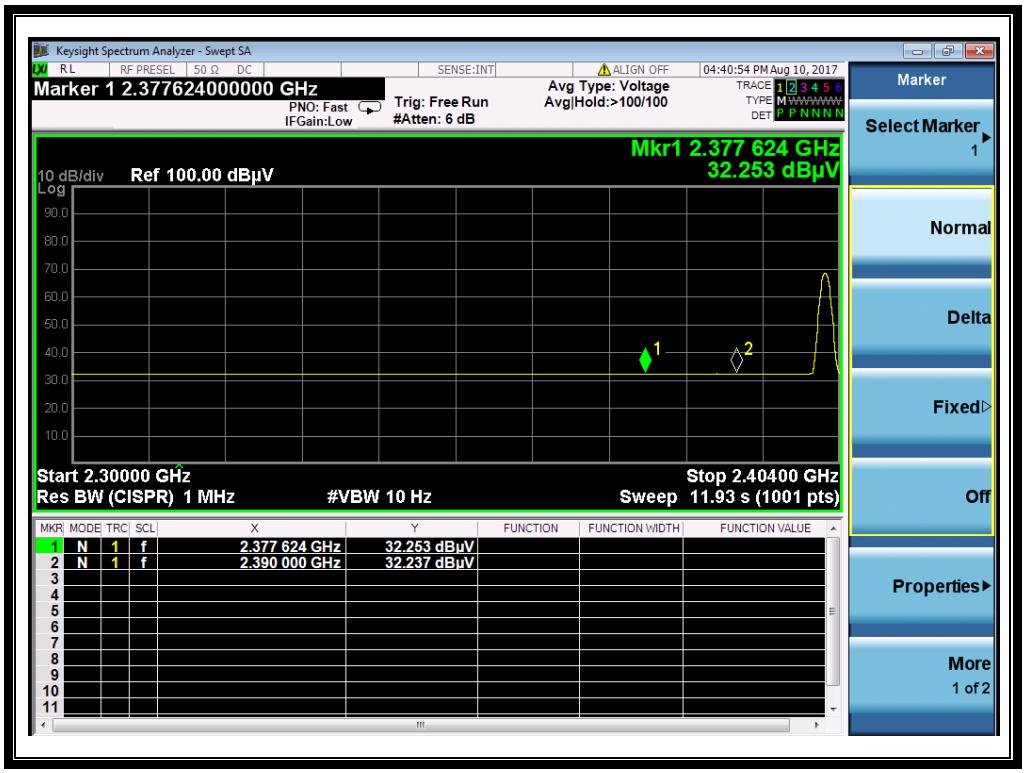
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2361.71	PK	44.94	-33.63	32.56	43.87	74	Pass
0	2377.62	AV	32.25	-33.63	32.56	31.18	54	Pass
39	2488.78	PK	44.54	-33.18	32.5	43.86	74	Pass
39	2487.17	AV	32.12	-33.18	32.5	31.44	54	Pass

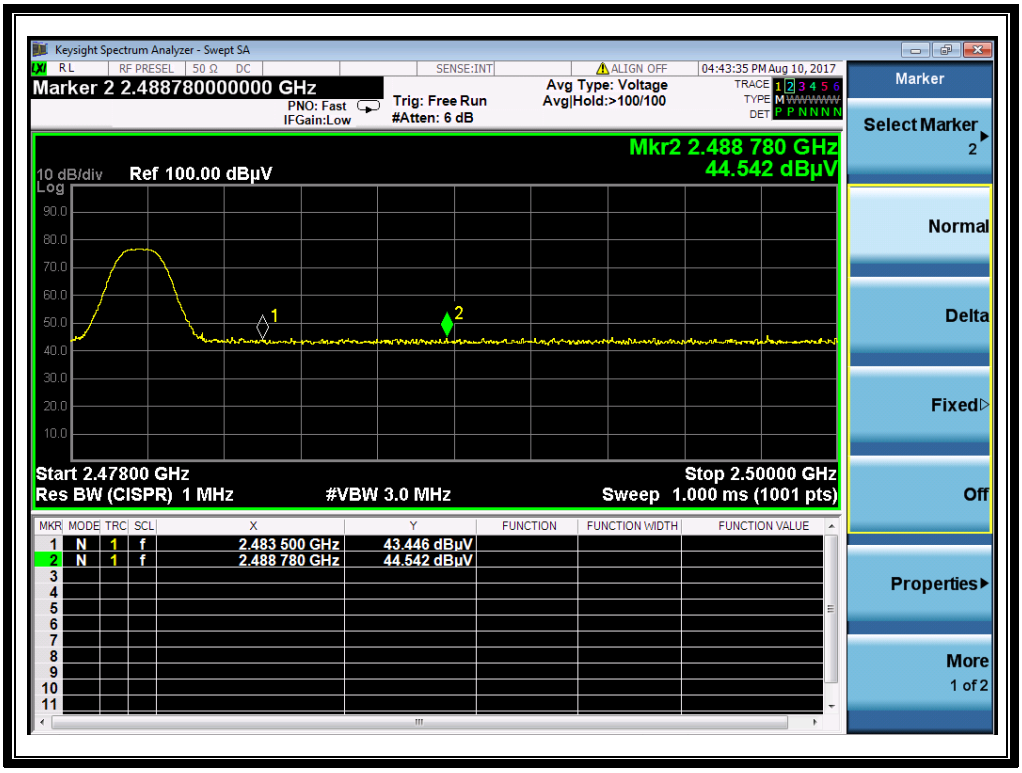
B. Test Plots:



