



REPORT No.: SZ16110119W04

# FCC RF TEST REPORT

**APPLICANT** : Starkey Laboratories, Inc.

**PRODUCT NAME** : The Dash

**MODEL NAME** : B1000-001

**TRADE NAME** : Starkey

**BRAND NAME** : Starkey

**FCC ID** : EOA-2AF5TB1001R

**STANDARD(S)** : 47 CFR Part 15 Subpart C

**ISSUE DATE** : 2016-12-20



SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.

**MORLAB GROUP**

FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,  
Block67, BaoAn District, Shenzhen , GuangDong Province, P. R. China

Tel: 86-755-36698555 Fax: 86-755-36698525  
Http://www.morlab.com E-mail: service@morlab.cn



## DIRECTORY

<b>TEST REPORT DECLARATION</b>	4
<b>1. TECHNICAL INFORMATION</b>	5
1.1 APPLICANT INFORMATION	5
1.2 EQUIPMENT UNDER TEST (EUT) DESCRIPTION	5
1.2.1 IDENTIFICATION OF ALL USED EUTS	5
1.3 TEST STANDARDS AND RESULTS	6
1.3.1 TEST ENVIRONMENT CONDITIONS	6
<b>2. 47 CFR PART 15C REQUIREMENTS</b>	7
2.1 ANTENNA REQUIREMENT	7
2.1.1 APPLICABLE STANDARD	7
2.1.2 RESULT: COMPLIANT	7
2.2 PEAK OUTPUT POWER	7
2.2.1 REQUIREMENT	7
2.2.2 TEST DESCRIPTION	7
2.2.3 TEST PROCEDURE	7
2.2.4 TEST RESULT	8
2.3 6DB BANDWIDTH	10
2.3.1 REQUIREMENT	10
2.3.2 TEST DESCRIPTION	10
2.3.3 TEST PROCEDURE	10
2.3.4 TEST RESULT	11
2.4 CONDUCTED SPURIOUS EMISSIONS AND BAND EDGE	13
2.4.1 REQUIREMENT	13
2.4.2 TEST DESCRIPTION	13
2.4.3 TEST RESULT	13
2.5 POWER SPECTRAL DENSITY (PSD)	17
2.5.1 REQUIREMENT	17
2.5.2 TEST DESCRIPTION	17
2.5.3 TEST PROCEDURE	17
2.5.4 TEST RESULT	17
2.6 RESTRICTED FREQUENCY BANDS	20



2.6.1	REQUIREMENT.....	20
2.6.2	TEST DESCRIPTION .....	20
2.6.3	TEST RESULT.....	21
<b>2.7</b>	<b>CONDUCTED EMISSION.....</b>	<b>24</b>
2.7.1	REQUIREMENT.....	24
2.7.2	TEST DESCRIPTION .....	24
2.7.3	TEST RESULT.....	25
<b>2.8</b>	<b>RADIATED EMISSION.....</b>	<b>27</b>
2.8.1	REQUIREMENT.....	27
2.8.2	TEST DESCRIPTION .....	28
2.8.3	TEST RESULT.....	30
<b>ANNEX A GENERAL INFORMATION.....</b>		<b>34</b>

Change History		
Issue	Date	Reason for change
1.0	2016-12-20	First edition



REPORT No.: SZ16110119W04

## TEST REPORT DECLARATION

Applicant	Starkey Laboratories, Inc.
Applicant Address	6600 Washington Avenue, South, Eden Prairie, MN 55344, USA
Manufacturer	Starkey Laboratories, Inc.
Manufacturer Address	6600 Washington Avenue, South, Eden Prairie, MN 55344, USA
Product Name	The Dash
Model Name	B1000-001
Brand Name	Starkey
HW Version	B1.2 for Beta3
SW Version	B3_RC2
Test Standards	47 CFR Part 15 Subpart C
Test Date	2016-08-17 to 2016-11-30
Test Result	PASS

Tested by : Li Jingzong  
Li Jingzong

Reviewed by : Qiu Xiaojun  
Qiu Xiaojun

Approved by : Peng Huarui  
Peng Huarui

**MORLAB GROUP**

FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,  
Block67, BaoAn District, Shenzhen , GuangDong Province, P. R. China

Tel: 86-755-36698555 Fax: 86-755-36698525  
Http://www.morlab.com E-mail: service@morlab.cn



## 1. TECHNICAL INFORMATION

Note: Provide by applicant.

### 1.1 Applicant Information

Company:	Starkey Laboratories, Inc.
Address:	6600 Washington Avenue, South, Eden Prairie, MN 55344, USA

### 1.2 Equipment under Test (EUT) Description

Brand Name:	Starkey
Trade Name:	Starkey
Model Name:	B1000-001
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 Type:	LDS Antenna
Antenna Gain:	-5.5 dBi

#### NOTE:

The EUT is a The Dash, it contain Bluetooth 4.0 LE Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth 4.0 LE is  $F(\text{MHz})=2402+2*n$  ( $0 \leq n \leq 39$ ). 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	B1.2 for Beta3	B3_RC2



### 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	<u>N/A</u>
2	15.247(b)	Peak Output Power	Aug 17, 2016	<u>PASS</u>
3	15.247(a)	Bandwidth	Nov 22, 2016	<u>PASS</u>
4	15.247(d)	Conducted Spurious Emission and Band Edge	Nov 22, 2016	<u>PASS</u>
5	15.247(d)	Restricted Frequency Bands	Nov 30, 2016	<u>PASS</u>
6	15.207	Conducted Emission	Nov 30, 2016	<u>PASS</u>
7	15.209 ,15.247(d)	Radiated Emission	Nov 30, 2016	<u>PASS</u>
8	15.247(e)	Power spectral density (PSD)	Nov 22, 2016	<u>PASS</u>

The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013 and KDB558074 D01 v03r05 (04/08/2016).

#### 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

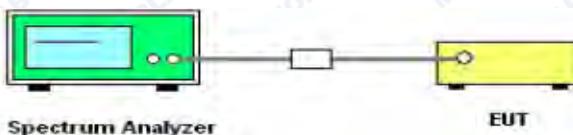
#### 2.2.1 Requirement

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) which is powered by the adapter 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 to 1MHz
- 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.

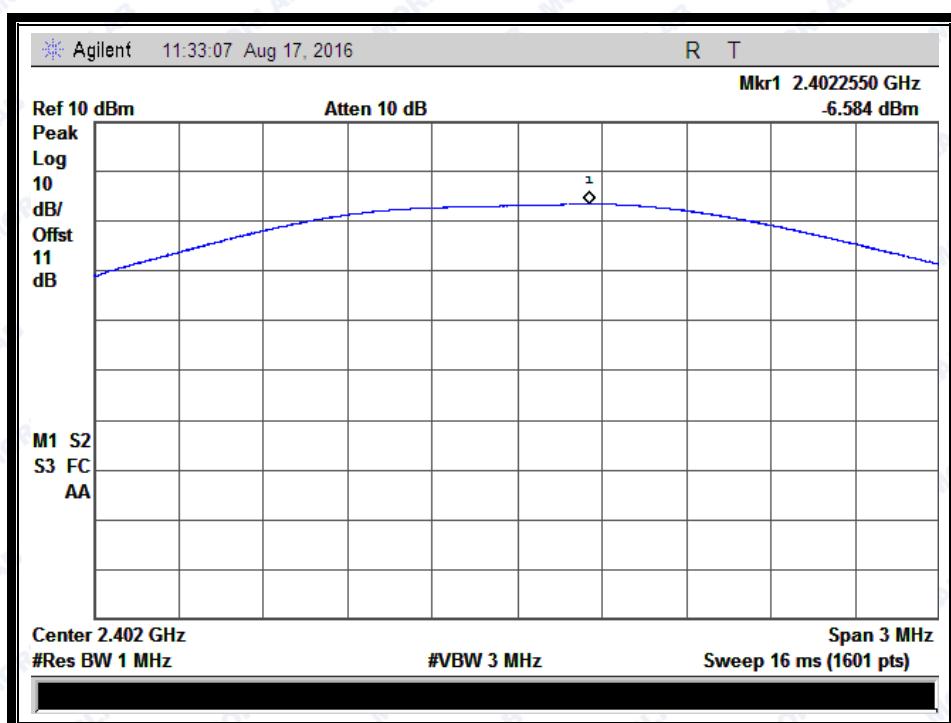
#### 2.2.4 Test Result

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	-6.58	0.0002	Plot A	30	1	PASS
19	2440	-4.72	0.0003				PASS
39	2480	-1.29	0.0007				PASS

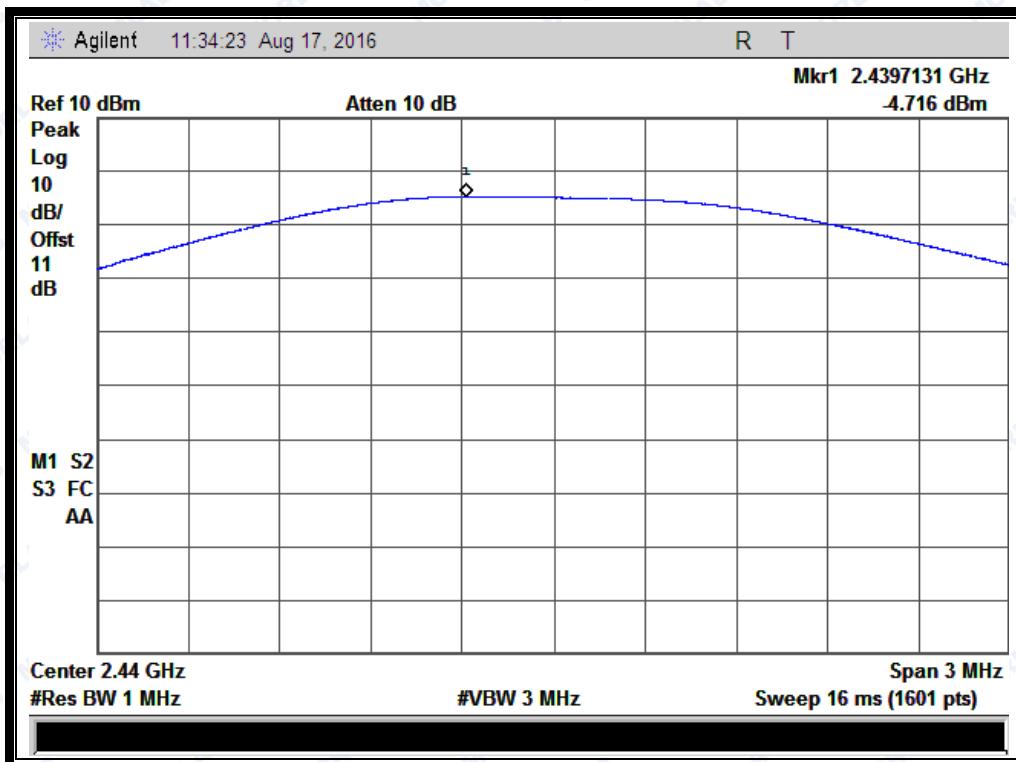
#### B. Test Plots:



