

FCC 47 CFR PART 15 SUBPART C
CERTIFICATION TEST REPORT

For

Wireless Communication Module

MODEL No.: MLWX001

FCC ID: 2AOA9MLWX001

Trade Mark: 

REPORT NO.: ES171207987E

ISSUE DATE: January 19, 2018

Prepared for

JIANGSU MULIN INTELLIGENCE ELECTRIC., LTD

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1 TEST RESULT CERTIFICATION

Applicant: JIANGSU MULIN INTELLIGENCE ELECTRIC., LTD
#10 BANGSHANG RD, CUIBEI INDUSTRIAL ZONE, WUJIN TOWN, CHANGZHOU, JIANGSU, CHINA

Manufacturer: JIANGSU MULIN INTELLIGENCE ELECTRIC., LTD
#10 BANGSHANG RD, CUIBEI INDUSTRIAL ZONE, WUJIN TOWN, CHANGZHOU, JIANGSU, CHINA

EUT Description: Wireless Communication Module

Model Number: MLWX001

File Number: ES171207987E

Date of Test: December 08, 2017 to January 18, 2018

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2, Subpart J	
FCC 47 CFR Part 15, Subpart C	PASS

The above equipment was tested by EMTEK (SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.249

The test results of this report relate only to the tested sample identified in this report.

Date of Test : December 08, 2017 to January 18, 2018

Prepared by : Doris Su
Doris Su /Editor

Reviewer : Joe Xia
Joe Xia/Editor

Approve & Authorized Signer : Lisa Wang
Lisa Wang/Manager



2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Modulation:	GFSK
Operating Frequency Range(s):	2420-2459MHz
Number of Channels:	40 channels
Antenna Type :	PCB Antenna
Antenna Gain:	0dBi
Power supply:	<input checked="" type="checkbox"/> DC supply: DC 1.6-3.6V <input type="checkbox"/> Adapter supply: Model: INPUT: OUTPUT:

Note: for more details, please refer to the User's manual of the EUT.

3 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark
15.207	Conducted Emission	N/A	
15.209	Radiated Emission	PASS	
15.249	Radiated Spurious Emission	PASS	
15.249	Band edge test	PASS	
15.249	20dB Bandwidth	PASS	

NOTE1: N/A (Not Applicable)
NOTE2: The report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2AOA9MLWX001 filing to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:
 FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C

4.2 MEASUREMENT EQUIPMENT USED

4.2.1 Radiated Emission Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	DUE CAL.
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/21/2017	05/20/2018
Pre-Amplifier	HP	8447D	2944A07999	05/20/2017	05/19/2018
Bilog Antenna	Schwarzbeck	VULB9163	142	05/20/2017	05/19/2018
Loop Antenna	ARA	PLA-1030/B	1029	05/21/2017	05/20/2018
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/21/2017	05/20/2018
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/21/2017	05/20/2018
Cable	Schwarzbeck	AK9513	ACRX1	05/21/2017	05/20/2018
Cable	Rosenberger	N/A	FP2RX2	05/21/2017	05/20/2018
Cable	Schwarzbeck	AK9513	CRPX1	05/21/2017	05/20/2018
Cable	Schwarzbeck	AK9513	CRRX2	05/21/2017	05/20/2018

4.2.2 Radio Frequency Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	DUE CAL.
Spectrum Analyzer	Agilent	E4407B	88156318	05/21/2017	05/20/2018
Signal Analyzer	Agilent	N9010A	My53470879	05/21/2017	05/20/2018
Power meter	Anritsu	ML2495A	0824006	05/21/2017	05/20/2018
Power sensor	Anritsu	MA2411B	0738172	05/21/2017	05/20/2018

Remark: Each piece of equipment is scheduled for calibration once a year.

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those modulation GFSK were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2420	18	2438
1	2421	19	2439	37	2457
2	2422	20	2440	38	2458
...	39	2459

Note: $fc = 2402\text{MHz} + k \times 2\text{MHz}$ $k=0 \text{ to } 39$

Test Frequency and channel:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2420	19	2440	39	2459

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

5.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

EMC Lab. : Accredited by CNAS, 2016.10.24
The certificate is valid until 2022.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01: 2006(identical to ISO/IEC17025: 2005)
The Certificate Registration Number is L2291

: Accredited by TUV Rheinland Shenzhen, 2016.5.19
The Laboratory has been assessed according to the requirements ISO/IEC 17025.

: Accredited by FCC, August 03, 2017
Designation Number: CN1204
Test Firm Registration Number: 882943.

: Accredited by Industry Canada, November 24, 2015
The Certificate Registration Number is 4480A

6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

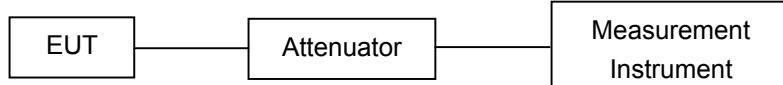
Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0 \text{dB}$
Conducted Emissions Test	$\pm 2.0 \text{dB}$
Radiated Emission Test	$\pm 2.0 \text{dB}$
Power Density	$\pm 2.0 \text{dB}$
Occupied Bandwidth Test	$\pm 1.0 \text{dB}$
Band Edge Test	$\pm 3 \text{dB}$
All emission, radiated	$\pm 3 \text{dB}$
Antenna Port Emission	$\pm 3 \text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

Measurement Uncertainty for a level of Confidence of 95%

7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP 1

The WLAN component's antenna port(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

Above 30MHz:

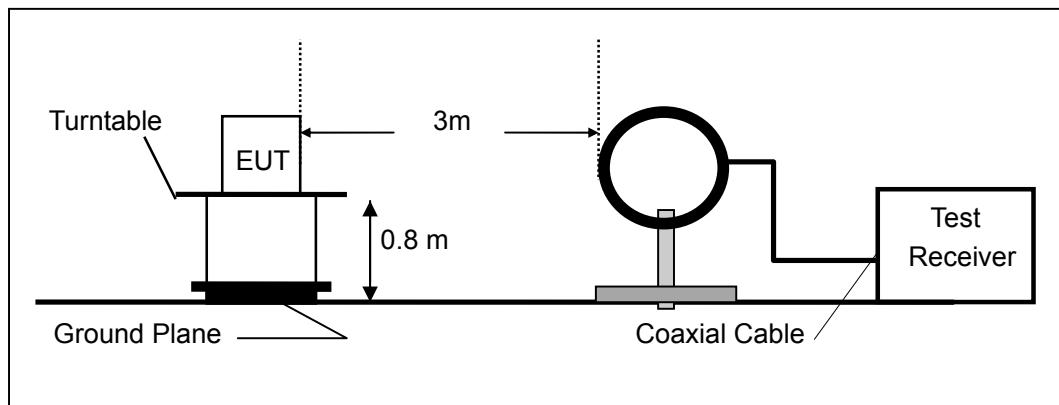
The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

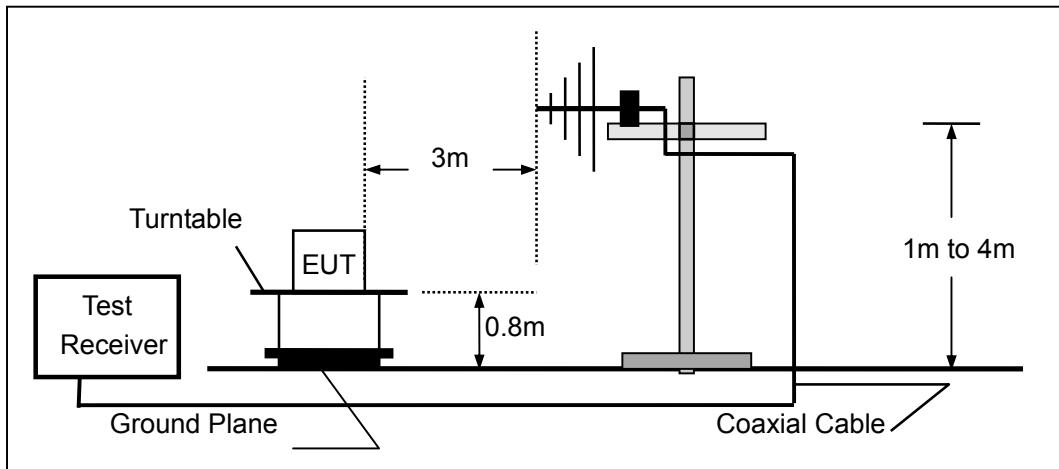
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

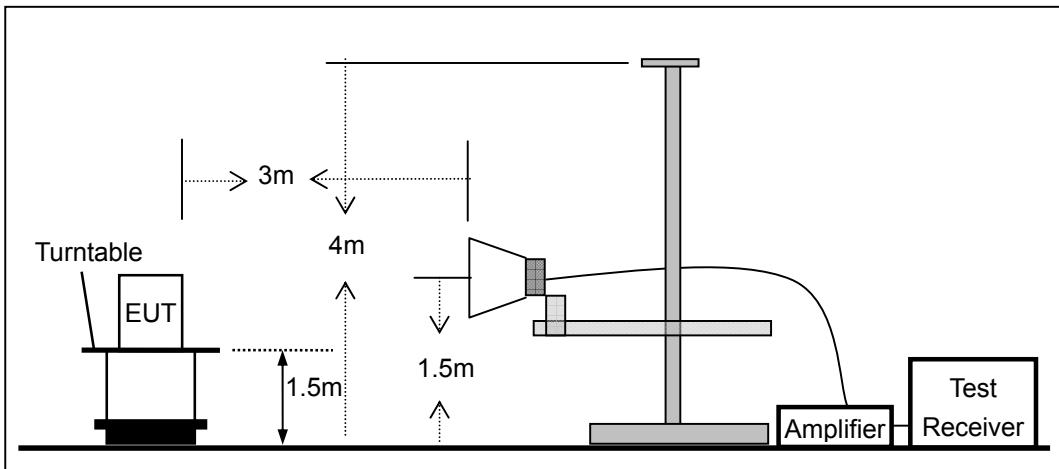
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz



7.3 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8 TEST REQUIREMENTS

8.1 BANDWIDTH TEST

8.1.1 Applicable Standard

According to FCC Part 15.249

8.1.2 Conformance Limit

N/A

8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.1.4 Test Procedure

The EUT was operating in controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) =300 kHz.

Set Span=2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

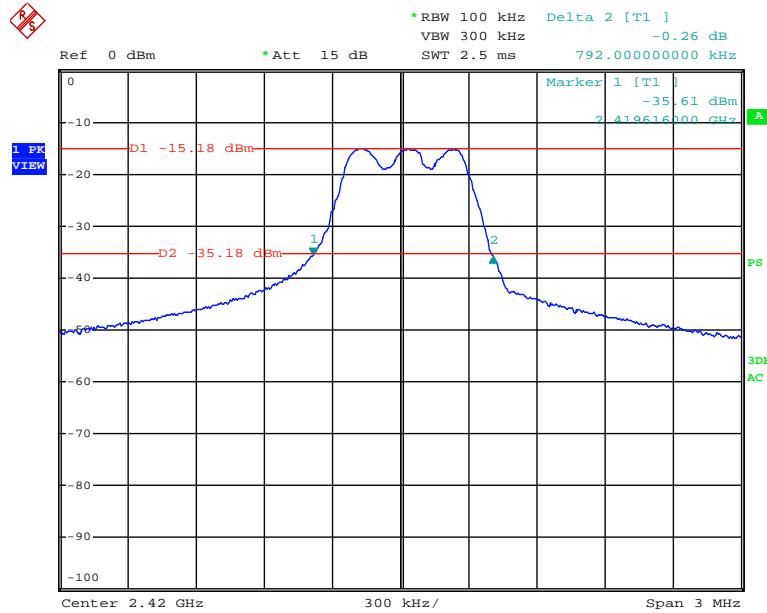
Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Measure and record the results in the test report.