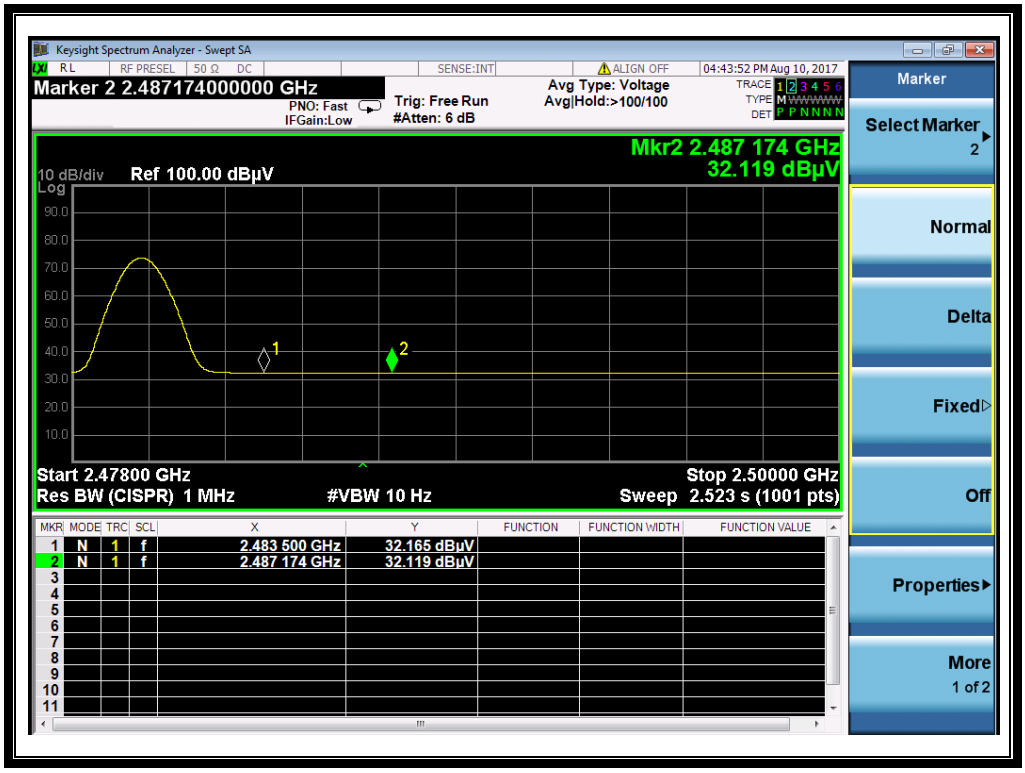
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVG)



(Plot C1: Channel = 39 PEAK)



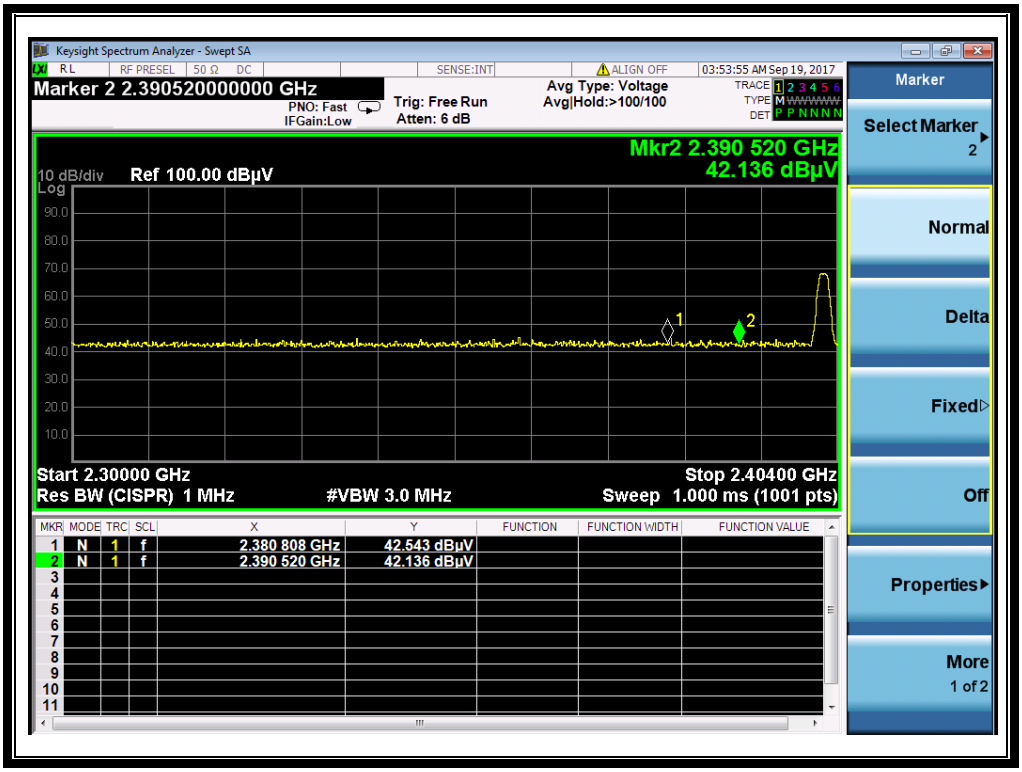
(Plot C2: Channel = 39 AVG)

Result for Antenna 2

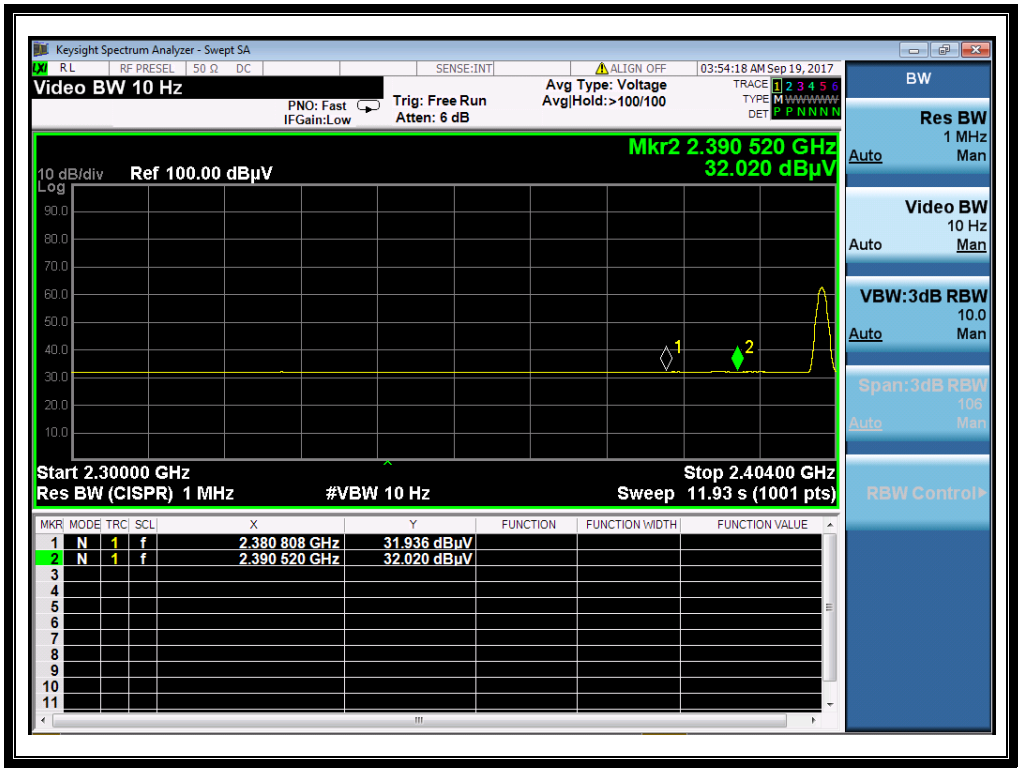
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2380.81	PK	42.54	-33.63	32.56	41.47	74	Pass
0	2380.81	AV	31.94	-33.63	32.56	30.87	54	Pass
39	2489.23	PK	42.83	-33.18	32.5	42.15	74	Pass
39	2489.23	AV	31.93	-33.18	32.5	31.25	54	Pass