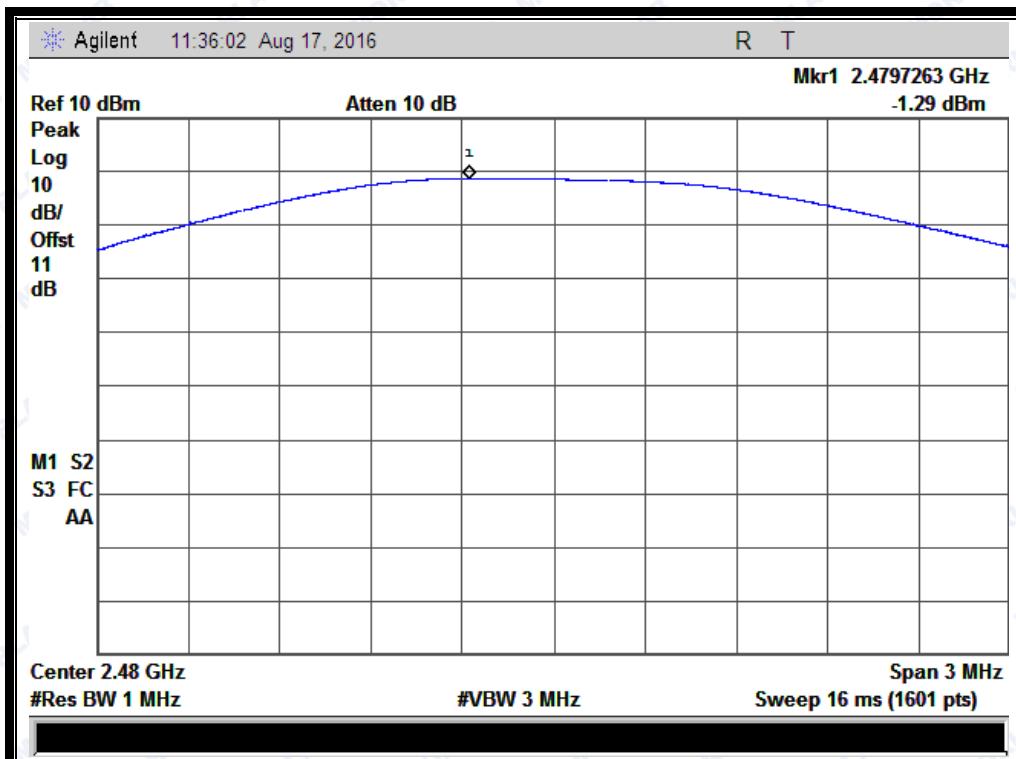
(Plot A: Channel 0: 2402MHz)



REPORT No.: SZ16110119W04



(Plot B: Channel 19: 2440MHz)



(Plot C: Channel 39: 2480MHz)

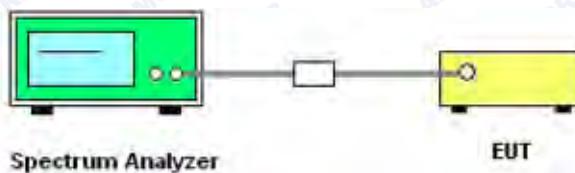
## 2.3 6dB Bandwidth

### 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 which is powered by the adapter, 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  $\geq 3 \times$  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  $\geq 6$  dB.

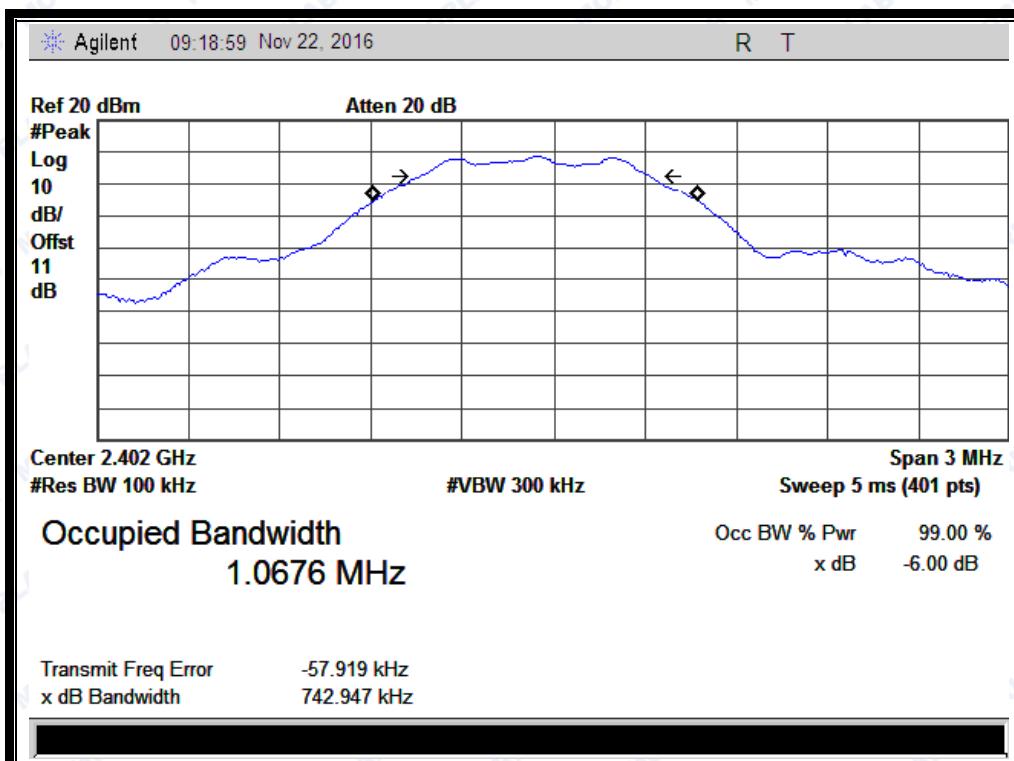
### 2.3.4 Test Result

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	0.7429	Plot A	$\geq 500$	PASS
19	2440	0.7407	Plot B	$\geq 500$	PASS
39	2480	0.7357	Plot C	$\geq 500$	PASS

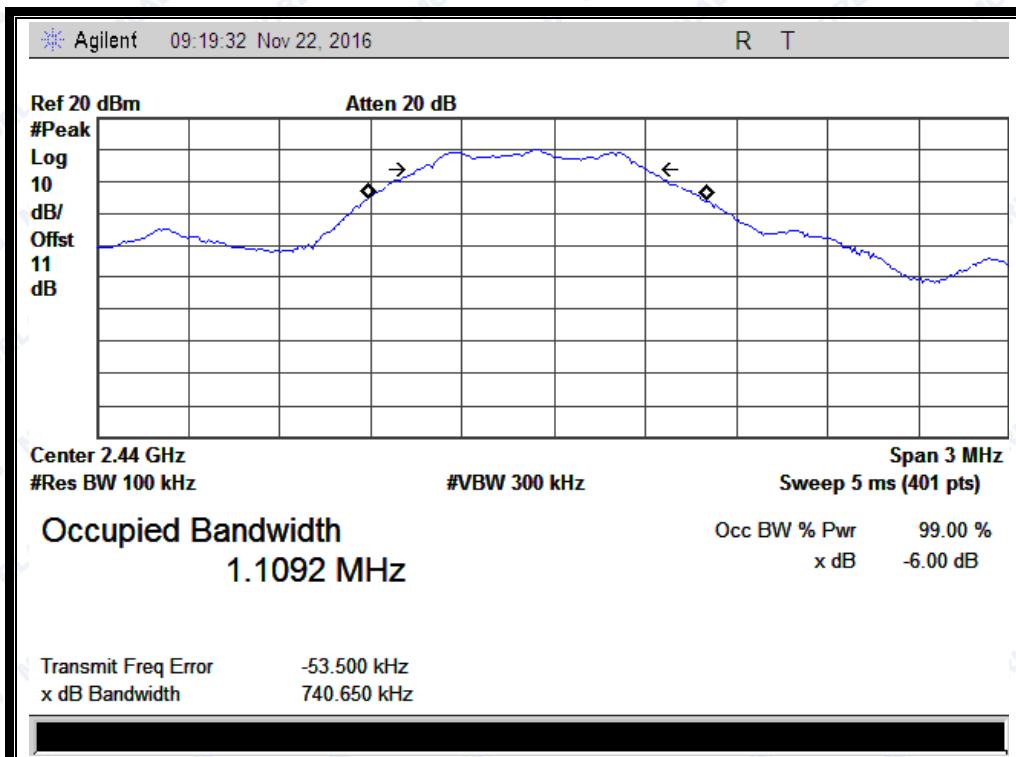
#### B. Test Plots:



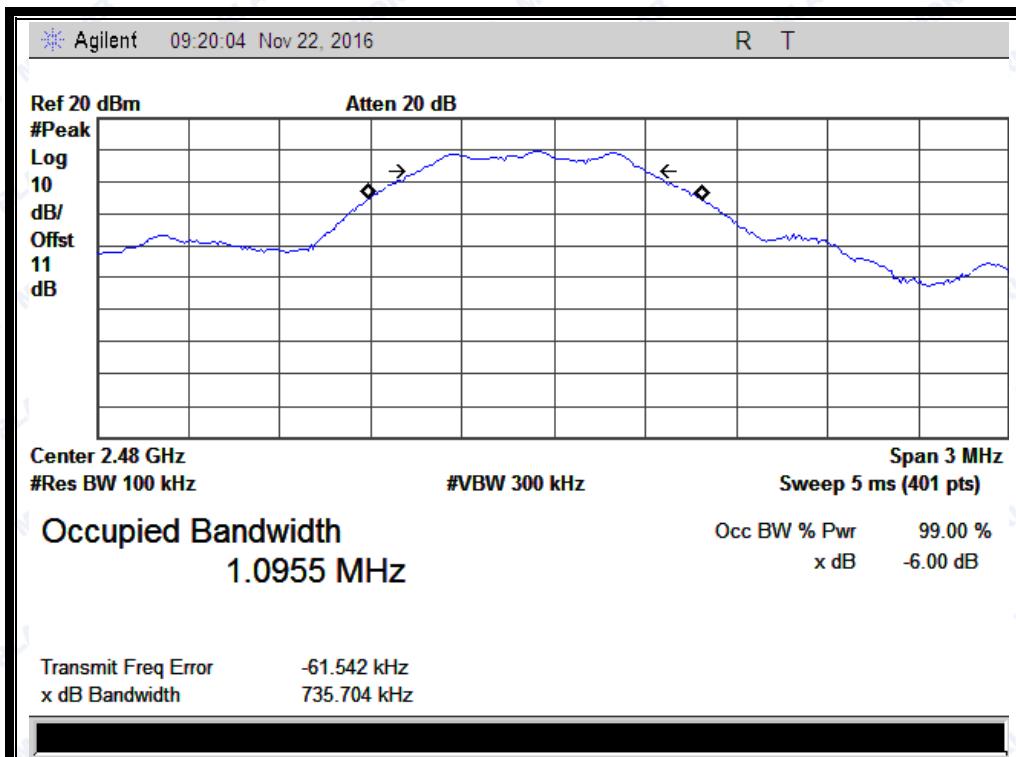
(Plot A: Channel 0: 2402MHz)