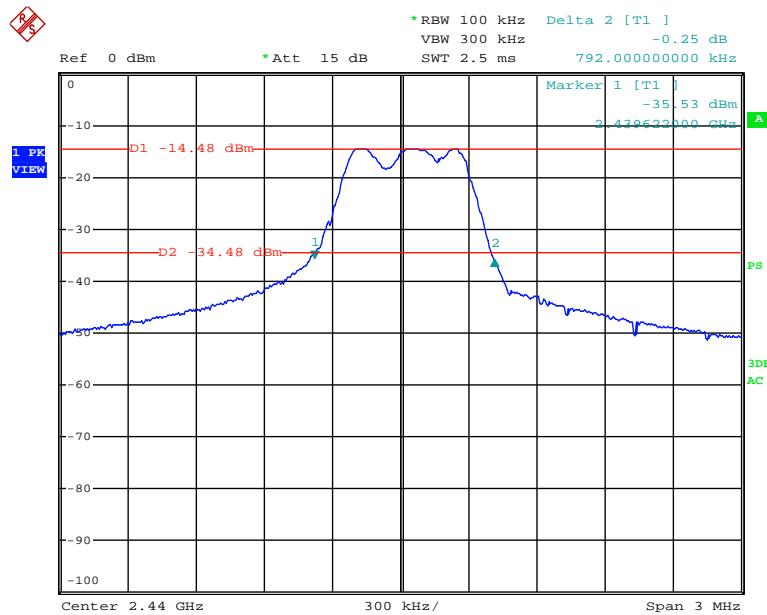
8.1.5 Test Results

Temperature :	21°C	Test Date :	Jan 11, 2018
Humidity :	50 %	Test By:	King Kong

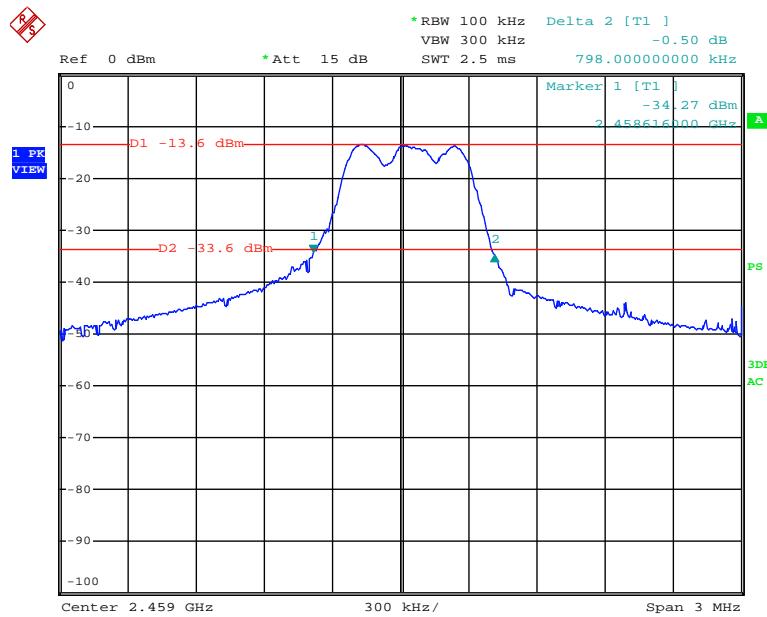
Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Verdict
TX	0	2420	0.792	PASS
	19	2440	0.792	PASS
	39	2459	0.798	PASS



Date: 11.JAN.2018 13:12:19



Date: 11.JAN.2018 13:08:01



Date: 11.JAN.2018 13:00:45

8.2 FREQUENCY STABILITY

8.2.1 Applicable Standard

According to FCC Part 15.249

8.2.2 Conformance Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 10\text{ppm}$ of the operating frequency over a temperature variation of -20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.2.3 Test Configuration

Test according to clause 6.1 radio frequency test setup

8.2.4 Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 10 kHz.

Set the video bandwidth (VBW) =30 kHz.

Set Span= Entire absence of modulation emissions bandwidth

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

Beginning at each temperature level specified in user manual , the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level

Measure and record the results in the test report.