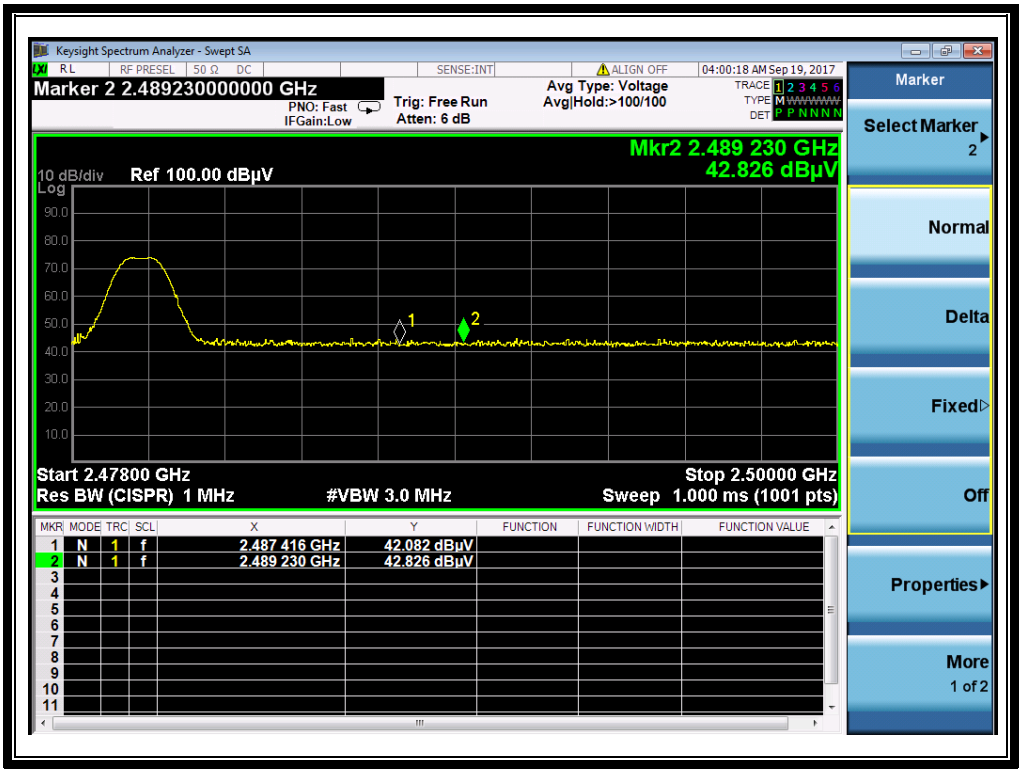
B. Test Plots:



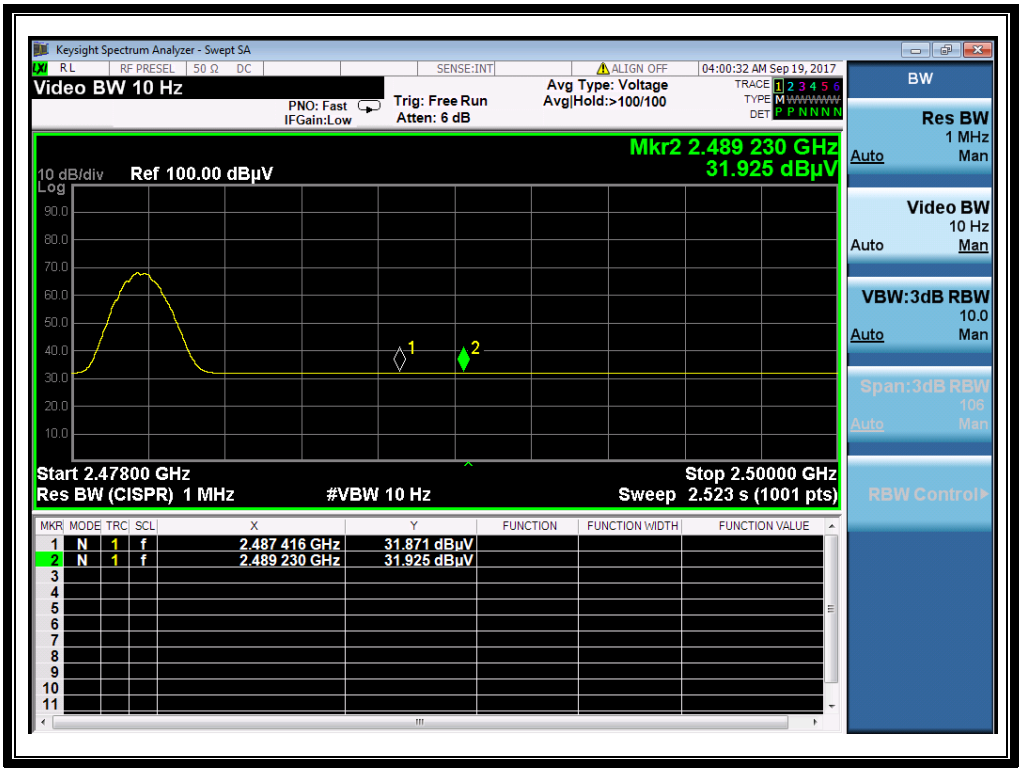
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVG)



(Plot C1: Channel = 39 PEAK)



(Plot C2: Channel = 39 AVG)