REPORT No.: SZ16110119W04



(Plot B: Channel 19: 2440 MHz)



(Plot C: Channel 39: 2480MHz)



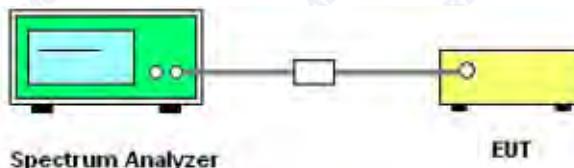
## 2.4 Conducted Spurious Emissions and Band Edge

### 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 which is powered by the adapter, 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:

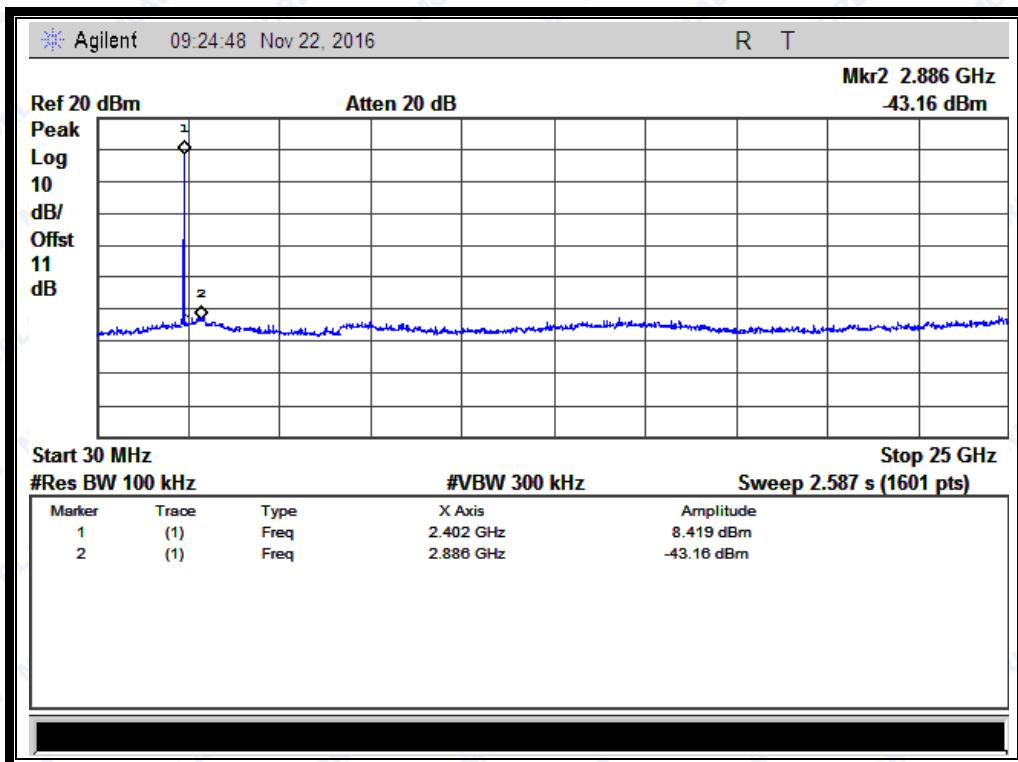
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-43.16	Plot A.1	8.42	-11.58	PASS
19	2440	-43.54	Plot B.1	8.53	-11.47	PASS
39	2480	-41.91	Plot C.1	8.90	-11.10	PASS

#### B. Test Plots:

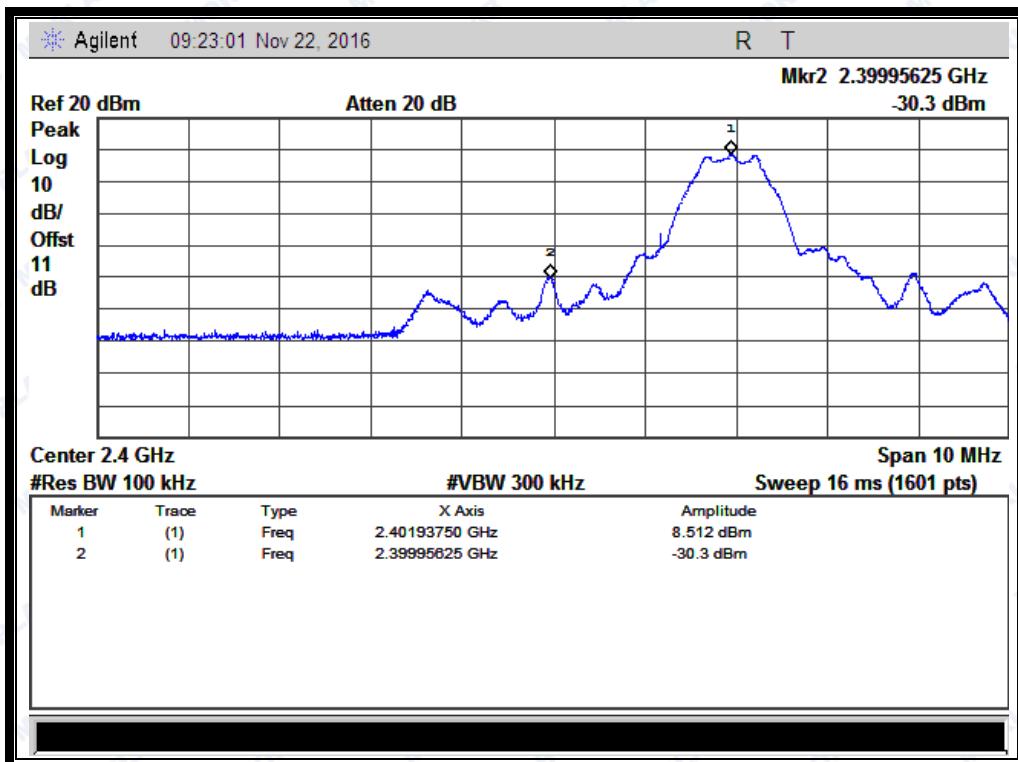
**Note:** the power of the Module transmitting frequency should be ignored.



REPORT No.: SZ16110119W04



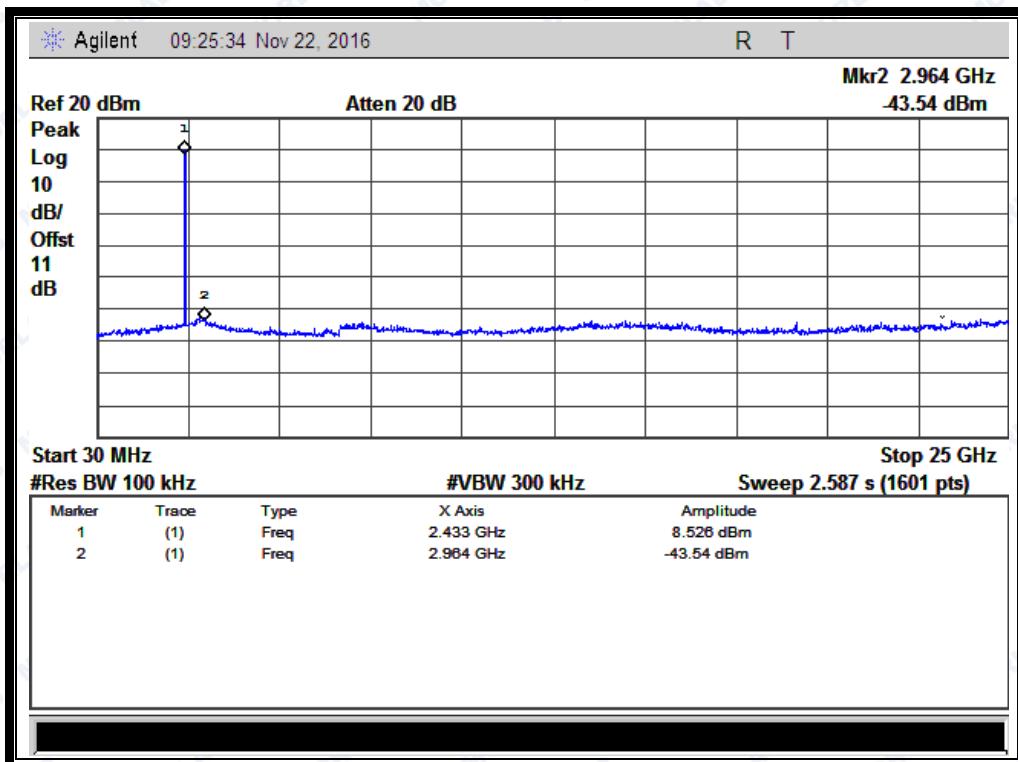
(Plot A.1: Channel = 0, 30MHz to 25GHz)