8.2.5 Test Results

Temperature :	20	Test Date :	Jan 11, 2017
Humidity :	50 %	Test By:	King Kong

Channel Number	Test Conditions		Test Frequency (MHz)	Max. Deviation (MHz)	Max. Deviation (ppm)	Verdict
	Voltage(V)	Temp(°C)				
0	Vnom	-20	2420	0.0030	1.240	PASS
		-10	2420	0.0030	1.240	PASS
		0	2420	0.0024	0.992	PASS
		10	2420	0.0030	1.240	PASS
		20	2420	0.0030	1.240	PASS
		30	2420	0.0024	0.992	PASS
		40	2420	0.0030	1.240	PASS
		50	2420	0.0030	1.240	PASS
		85% Vnom	20	0.0024	0.992	PASS
	115% Vnom	20	2420	0.0030	1.240	PASS
19	Vnom	-20	2440	0.0018	0.738	PASS
		-10	2440	0.0018	0.738	PASS
		0	2440	0.0017	0.697	PASS
		10	2440	0.0017	0.697	PASS
		20	2440	0.0018	0.738	PASS
		30	2440	0.0017	0.697	PASS
		40	2440	0.0018	0.738	PASS
		50	2440	0.0017	0.697	PASS
		85% Vnom	20	0.0017	0.697	PASS
	115% Vnom	20	2440	0.0017	0.697	PASS
39	Vnom	-20	2459	0.0022	0.895	PASS
		-10	2459	0.0022	0.895	PASS
		0	2459	0.0020	0.813	PASS
		10	2459	0.0020	0.813	PASS
		20	2459	0.0022	0.895	PASS
		30	2459	0.0022	0.895	PASS
		40	2459	0.0022	0.895	PASS
		50	2459	0.0020	0.813	PASS
		85% Vnom	20	0.0022	0.895	PASS
	115% Vnom	20	2459	0.0022	0.895	PASS

8.3 RADIATED SPURIOUS EMISSION

8.3.1 Applicable Standard

According to FCC Part 15.249 and 15.209

8.3.2 Conformance Limit

According to FCC Part 15.249: 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) (see §15.205(c)).

According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (μ V/m)	300
0.490-1.705	2400/F(KHz)	20 log (μ V/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remark :1. Emission level in dB μ V/m=20 log (μ V/m)
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
 Limit line=Specific limits(dB μ V) + distance extrapolation factor.
 for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

Field strength of fundamental and Field strength of harmonics Limit:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50(94 dBV/m)	500(54 dBV/m)
2400-2483.5 MHz	50(94 dBV/m)	500(54 dBV/m)
5725-5875 MHz	50(94 dBV/m)	500(54 dBV/m)
24.0-24.25 GHz	250(108 dBV/m)	2500(68 dBV/m)

8.3.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

8.3.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz for

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 9kHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 200Hz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT,

measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data. Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

8.3.5 Test Results

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Temperature:	21 °C	Test Date:	Jan 11, 2018
Humidity:	51 %	Test By:	King Kong
Test mode:	TX Mode		

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor = $40\log(\text{Specific distance}/ \text{test distance})(\text{ dB})$;

Limit line=Specific limits(dBuV) + distance extrapolation factor

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Temperature :	24°C	Test Date :	Jan 11, 2018
Humidity :	53 %	Test By:	King Kong
Test mode:	GFSK	Frequency:	2420MHz

Freq. (MHz)	Ant.Po I. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4840.00	V	53.65	41.02	74.00	54.00	-20.35	-12.98
7260.00	V	53.75	42.10	74.00	54.00	-20.25	-11.90
9840.00	V	52.96	40.12	74.00	54.00	-21.04	-13.88
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
6831.00	H	48.08	37.89	74.00	54.00	-25.92	-16.11
7817.00	H	51.53	39.25	74.00	54.00	-22.47	-14.75
10367.00	H	54.51	40.21	74.00	54.00	-19.49	-13.79

Temperature :	24°C	Test Date :	Jan 11, 2018
Humidity :	53 %	Test By:	King Kong
Test mode:	GFSK	Frequency:	2440MHz

Freq. (MHz)	Ant.Po I. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7320.00	V	53.63	42.21	74.00	54.00	-20.37	-11.79
9760.00	V	53.65	43.10	74.00	54.00	-20.35	-10.90
11115.00	V	53.85	42.59	74.00	54.00	-20.15	-11.41
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
7919.00	H	51.93	42.10	74.00	54.00	-22.07	-11.90
10350.00	H	54.77	41.25	74.00	54.00	-19.23	-12.75
12373.00	H	55.29	42.65	74.00	54.00	-18.71	-11.35

Temperature :	24°C	Test Date :	Jan 11, 2018
Humidity :	53 %	Test By:	King Kong
Test mode:	GFSK	Frequency:	2459MHz

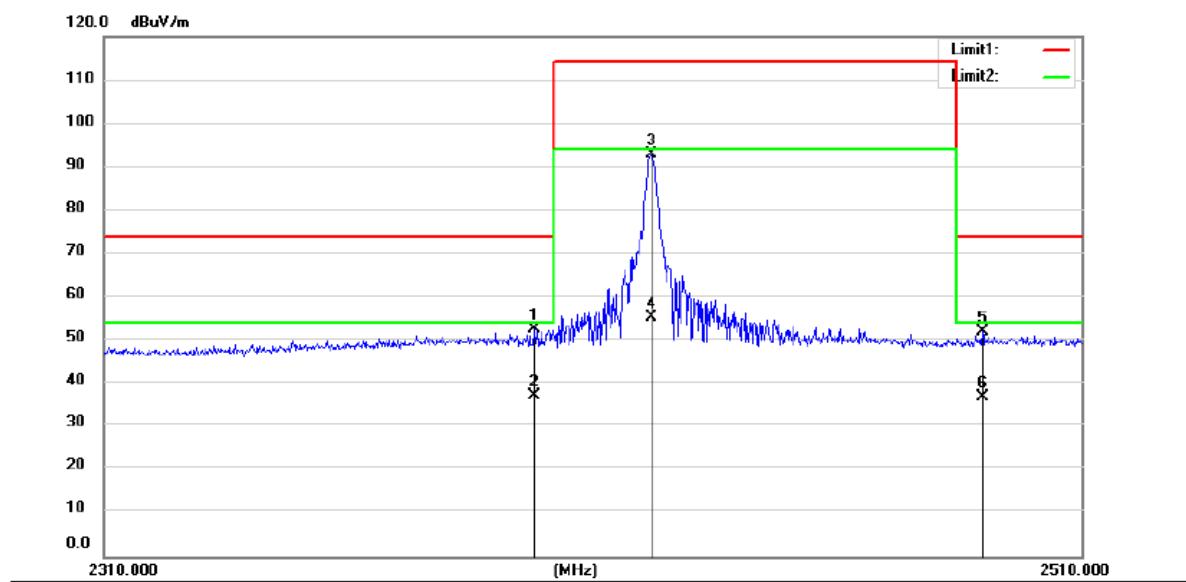
Freq. (MHz)	Ant.Po I. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7377.00	V	54.92	42.68	74.00	54.00	-19.08	-11.32
9836.00	V	55.29	43.91	74.00	54.00	-18.71	-10.09
13393.00	V	55.88	42.65	74.00	54.00	-18.12	-11.35
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
7377.00	H	51.09	41.25	74.00	54.00	-22.91	-12.75
9449.00	H	53.46	42.08	74.00	54.00	-20.54	-11.92
10401.00	H	54.96	42.56	74.00	54.00	-19.04	-11.44