2.7 Conducted Emission

2.7.1 Requirement

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

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

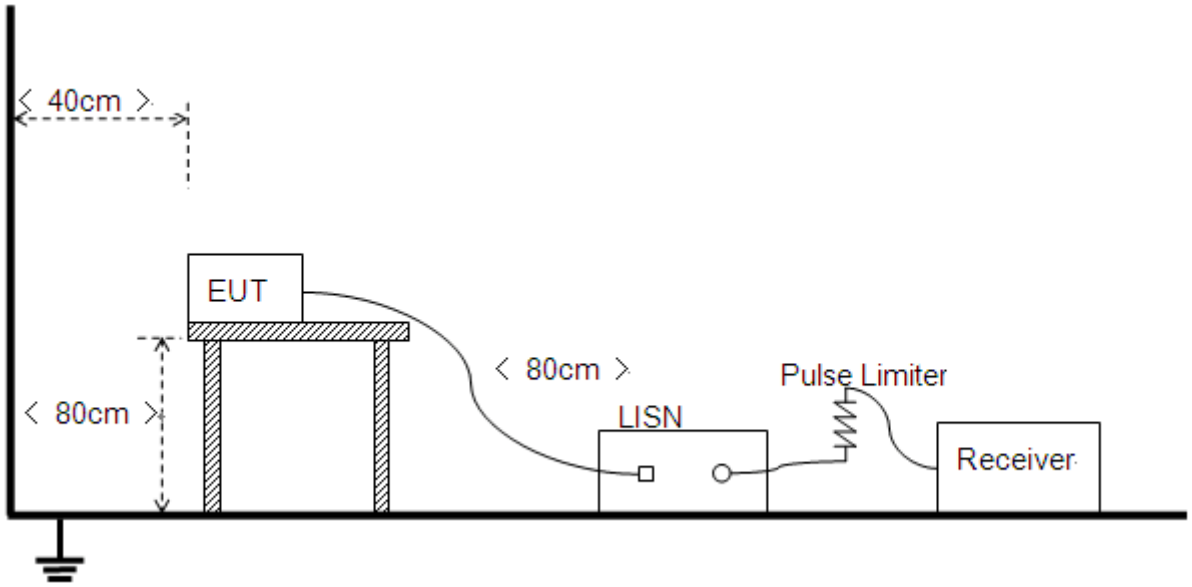
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2 Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

B. Equipments List:

Please reference ANNEX A(1.5).

2.7.3 Test Result

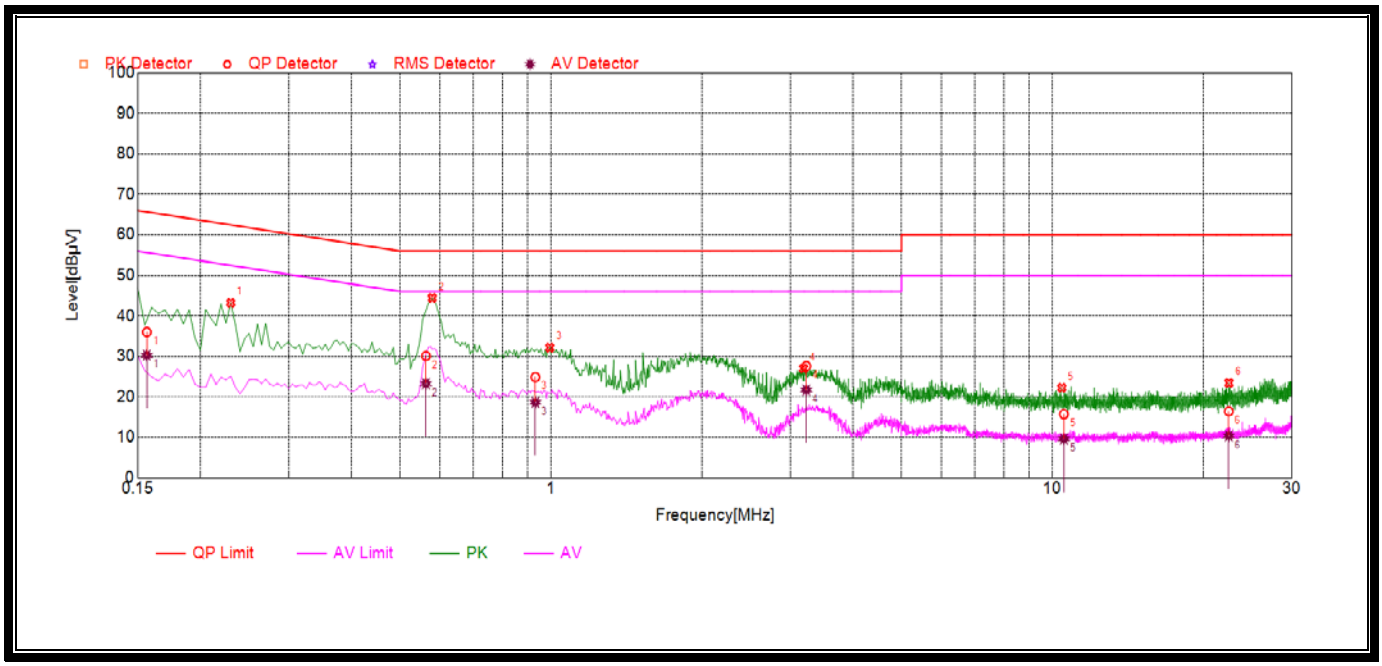
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