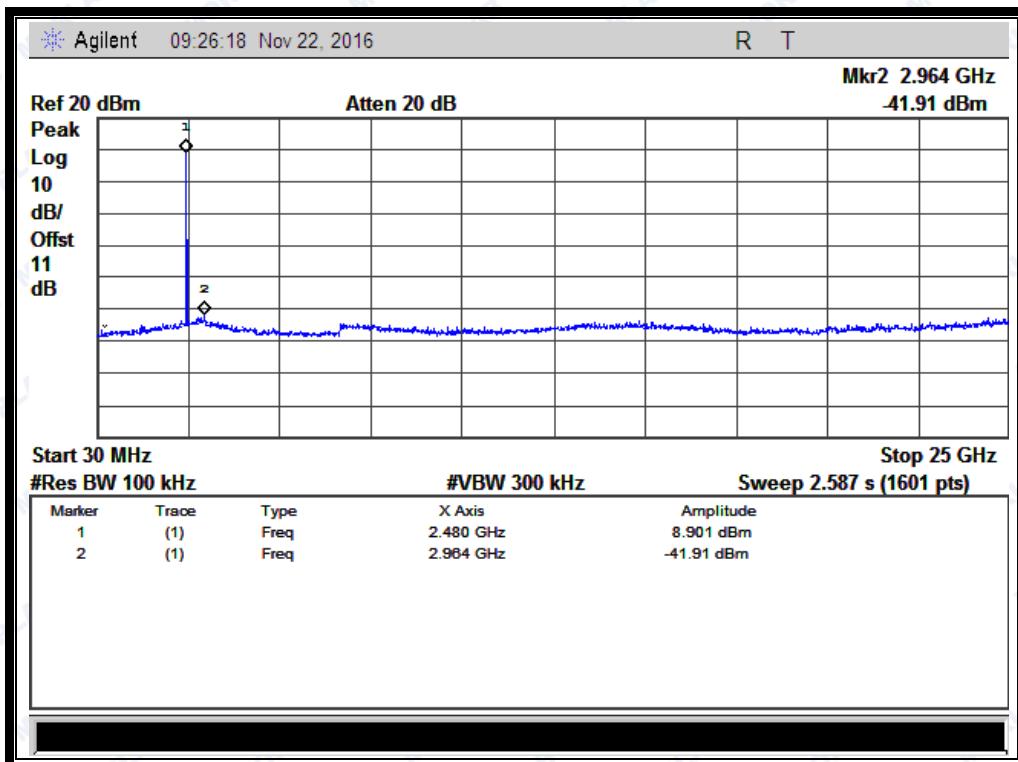
(Band Edge@ Channel = 0)



REPORT No.: SZ16110119W04



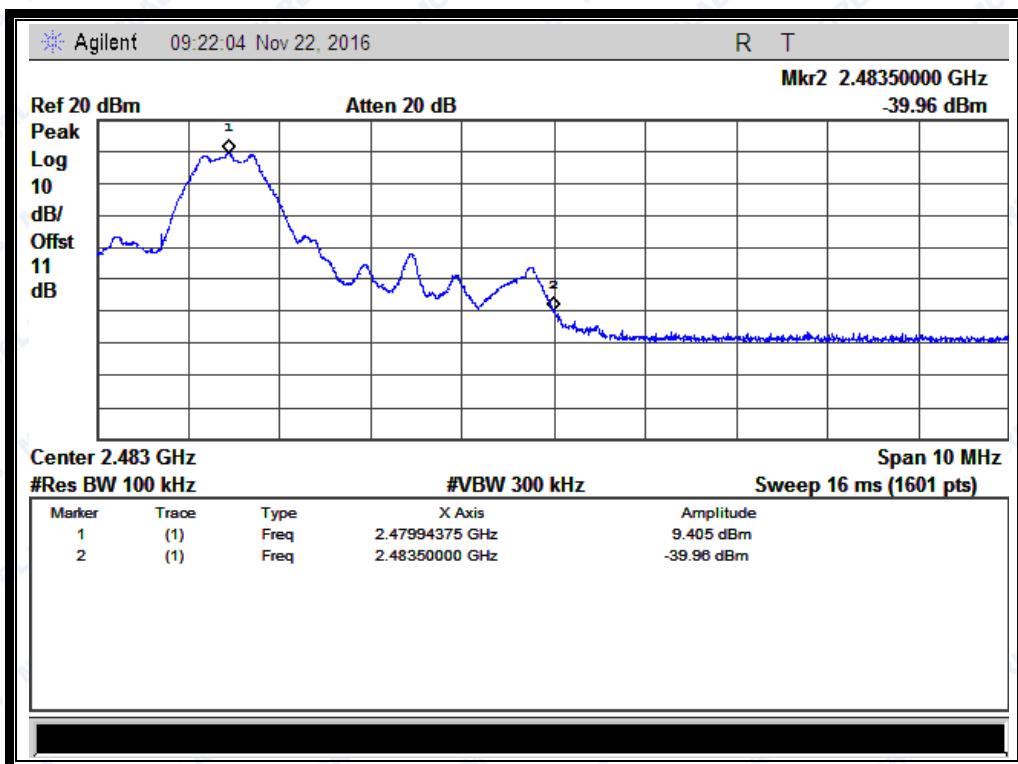
(Plot B.1: Channel = 19, 30MHz to 25GHz)



(Plot C.1: Channel = 39, 30MHz to 25GHz)



REPORT No.: SZ16110119W04



MORLAB GROUP

FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,  
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China

Tel: 86-755-36698555  
Http://www.morlab.com

Fax: 86-755-36698525  
E-mail: service@morlab.cn

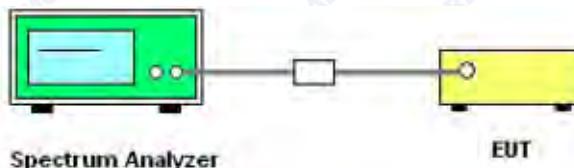
## 2.5 Power spectral density (PSD)

### 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 which is powered by the adapter, 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:

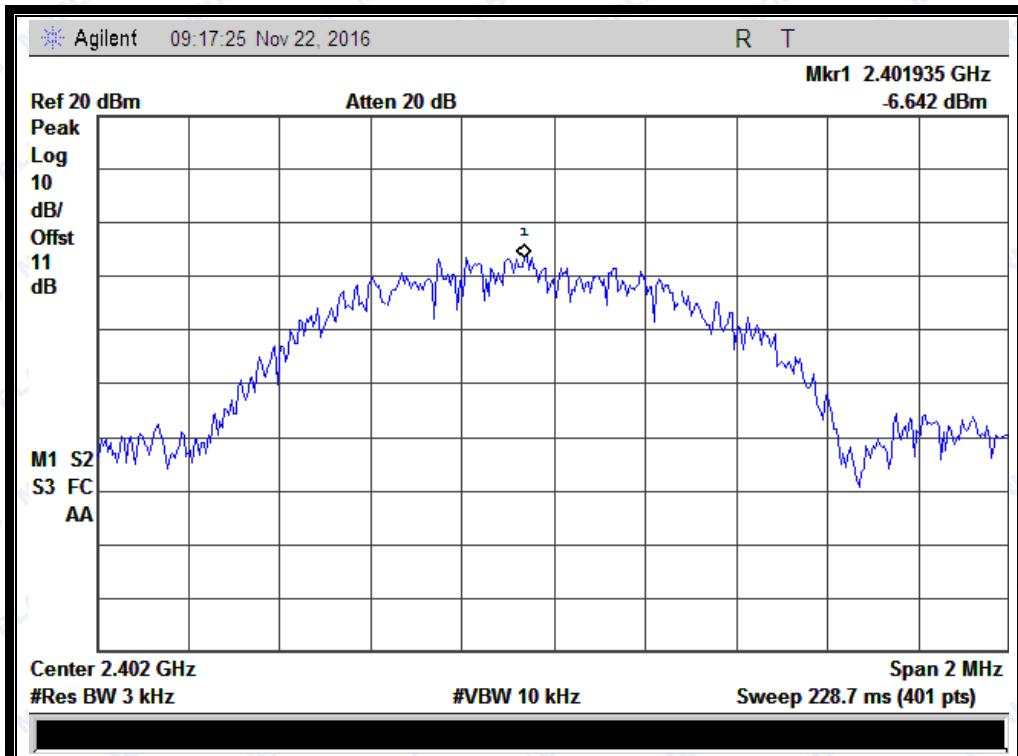


REPORT No.: SZ16110119W04

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
0	2402	-6.64	Plot A	8	PASS
19	2440	-4.95	Plot B	8	PASS
39	2480	-5.34	Plot C	8	PASS

Measurement uncertainty:  $\pm 1.3$ dB

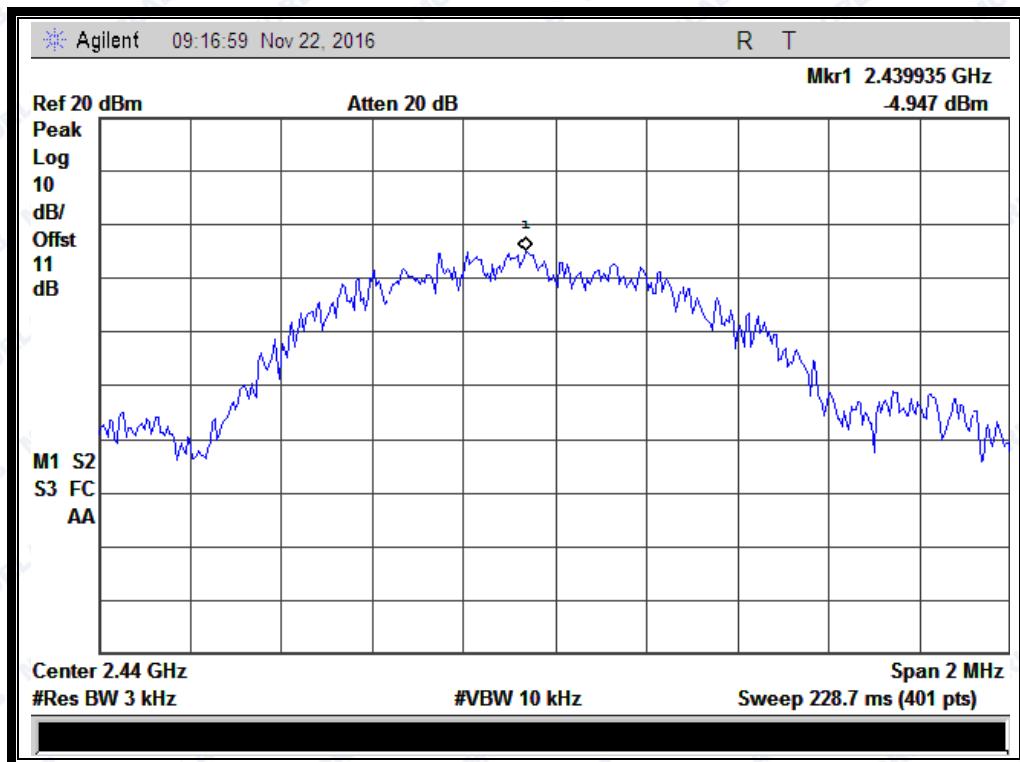
## B. Test Plots:



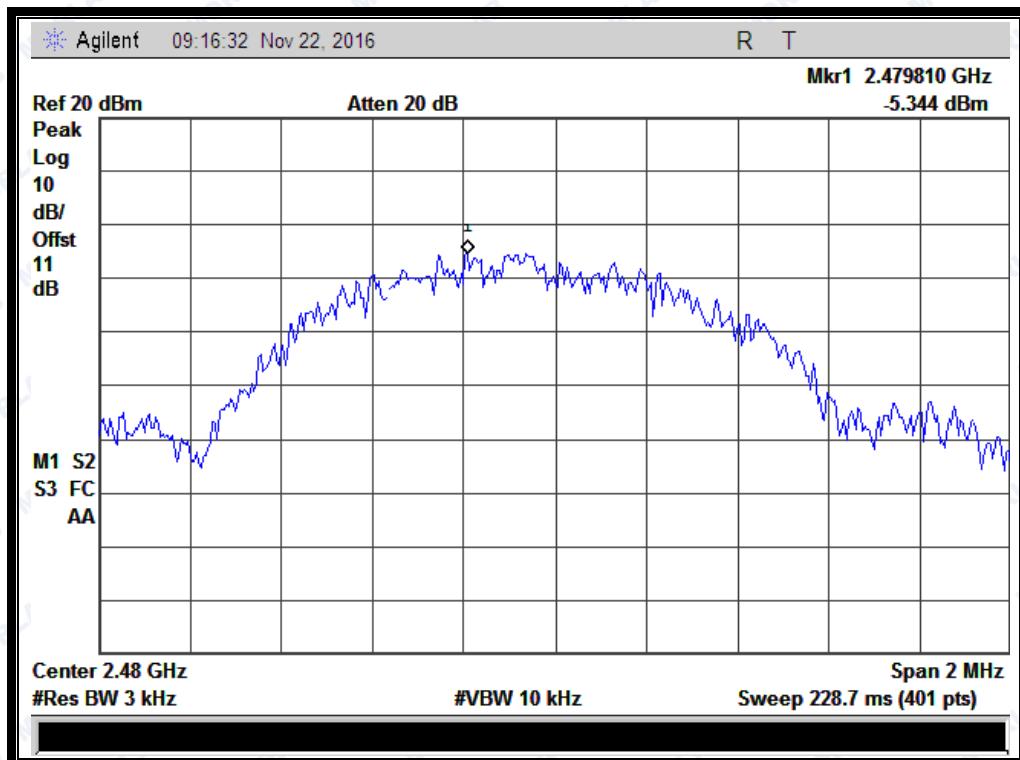
(Plot A: Channel = 0)



REPORT No.: SZ16110119W04



(Plot B: Channel = 19)



(Plot C: Channel = 39)

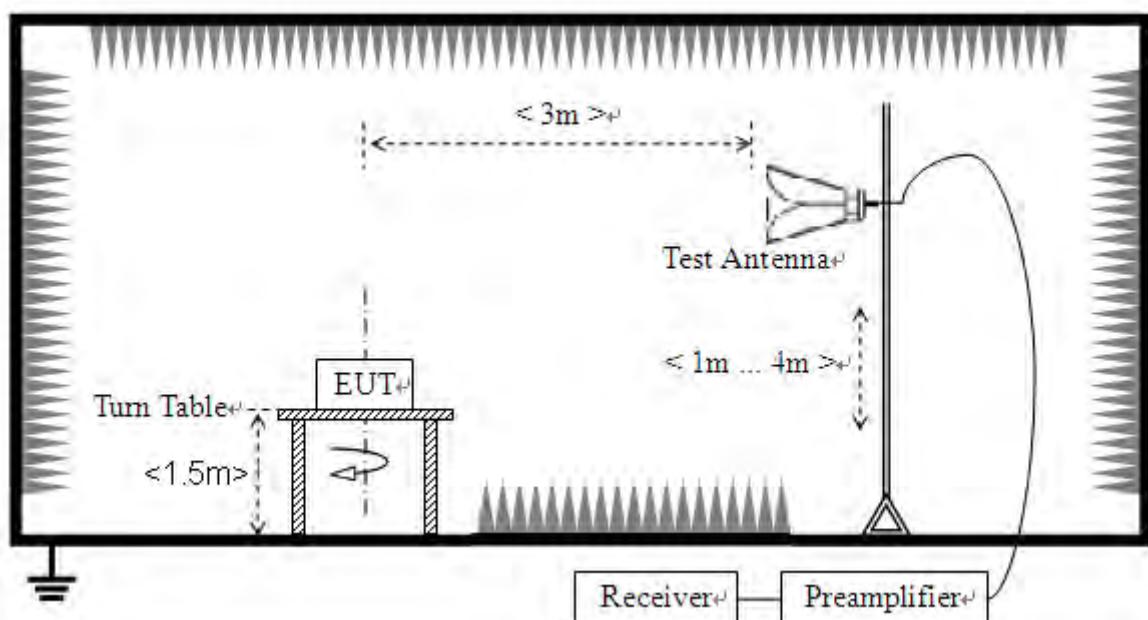
## 2.6 Restricted Frequency Bands

### 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:

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

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : 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.

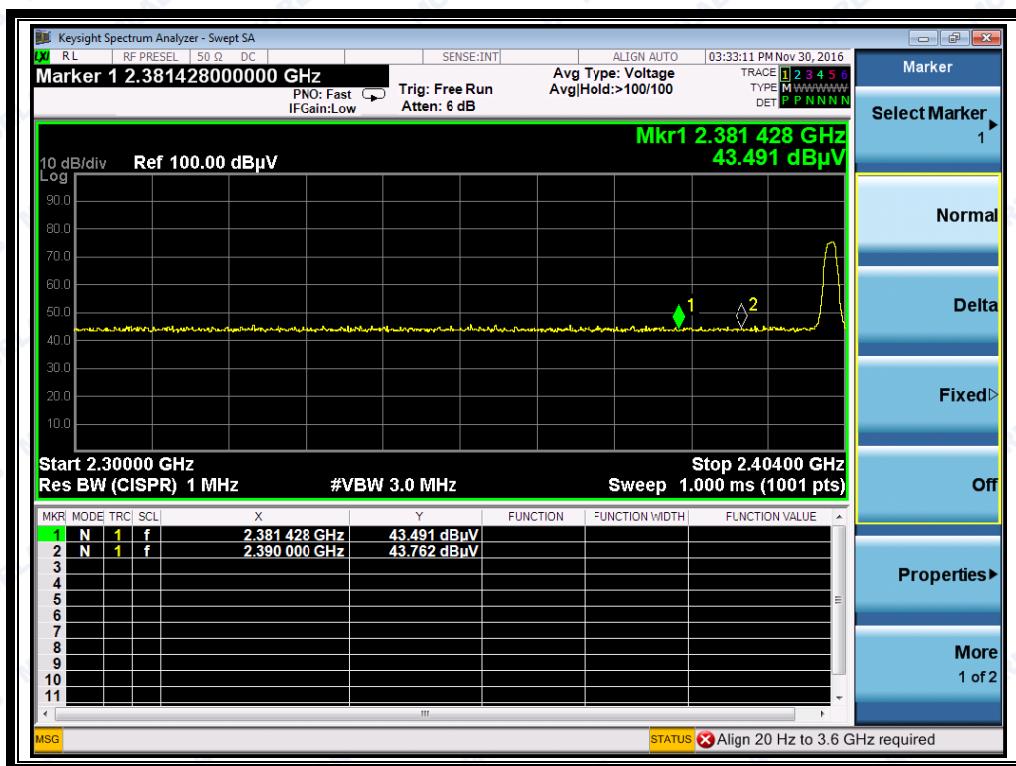
#### A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading $U_R$ (dBuV)	$A_T$ (dB)	$A_{\text{Factor}}$ (dB@3m)	Max. Emission $E$ (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Verdict
0	2381.43	PK	43.49	-33.63	32.56	42.42	74	Pass
0	2378.20	AV	32.53	-33.63	32.56	31.46	54	Pass
39	2485.77	PK	43.54	-33.18	32.5	42.86	74	Pass
39	2485.24	AV	32.61	-33.18	32.5	31.93	54	Pass

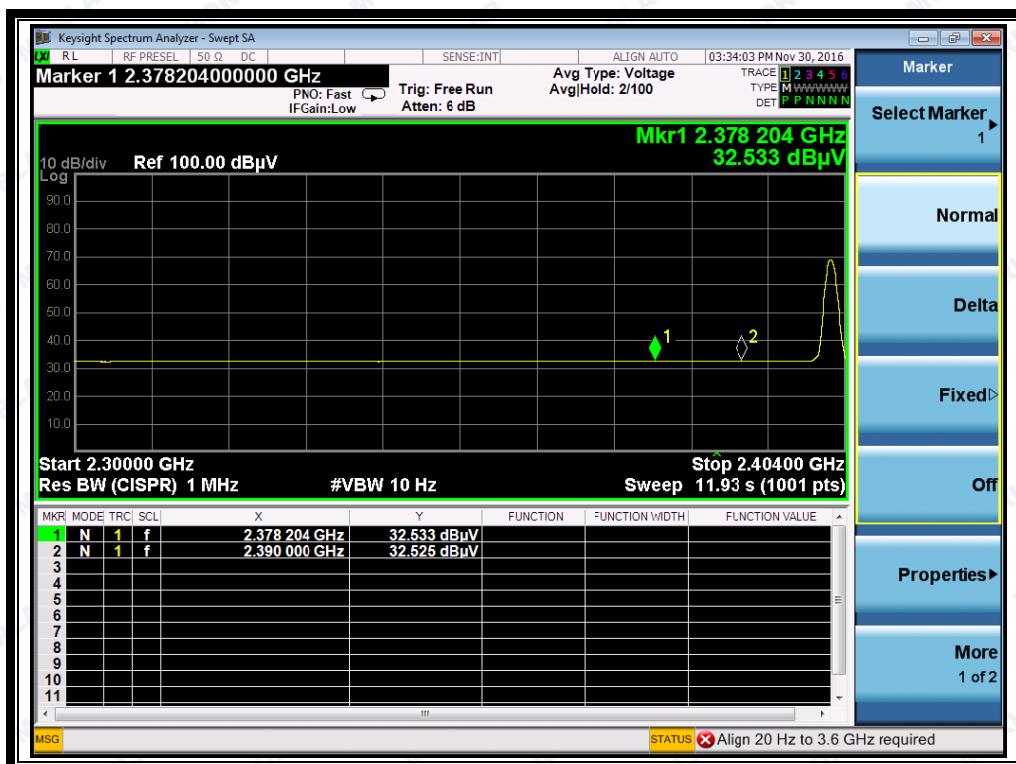
#### B. Test Plots:



REPORT No.: SZ16110119W04



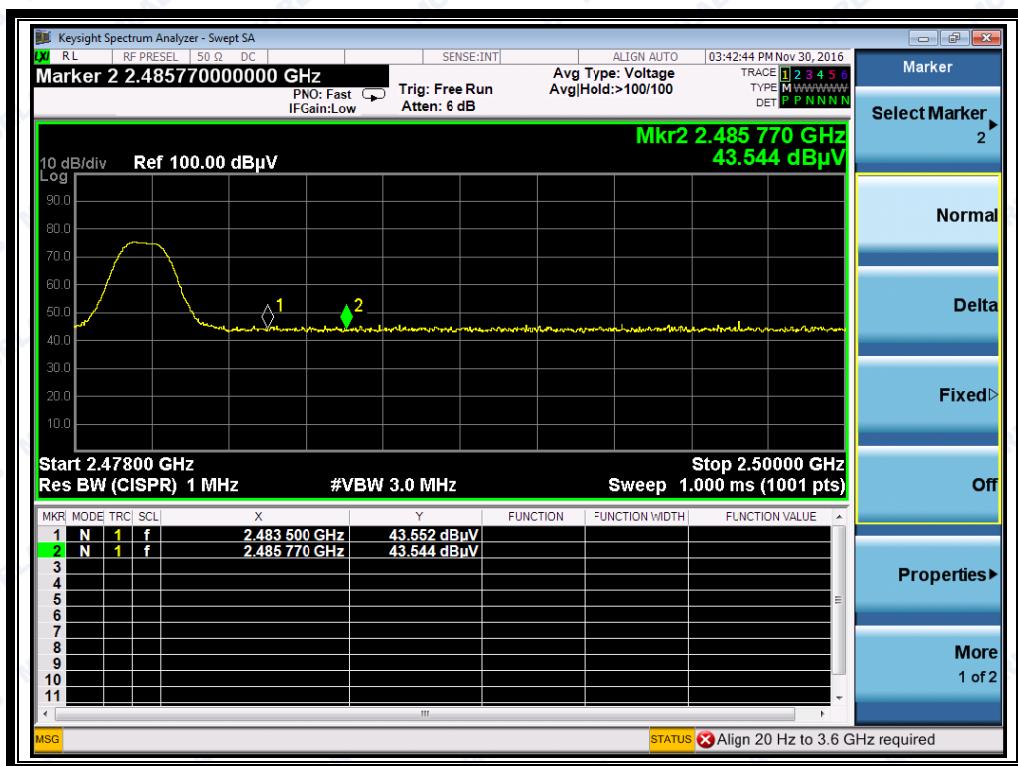
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVG)



REPORT No.: SZ16110119W04



(Plot B1: Channel = 39 PEAK)



(Plot B2: 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 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

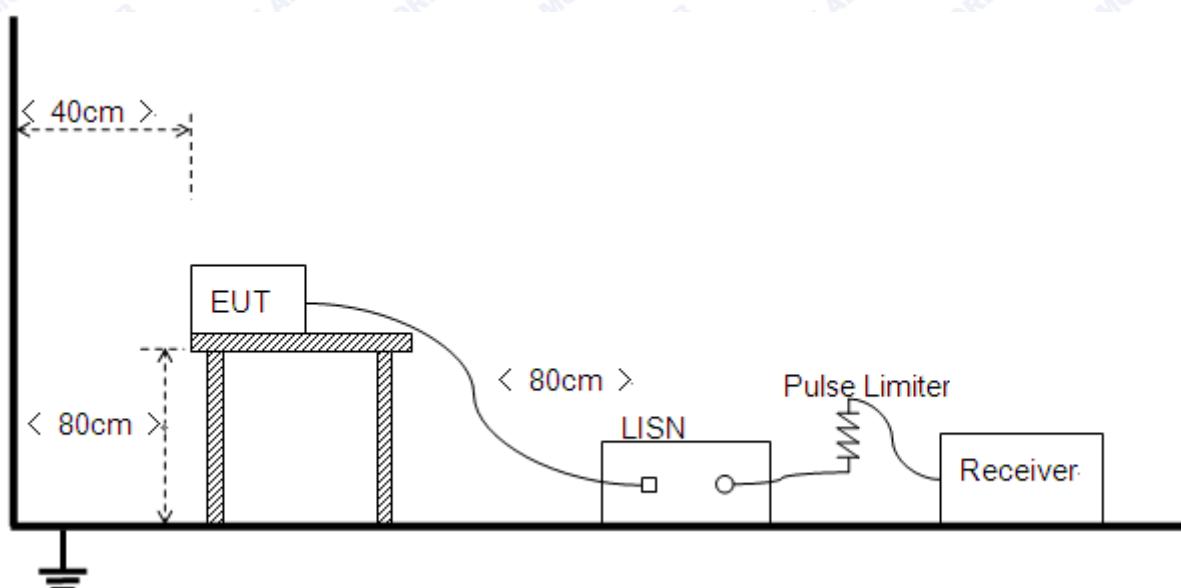
Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

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

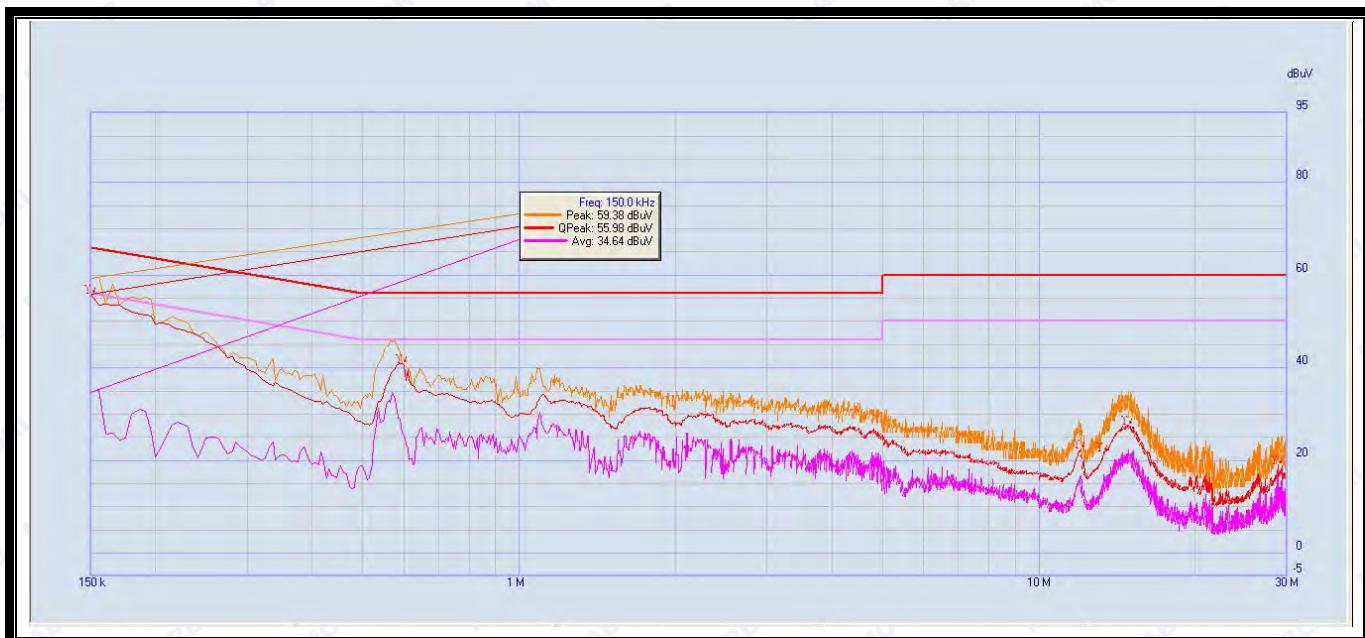
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT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

#### A. Test setup:

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

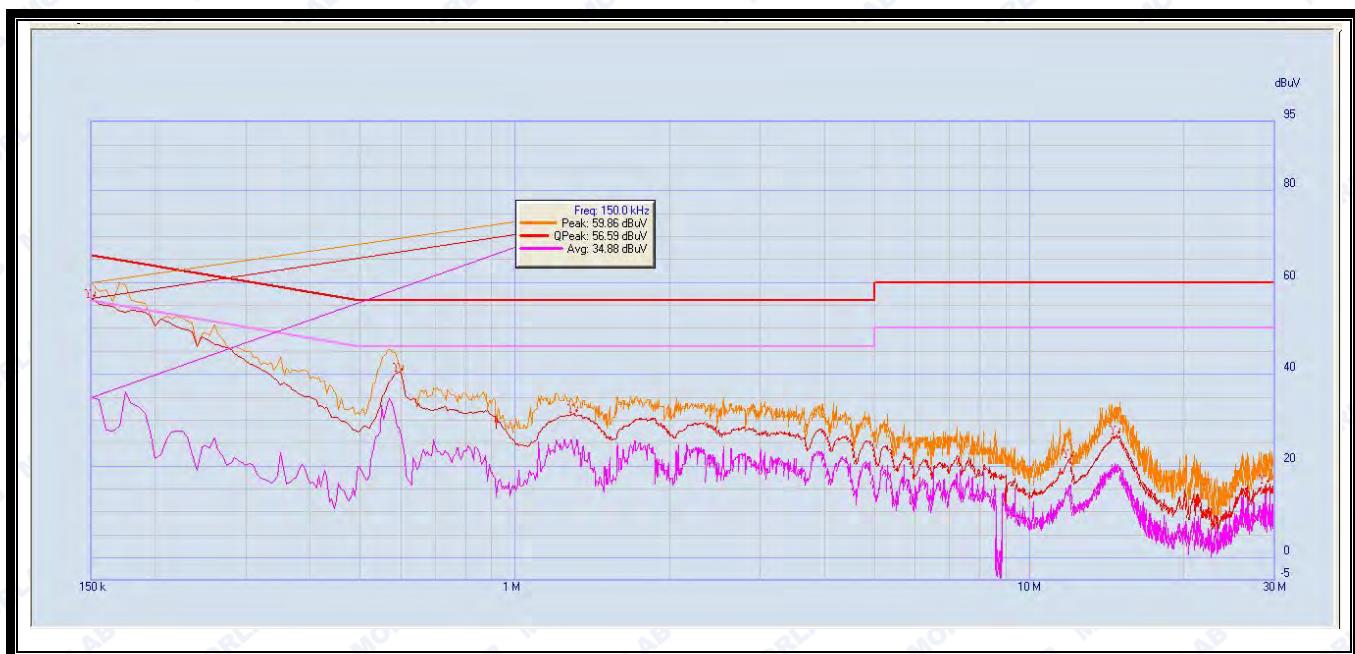
**Note:** The test voltage is AC 120V/60Hz.