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) 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.

■ Band Edge Test

Test Model GFSK
Channel 1: 2420MHz

Polarity: V
Test By: King Kong



Site site #1

Polarization: *Vertical*

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2420MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
			Level	Factor	ment					
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1		2396.200	41.64	11.00	52.64	74.00	-21.36	peak		
2	*	2396.200	26.21	11.00	37.21	54.00	-16.79	AVG		
3		2420.000	81.70	11.09	92.79	114.00	-21.21	peak		
4		2420.000	44.39	11.09	55.48	94.00	-38.52	AVG		
5		2489.200	40.99	11.11	52.10	74.00	-21.90	peak		
6		2489.200	26.07	11.11	37.18	54.00	-16.82	AVG		

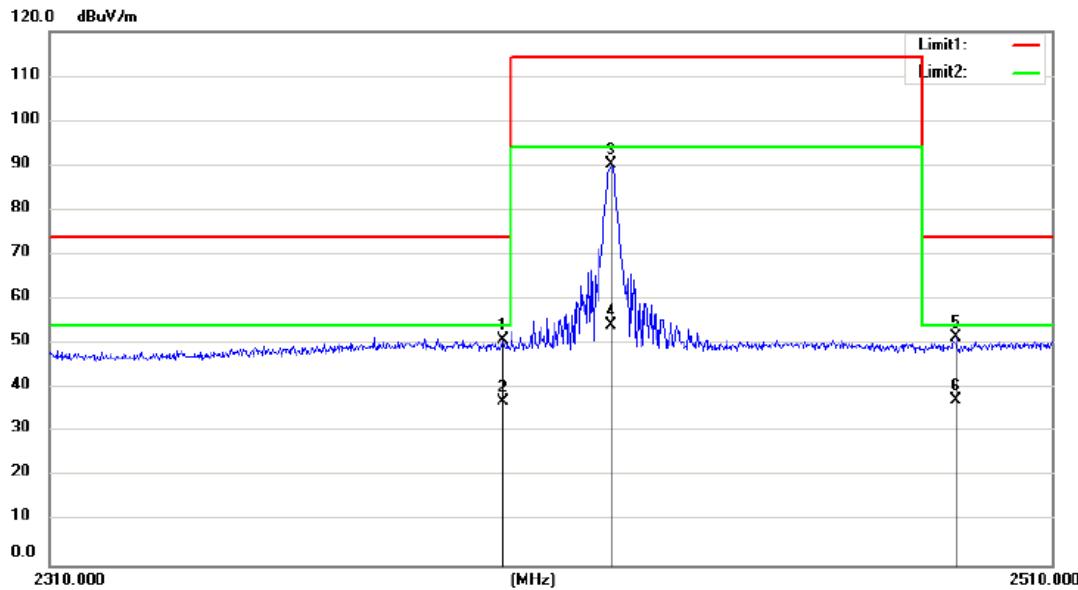
*:Maximum data x:Over limit !:over margin

Operator: KK

Test Model

GFSK
Channel 1: 2420MHz

Polarity: V
Test By: King Kong



Site site #1

Polarization: *Horizontal*

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2440MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table		
			Level	Factor	ment				Height	Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	
1		2398.600	40.02	10.96	50.98	74.00	-23.02	peak			
2		2398.600	25.99	10.96	36.95	54.00	-17.05	AVG			
3		2420.000	78.95	11.09	90.04	114.00	-23.96	peak			
4		2420.000	43.12	11.09	54.21	94.00	-39.79	AVG			
5		2490.400	40.29	11.13	51.42	74.00	-22.58	peak			
6	*	2490.400	26.13	11.13	37.26	54.00	-16.74	AVG			