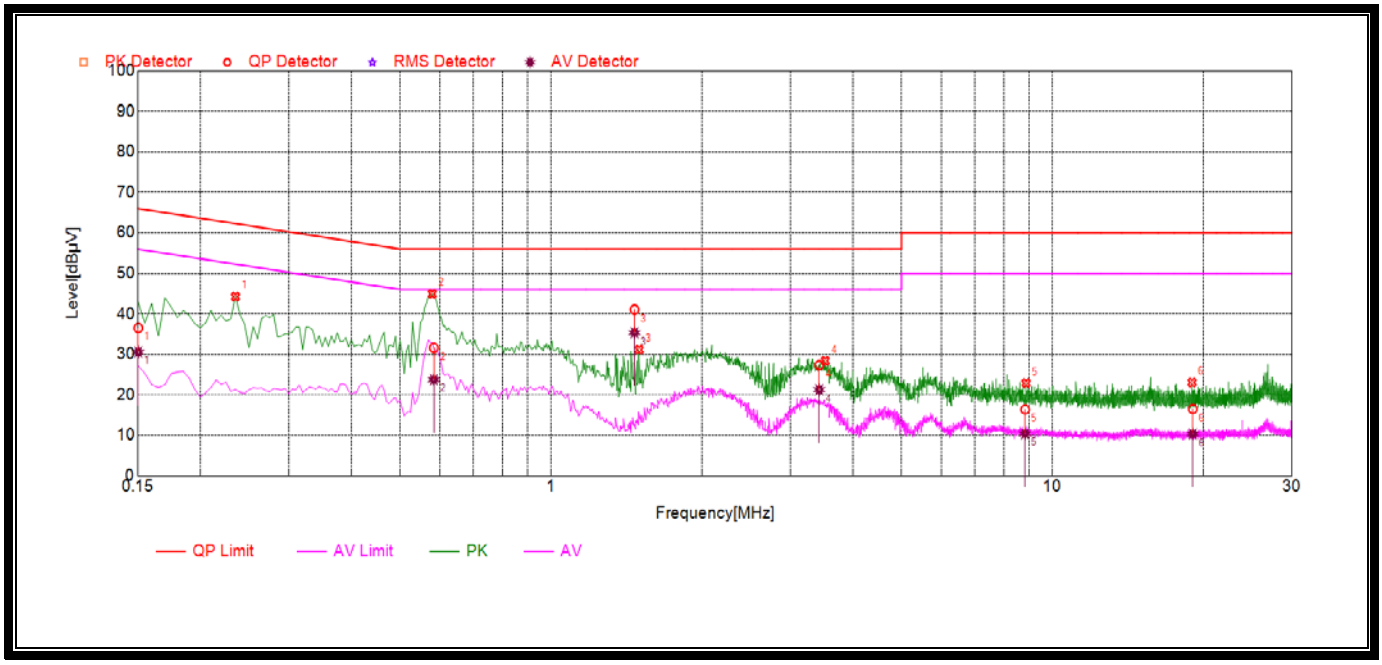
Note: The test voltage is AC 120V/60Hz.

B. Test Plots:



(Plot A: L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1564	36.00	30.26	65.82	55.82	Line	PASS
2	0.5634	30.08	23.28	56	46		PASS
3	0.9312	24.86	18.67	56	46		PASS
4	3.2308	27.60	21.72	56	46		PASS
5	10.541	15.74	9.61	60	50		PASS
6	22.473	16.43	10.38	60	50		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1504	36.52	30.56	65.99	55.99	Line	PASS
2	0.5844	31.61	23.77	56	46		PASS
3	1.468	41.06	35.36	56	46		PASS
4	3.428	27.32	21.28	56	46		PASS
5	8.8204	16.40	10.40	60	50		PASS
6	19.0508	16.51	10.36	60	50		PASS

2.8 Radiated Emission

2.8.1 Requirement

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

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

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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:

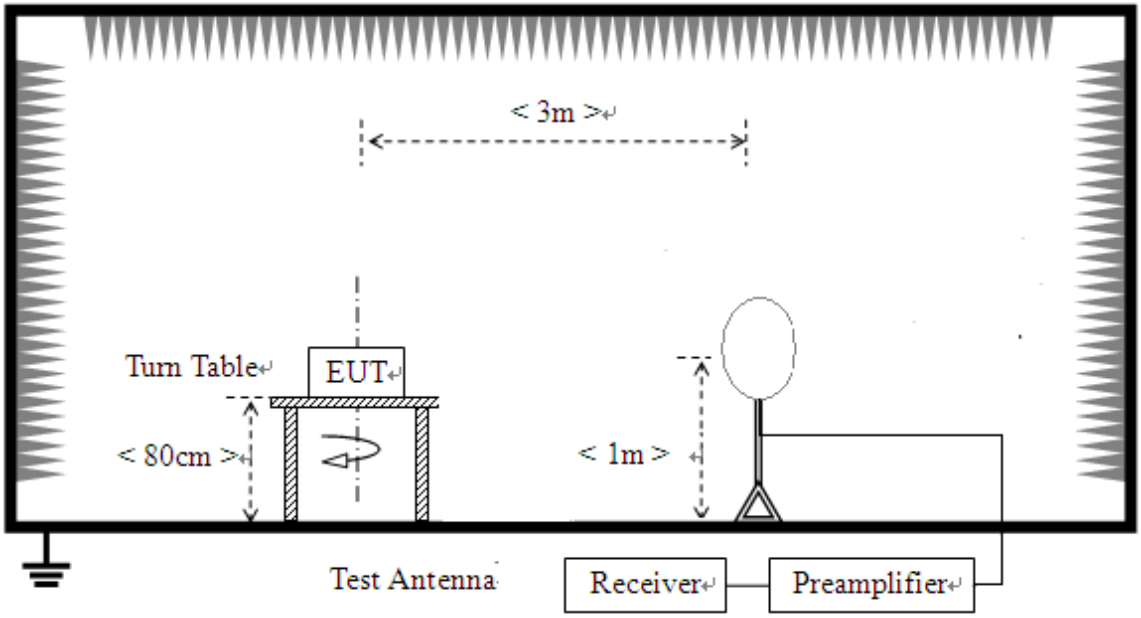
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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