#### B. Test Plots:



(Plot A: L Phase)

NO.	Fre. (MHz)	Emission Level (dB $\mu$ V)		Limit (dB $\mu$ V)		Power- line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.15	55.98	34.64	66	56	Line	PASS
2	0.595	40.93	25.99	56	46		PASS
3	12.01	22.13	15.01	60	50		PASS
4	13.245	20.71	13.25	60	50		PASS
5	14.825	27.38	19.38	60	50		PASS
6	28.69	18.72	18.23	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	0.15	56.59	34.88	66	56	Line	PASS
2	0.595	40.43	28.42	56	46		PASS
3	1.305	31.02	23.76	56	46		PASS
4	11.925	21.33	14.59	60	50		PASS
5	14.73	26.36	19.42	60	50		PASS
6	28.685	15.05	13.93	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 ( $\mu$ V/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:

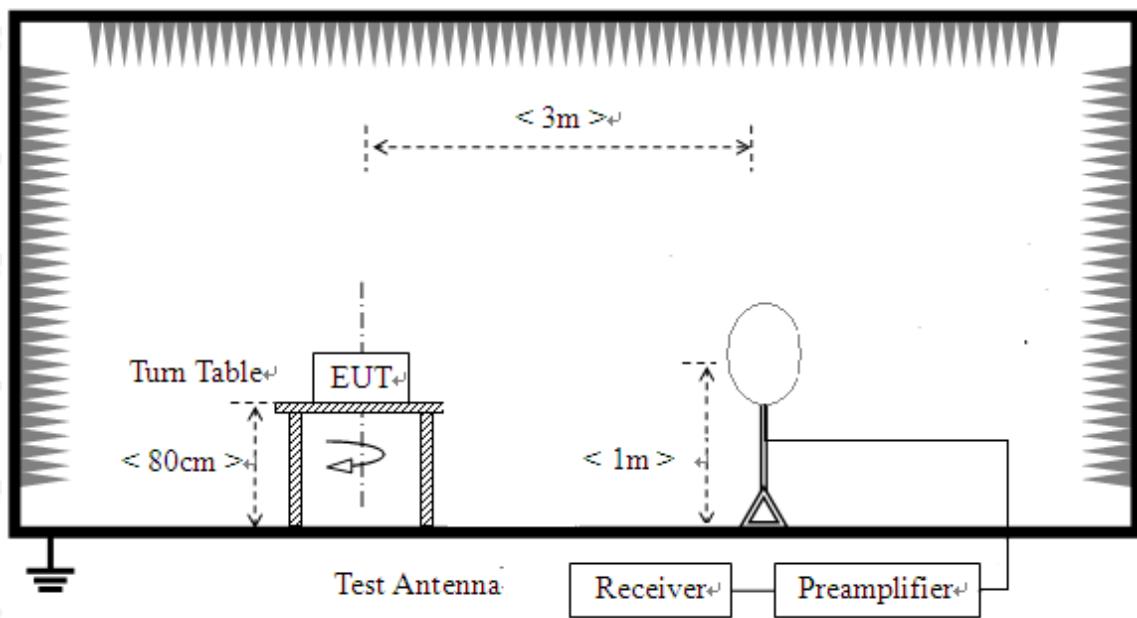
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength 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)

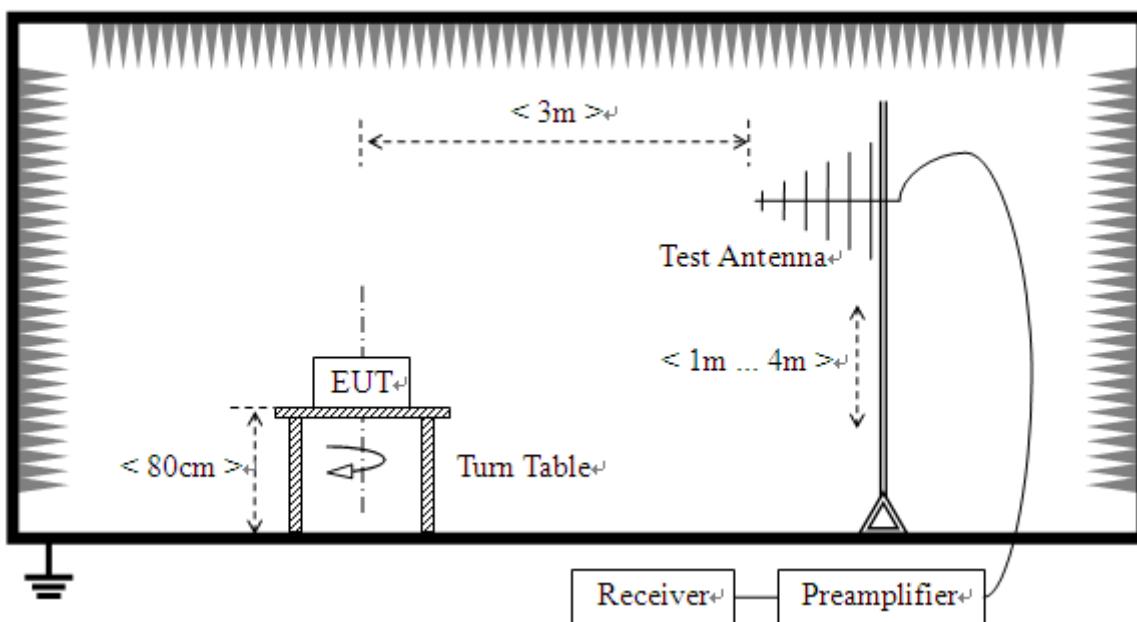
## 2.8.2 Test Description

### A. Test Setup:

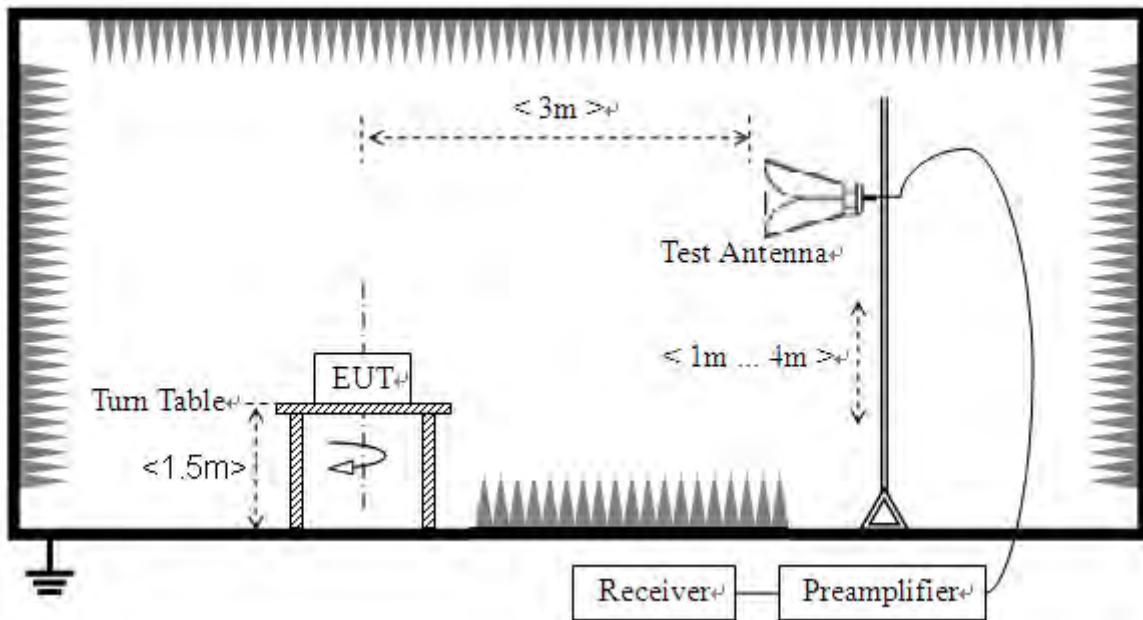
- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



## 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:

- 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.
- 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:

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

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

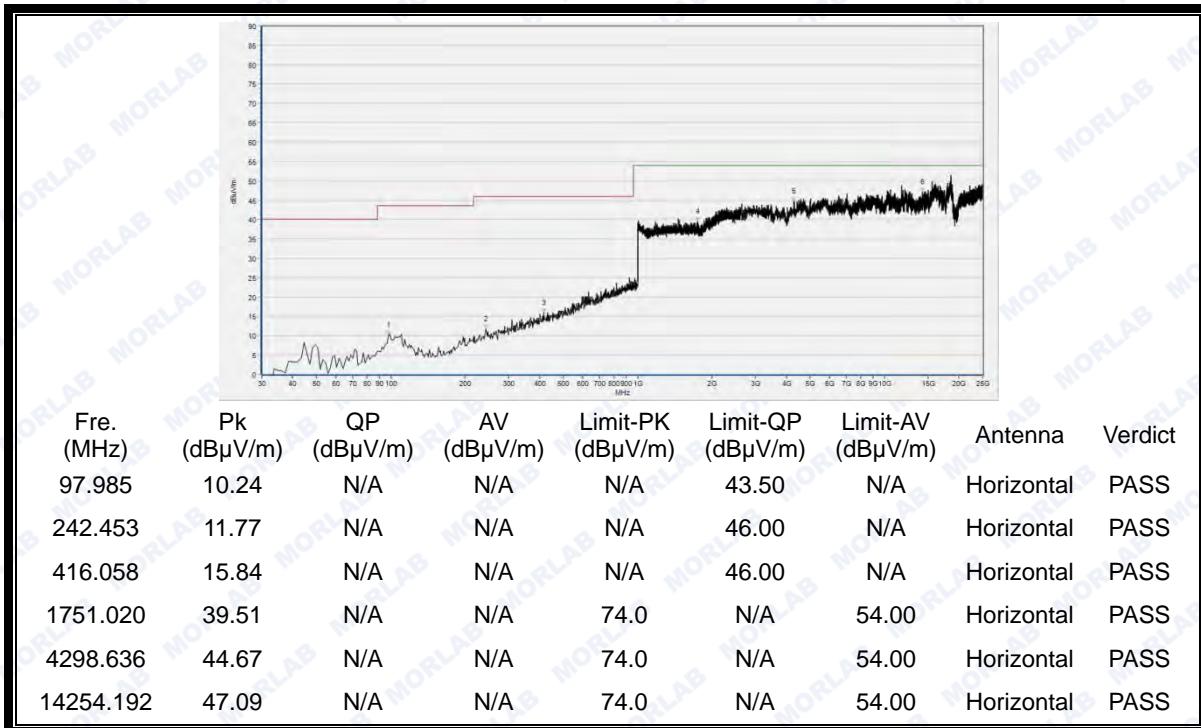
$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