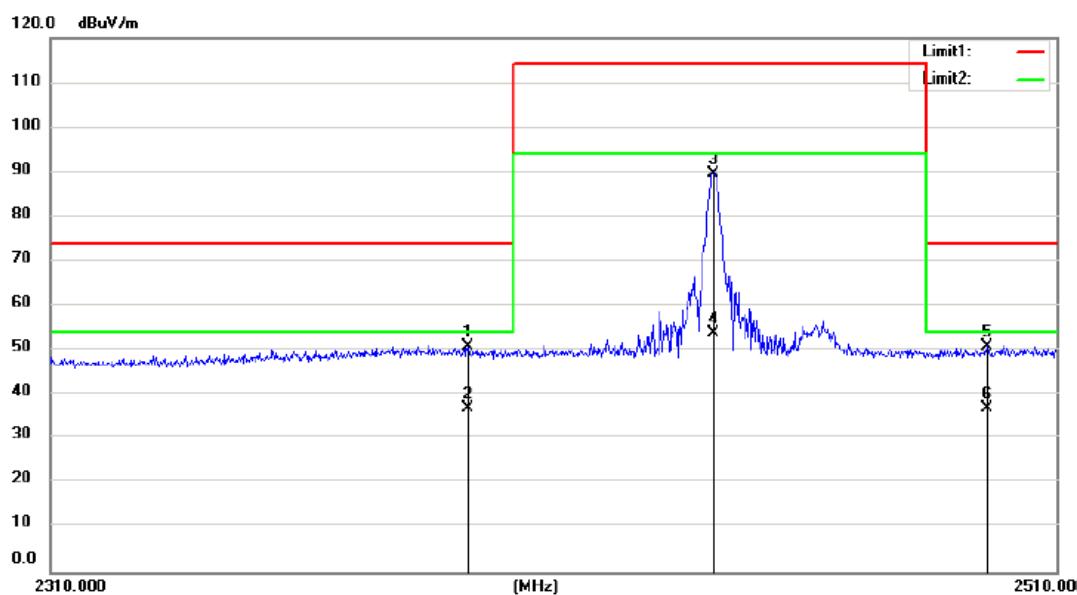
*:Maximum data x:Over limit !:over margin

Operator: KK

Test Model

GFSK
Channel 4: 2440MHz

Polarity:V
Test By: King Kong



Site site #1

Polarization: **Vertical**

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2440MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
			Level	Factor	ment					Degree
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1		2391.000	39.86	11.10	50.96	74.00	-23.04	peak		
2		2391.000	25.84	11.10	36.94	54.00	-17.06	AVG		
3		2440.000	78.73	10.94	89.67	114.00	-24.33	peak		
4		2440.000	42.92	10.94	53.86	94.00	-40.14	AVG		
5		2495.800	39.78	11.22	51.00	74.00	-23.00	peak		
6	*	2495.800	25.80	11.22	37.02	54.00	-16.98	AVG		

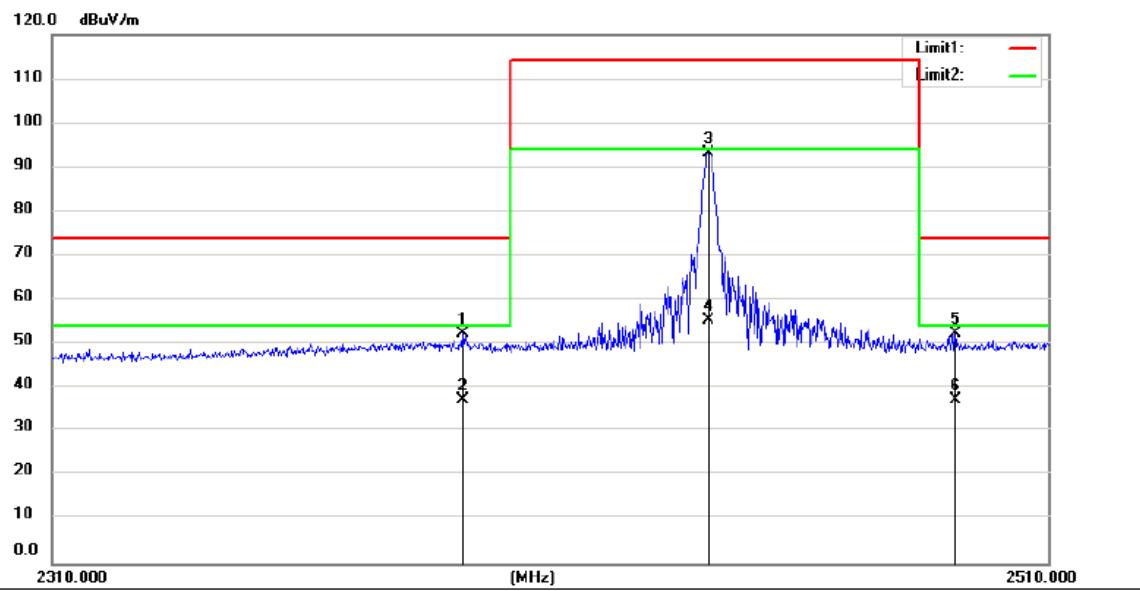
*:Maximum data x:Over limit !:over margin

Operator: KK

Test Model

GFSK
Channel 4: 2440MHz

Polarity:H
Test By: King Kong



Site site #1

Polarization: **Horizontal**

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2440MHz

Note:

No.	Mk.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
		Freq.	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1	2390.400	41.13	11.11	52.24	74.00	-21.76	peak		
2	2390.400	26.23	11.11	37.34	54.00	-16.66	AVG		
3	2440.000	82.34	10.94	93.28	114.00	-20.72	peak		
4	2440.000	44.27	10.94	55.21	94.00	-38.79	AVG		
5	2490.800	41.25	11.13	52.38	74.00	-21.62	peak		
6	* 2490.800	26.29	11.13	37.42	54.00	-16.58	AVG		