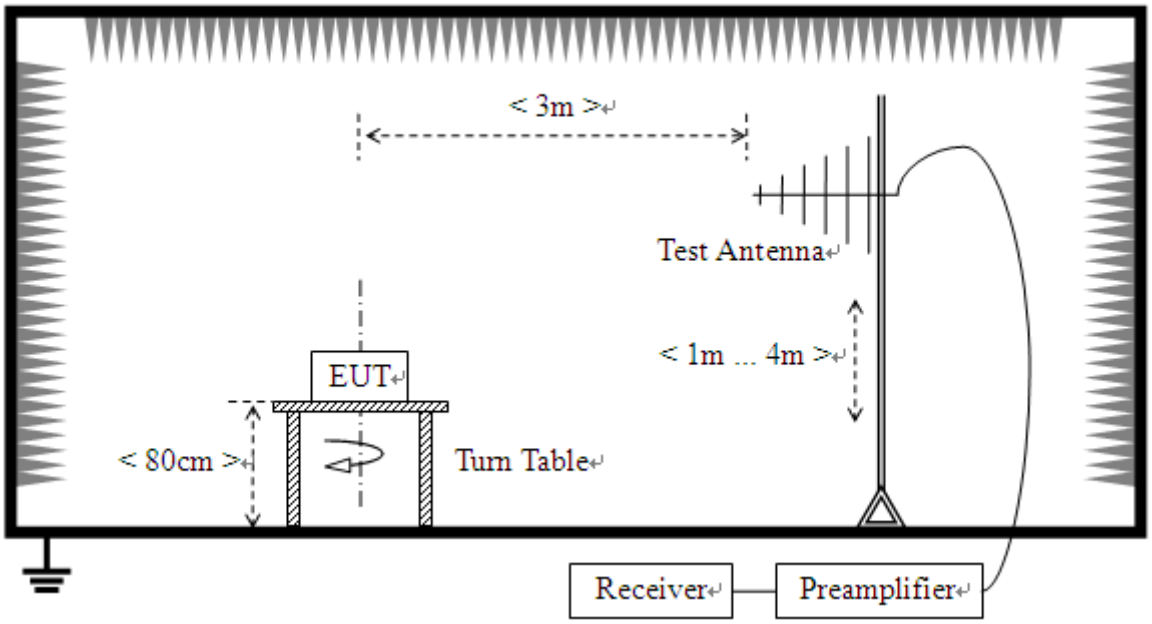
2.8.2 Test Description

A. Test Setup:

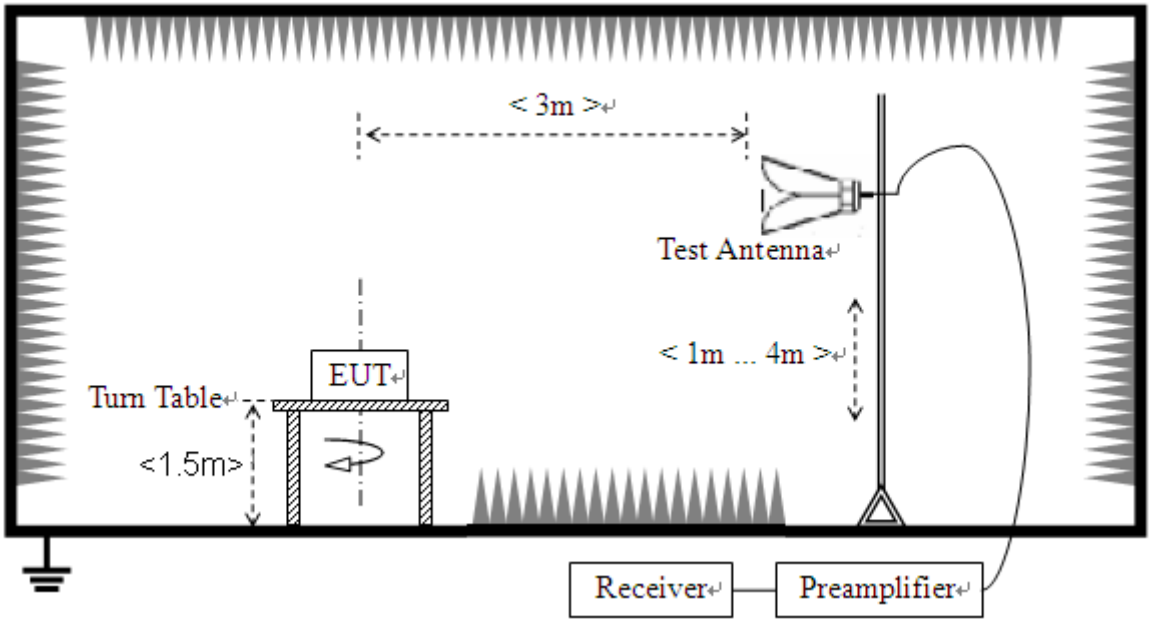
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz. Test site have a minimum area of the ground plane covered with RF absorbing material as specified in Figure 6 of ANSI C63.4: 2014.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10:2013. For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

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

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.

(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant

emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Please reference ANNEX A(1.5).

2.8.3 Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

E [dBμV/m] $= U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

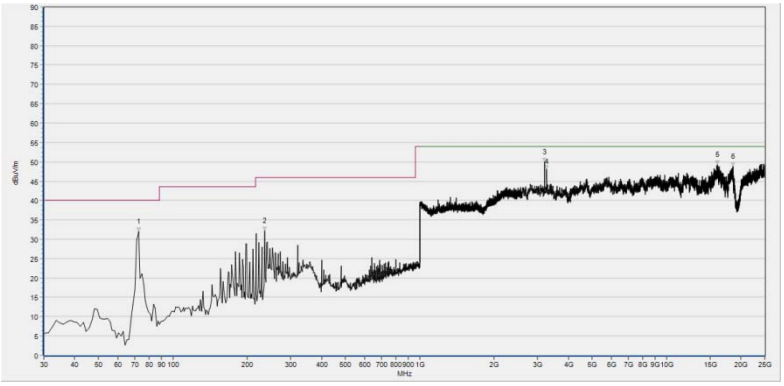
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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

Result for Antenna 1

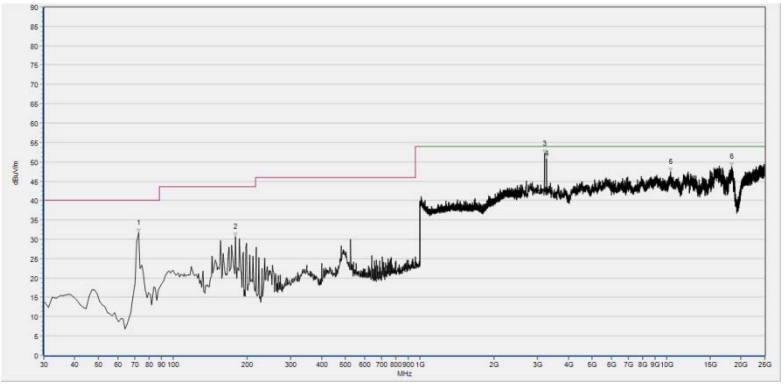
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	32.02	N.A	N.A	N.A	40.00	N.A	Horizontal	PASS
235.169	32.12	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
3202.873	49.99	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
3263.975	48.12	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
16046.518	49.24	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
18539.480	48.85	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



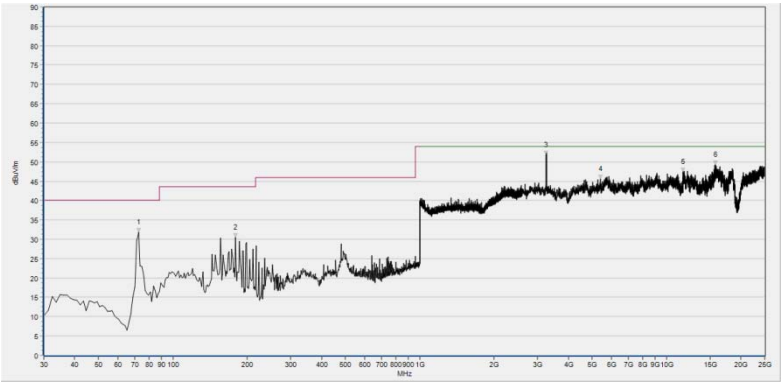
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	31.64	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
179.324	30.60	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
3202.600	51.95	49.44	45.86	74.0	N.A	54.0	Vertical	PASS
3263.975	50.70	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
10364.030	47.44	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
18372.468	48.76	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 19

Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	31.52	N.A	N.A	N.A	40.00	N.A	Horizontal	PASS
240.025	32.16	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2415.606	51.27	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
3251.755	49.26	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
5667.321	47.40	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
12135.988	48.78	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

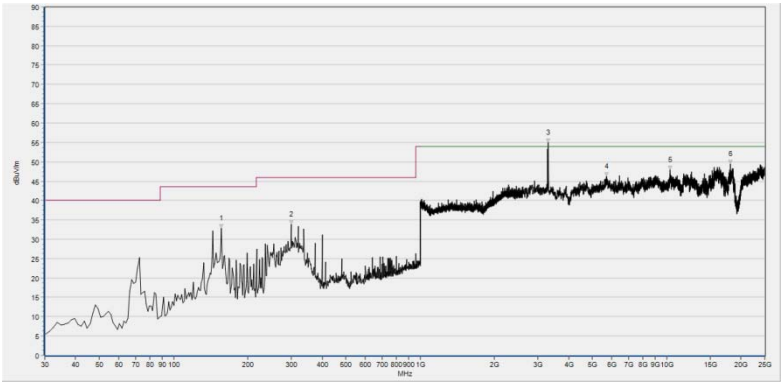
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	31.91	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
179.324	30.55	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
3251.755	51.84	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
5386.252	45.57	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
11667.540	47.35	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15757.301	49.26	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

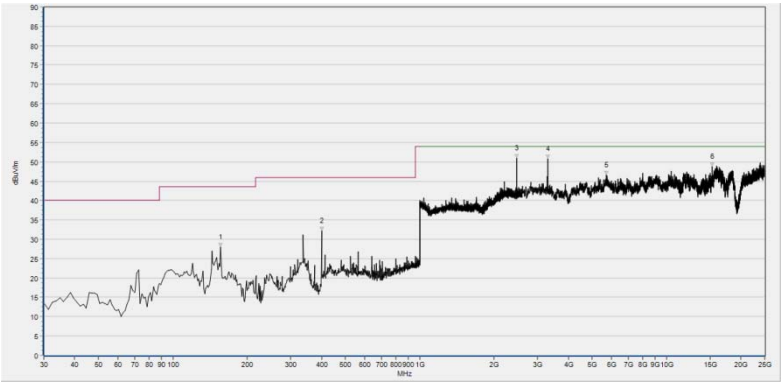
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
156.258	32.86	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
299.512	33.86	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
3306.700	56.82	55.60	53.08	74.0	N.A	54.0	Horizontal	PASS
5695.836	46.20	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
10294.781	48.01	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
18152.500	49.37	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



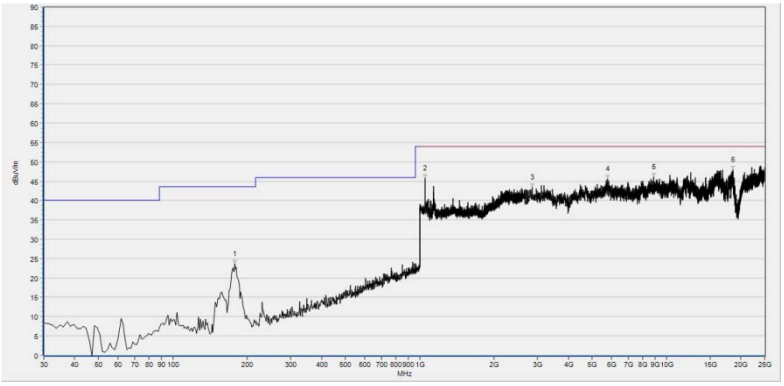
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
156.258	28.02	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
400.275	32.24	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2465.546	51.01	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
3304.710	50.74	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
5691.762	46.63	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15329.587	48.82	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Result for Antenna 2

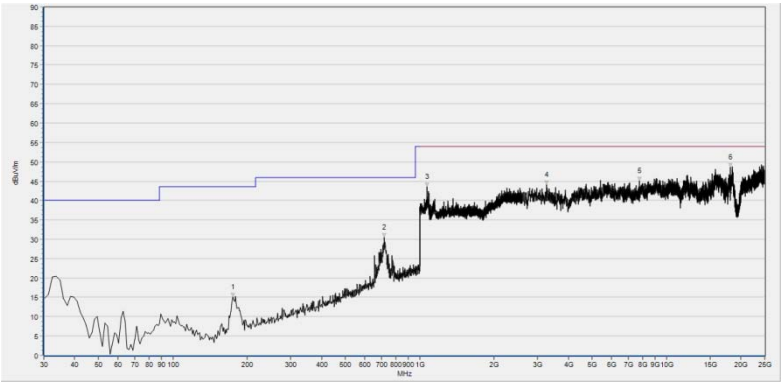
B. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
178.110	23.59	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
1049.300	45.70	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
2852.555	43.41	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
5752.864	45.62	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
8856.847	46.05	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
18551.700	47.90	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

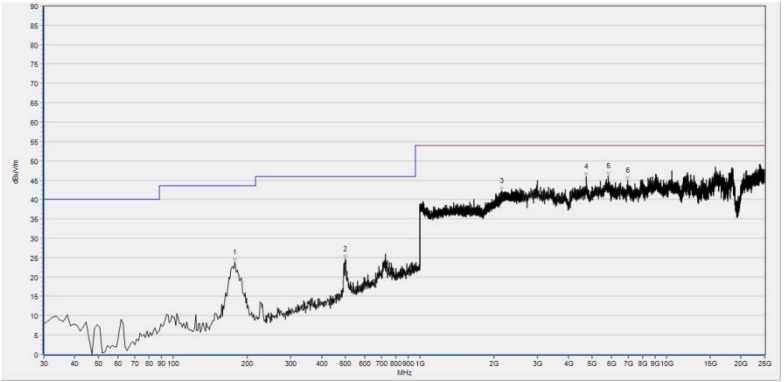
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
174.468	15.06	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
719.562	30.49	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
1072.349	43.54	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
3268.049	43.99	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7773.304	45.08	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
18172.868	48.56	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