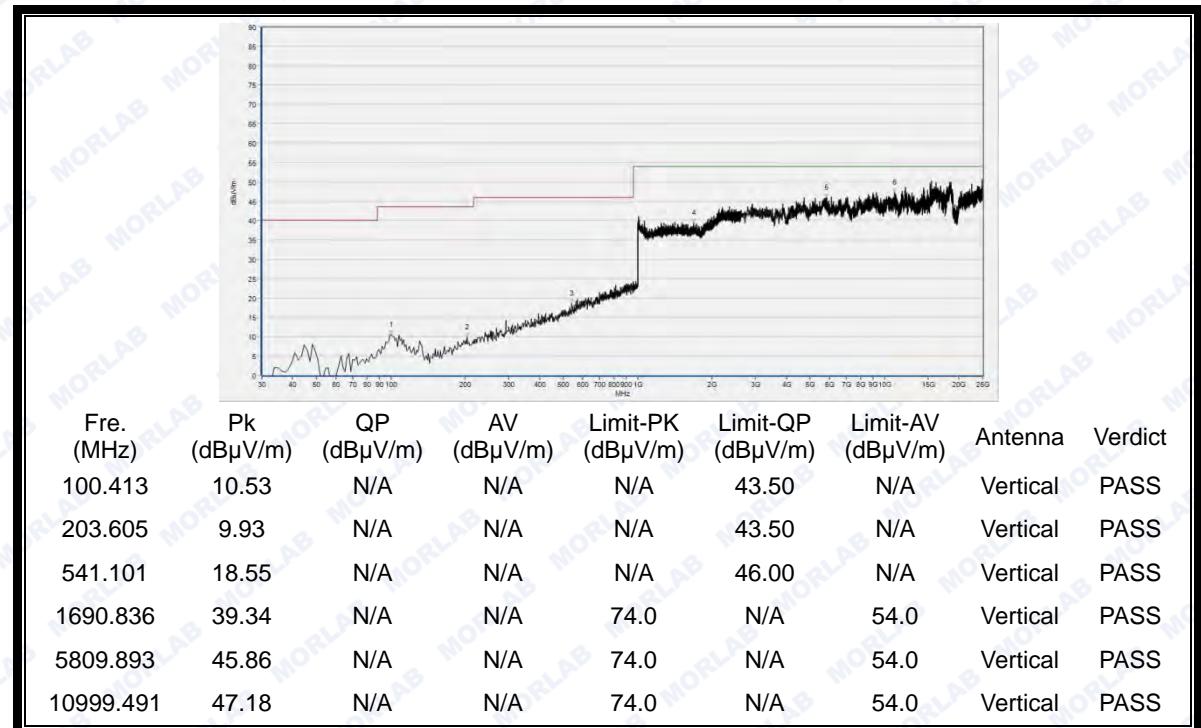
During the test, the total correction Factor  $A_T$  and  $A_{\text{Factor}}$  were built in test software.

**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.

**A. Test Plots for the Whole Measurement Frequency Range:**Plots for Channel = 0

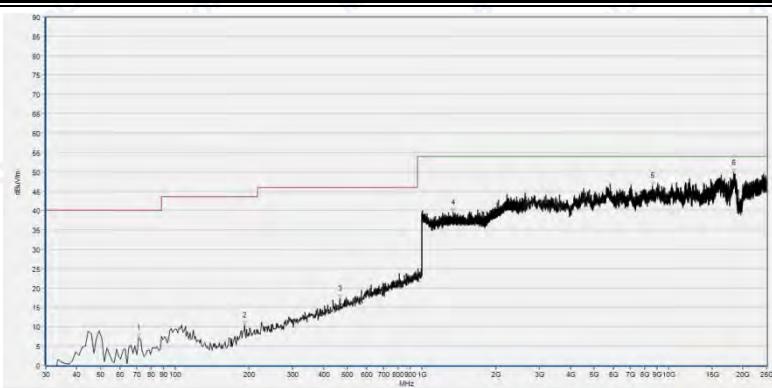
(Antenna Horizontal, 30MHz to 25GHz)



(Antenna Vertical, 30MHz to 25GHz)

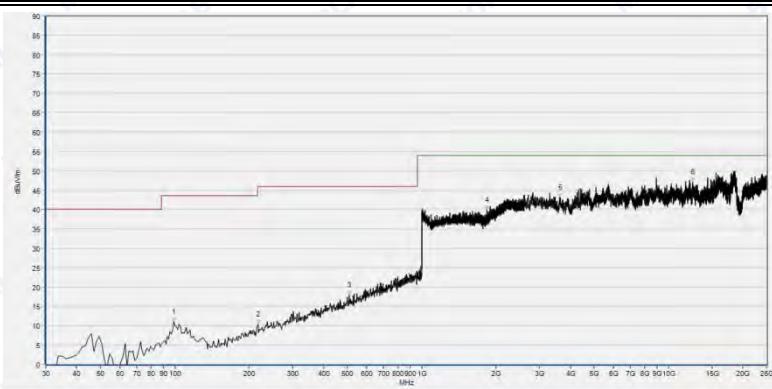


## Plot for Channel = 19



Fre. (MHz)	Pk (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-QP (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Antenna	Verdict
71.277	7.17	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
191.464	10.35	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
465.832	17.29	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1338.055	39.55	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
8608.365	46.46	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS
18384.688	49.77	N/A	N/A	74.0	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

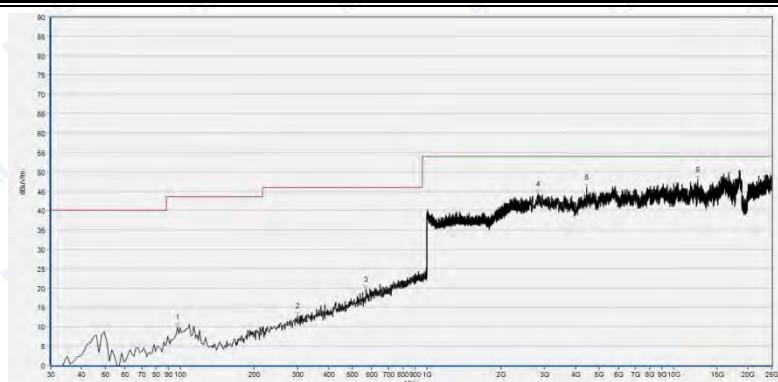


Fre. (MHz)	Pk (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-QP (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Antenna	Verdict
99.199	11.14	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
216.959	10.32	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
507.109	17.94	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1840.656	39.83	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
3638.734	43.10	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12510.747	47.09	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

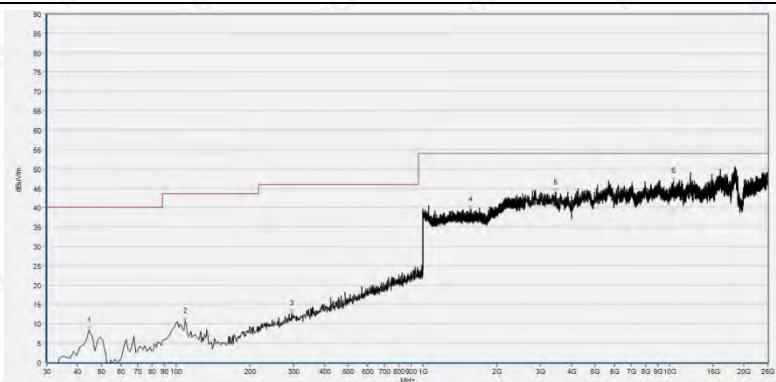


## Plot for Channel = 39



Fre. (MHz)	Pk (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-QP (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Antenna	Verdict
97.985	9.92	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
300.726	12.73	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
567.810	19.58	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2824.041	44.29	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4437.134	46.00	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
12518.894	47.97	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	AV (dB $\mu$ V/m)	Limit-PK (dB $\mu$ V/m)	Limit-QP (dB $\mu$ V/m)	Limit-AV (dB $\mu$ V/m)	Antenna	Verdict
44.568	8.33	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
108.911	10.65	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
294.656	12.69	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1562.145	39.50	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
3451.355	43.99	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
10355.883	46.94	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.1, 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 registration number is 695796.

### 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



REPORT No.: SZ16110119W04

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	2016.03.02	2017.03.01
2	Power Splitter	NW521	1506A	Weinschel	2016.03.02	2017.03.01
3	Attenuator 1	(N/A.)	10dB	Resnet	2016.03.02	2017.03.01
4	Attenuator 2	(N/A.)	3dB	Resnet	2016.03.02	2017.03.01
5	EXA Signal Analyzer	MY53470836	N9010A	Agilent	2015.12.03	2016.12.02
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	2016.03.02	2017.03.01
2	LISN	812744	NSLK 8127	Schwarzbeck	2016.03.02	2017.03.01
3	Service Supplier	100448	CMU200	R&S	2016.03.02	2017.03.01
4	Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2016.03.02	2017.03.01
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



REPORT No.: SZ16110119W04

## 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	2016.03.02	2017.03.01
2	Receiver	MY54130016	N9038A	Agilent	2016.03.02	2017.03.01
3	Test Antenna - Bi-Log	N/A	VULB9163	Schwarzbeck	2016.03.02	2017.03.01
4	Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2016.03.02	2017.03.01
5	Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2016.03.02	2017.03.01
6	Test Antenna - Horn	71688	BBHA 9120D	Schwarzbeck	2016.03.02	2017.03.01
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	2016.03.02	2017.03.01
11	18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde&Schwarz	2016.03.02	2017.03.01

## 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	2016.03.02	2017.03.01

## 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	2016.03.02	2017.03.01

## 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	2016.03.02	2017.03.01

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

MORLAB GROUP

FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,  
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China

Tel: 86-755-36698555

Fax: 86-755-36698525

Http://www.morlab.com

E-mail: service@morlab.cn