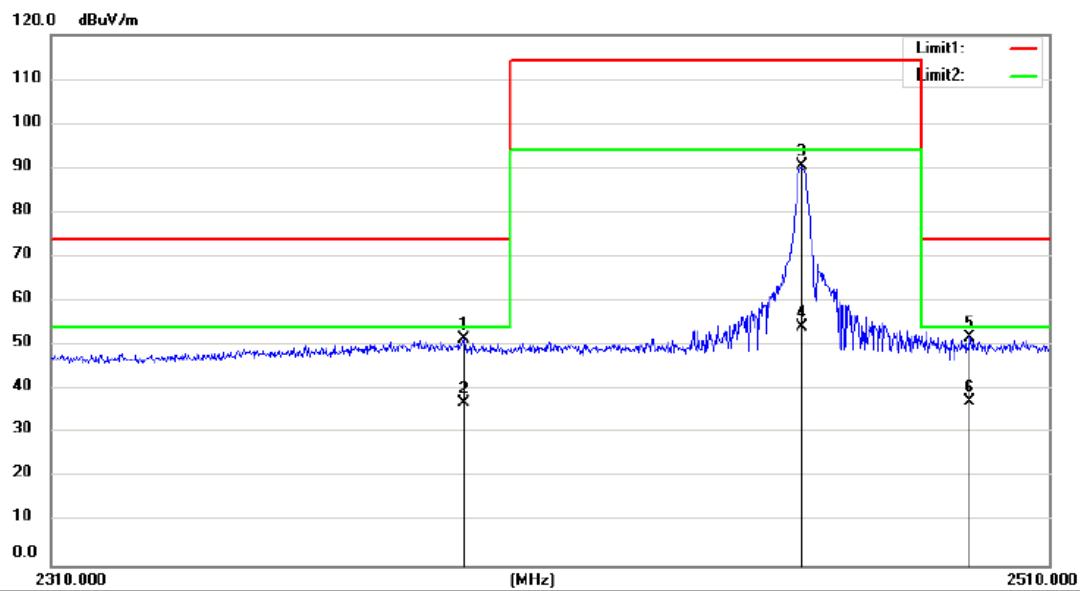
*:Maximum data x:Over limit !:over margin

Operator: KK

Test Model

GFSK
Channel 8: 2409MHz

Polarity:V
Test By: King Kong



Site site #1

Polarization: **Vertical**

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2459MHz

Note:

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
			dBuV	dB	dBuV/m					
1		2390.800	40.30	11.10	51.40	74.00	-22.60	peak		
2		2390.800	26.04	11.10	37.14	54.00	-16.86	AVG		
3		2459.000	78.66	11.65	90.31	114.00	-23.69	peak		
4		2459.000	42.37	11.65	54.02	94.00	-39.98	AVG		
5		2493.400	40.72	11.18	51.90	74.00	-22.10	peak		
6	*	2493.400	26.03	11.18	37.21	54.00	-16.79	AVG		

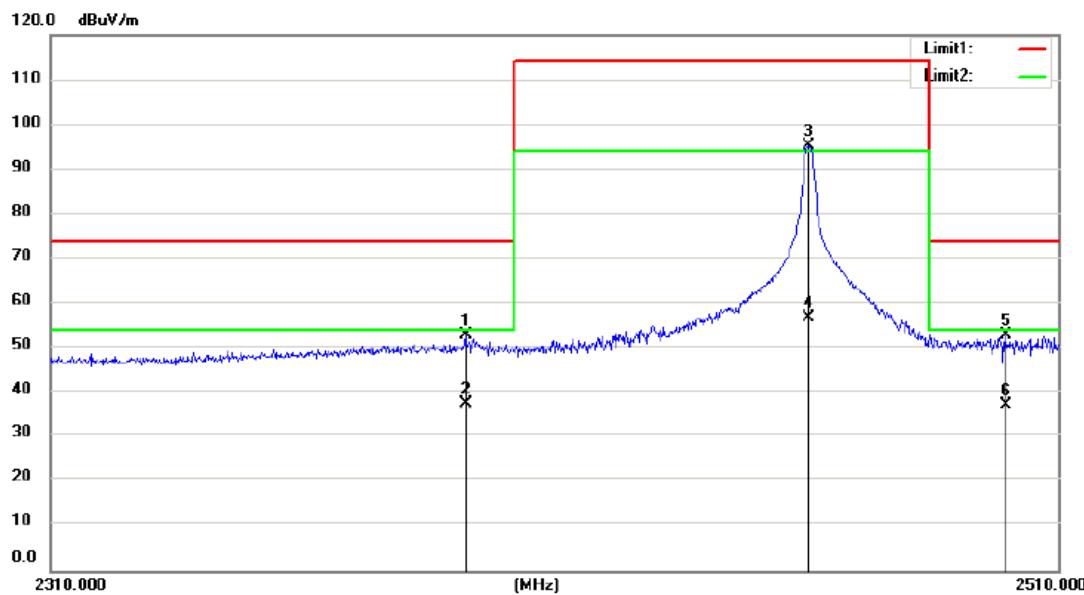
*:Maximum data x:Over limit !:over margin

Operator: KK

Test Model

GFSK
Channel 8: 2459MHz

Polarity:H
Test By: King Kong



Site site #1

Polarization: **Horizontal**

Temperature: 21 C

Limit: (RE)FCC Band Edge(Peak)