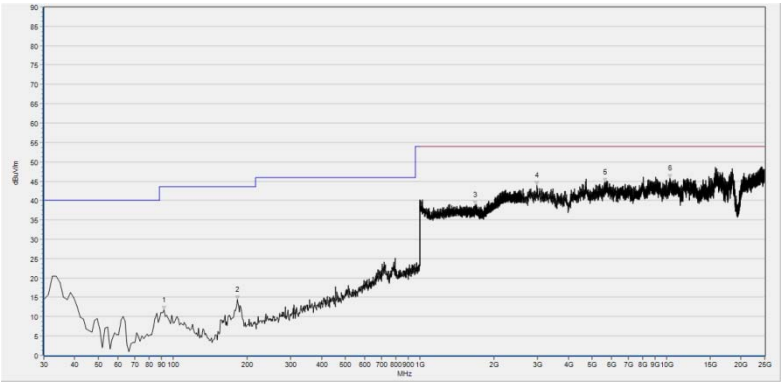
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 19



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
178.110	23.82	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
499.825	24.66	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2142.857	42.19	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
4734.497	45.93	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
5813.966	46.01	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
6958.611	44.85	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

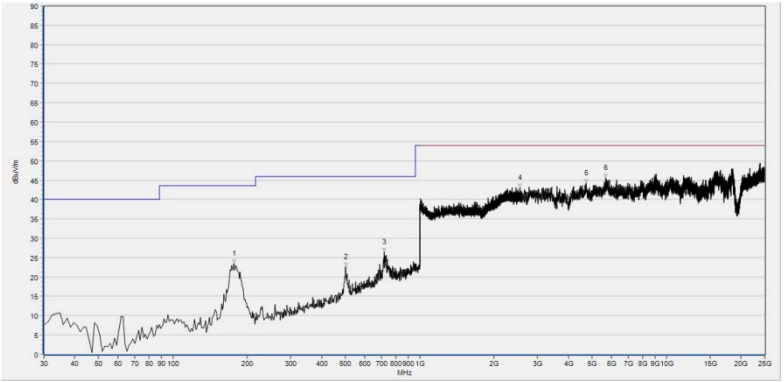
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
91.915	11.74	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
182.966	14.45	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
1674.190	38.93	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2986.979	43.96	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
5642.881	44.78	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
10315.148	45.67	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

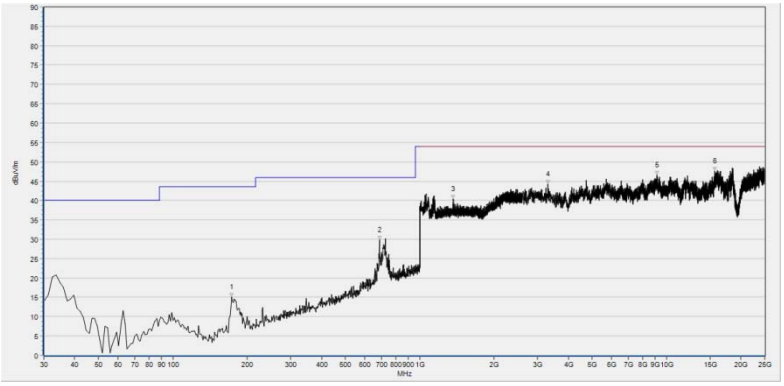
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
176.896	23.41	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
501.039	22.68	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
719.562	26.55	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2546.218	43.01	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
4722.277	44.32	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
5679.542	45.57	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
173.254	15.00	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
686.783	29.78	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
1368.147	40.45	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
3300.636	44.32	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
9170.504	46.57	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15708.420	47.52	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

ANNEX A GENERAL INFORMATION

1.1 Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

1.2 Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

1.3 Facilities and Accreditations

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192.

1.4 Maximum measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Peak Output Power	±2.22dB
Power spectral density (PSD)	±2.22dB
Bandwidth	±5%
Conducted Spurious Emission	±2.77 dB
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

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

1.5 Test Equipments Utilized

1.5.1 Conducted Test Equipments

Conducted Test Equipment						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal. Due**
1	Spectrum Analyzer	MY45101810	E4407B	Agilent	2017.05.24	2018.05.23
2	Power Splitter	NW521	1506A	Weinschel	2017.05.24	2018.05.23
3	Attenuator 1	(N/A.)	10dB	Resnet	2017.05.24	2018.05.23
4	Attenuator 2	(N/A.)	3dB	Resnet	2017.05.24	2018.05.23
5	EXA Signal Analzyer	MY53470836	N9010A	Agilent	2016.12.07	2017.12.06
6	RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
7	Coaxial cable	CB02	RF02	Morlab	N/A	N/A
8	SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

1.5.2 Conducted Emission Test Equipments

Conducted Emission Test Equipments						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal. Due**
1	Receiver	US44210471	E7405A	Agilent	2017.05.24	2018.05.23
2	LISN	812744	NSLK 8127	Schwarzbeck	2017.05.24	2018.05.23
3	Service Supplier	100448	CMU200	R&S	2017.05.24	2018.05.23
4	Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2017.05.24	2018.05.23
5	Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

1.5.3 Auxiliary Test Equipment

Auxiliary Test Equipment						
No.	**Equipment Name**	**Model No.**	**Brand Name**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Computer	T430i	Think Pad	Lenovo	N/A	N/A

1.5.4 Radiated Test Equipments

Radiated Test Equipments						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal. Date**	**Cal.Due Date**
1	System Simulator	GB45360846	8960-E5515C	Agilent	2017.05.17	2018.05.16
2	Receiver	MY54130016	N9038A	Agilent	2017.05.17	2018.05.16
3	Test Antenna - Bi-Log	N/A	VULB9163	Schwarzbeck	2016.12.09	2017.12.08
4	Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2017.03.30	2018.03.29
5	Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2017.03.30	2018.03.29
6	Test Antenna - Horn	71688	BBHA 9120D	Schwarzbeck	2017.03.30	2018.03.29
7	Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
8	Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
9	Coaxial cable(N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
10	1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
11	18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16

1.5.5 Climate Chamber

Climate Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Climate Chamber	2004012	HL4003T	Yinhe	2017.01.11	2018.01.10

1.5.6 Vibration Table

Vibration Table						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Vibration Table	N/A	ACT2000-S015L	CMI-COM	2017.01.11	2018.01.10

1.5.7 Anechoic Chamber

Anechoic Chamber						
No.	**Equipment Name**	**Serial No.**	**Type**	**Manufacturer**	**Cal.Date**	**Cal.Due Date**
1	Anechoic Chamber	N/A	9m*6m*6m	Changning	2017.01.11	2018.01.10

***** END OF REPORT *****