Power: DC 4.5V

Humidity: 47 %

Mode:TX 2459MHz

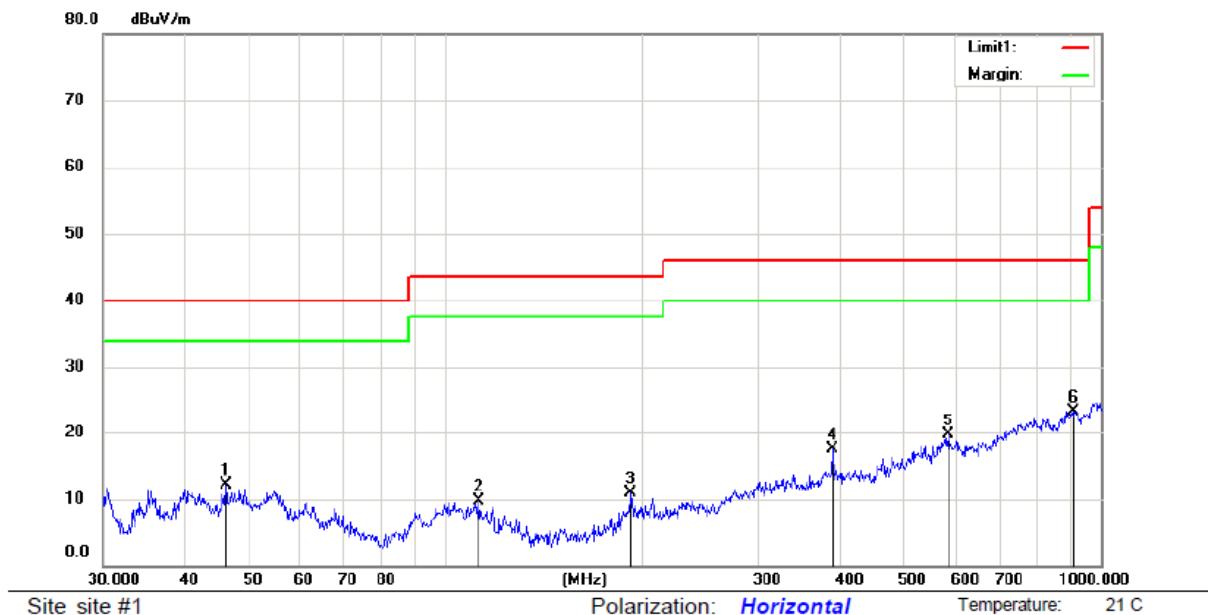
Note:

No.	Mk.	Reading	Correct	Measure-	Limit	Over	Antenna	Table		
		Freq.	Level	Factor					Comment	
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	
1	2390.400	41.82	11.11	52.93	74.00	-21.07	peak			
2 *	2390.400	26.45	11.11	37.56	54.00	-16.44	AVG			
3	2459.000	83.46	11.65	95.11	114.00	-18.89	peak			
4	2459.000	45.20	11.65	56.85	94.00	-37.15	AVG			
5	2499.200	41.70	11.29	52.99	74.00	-21.01	peak			
6	2499.200	25.94	11.29	37.23	54.00	-16.77	AVG			

*:Maximum data x:Over limit !:over margin

Operator: KK

Spurious Emission below 1GHz (30MHz to 1GHz)



Site site #1

Polarization: **Horizontal**

Temperature: 21 C

Limit: FCC Part15 Class B 3M Radiation

Power: DC 4.5V

Humidity: 47 %

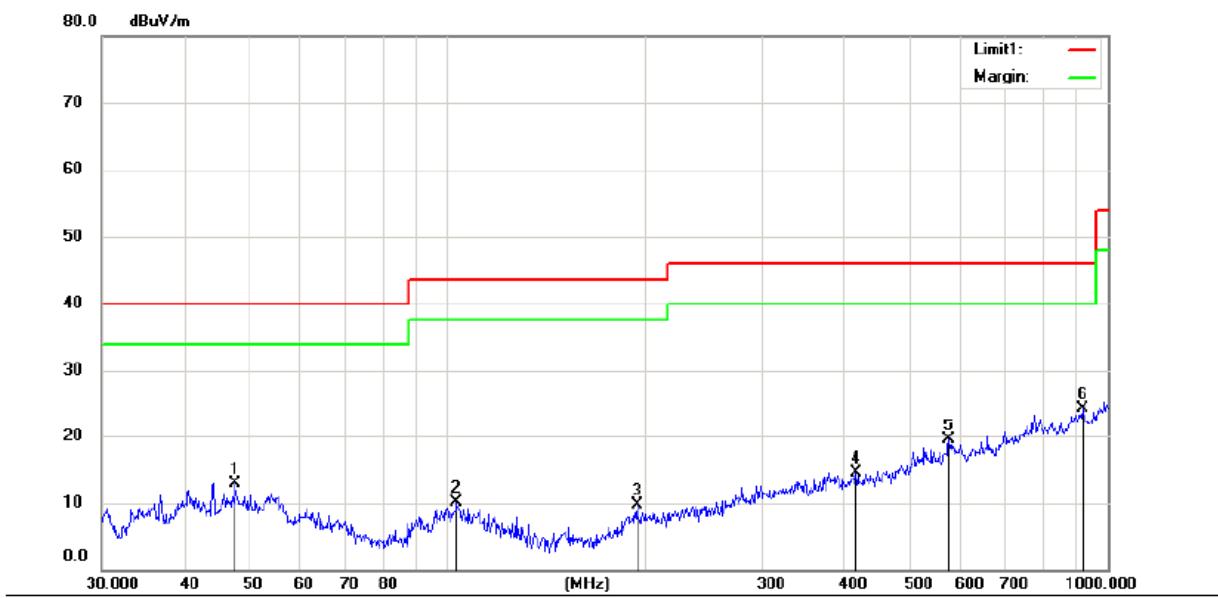
Mode:TX 2420MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
			Level	Factor	ment					Comment
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	
1		46.1780	31.51	-19.46	12.05	40.00	-27.95	QP		
2		112.5244	31.91	-22.24	9.67	43.50	-33.83	QP		
3		191.7450	32.91	-22.02	10.89	43.50	-32.61	QP		
4		389.3550	34.26	-16.79	17.47	46.00	-28.53	QP		
5		584.7895	31.36	-11.72	19.64	46.00	-26.36	QP		
6	*	909.6667	29.42	-6.06	23.36	46.00	-22.64	QP		

*:Maximum data x:Over limit !:over margin

Operator: KK



Site site #1

Polarization: **Vertical**

Temperature: 21 C

Limit: FCC Part15 Class B 3M Radiation

Power: DC 4.5V

Humidity: 47 %

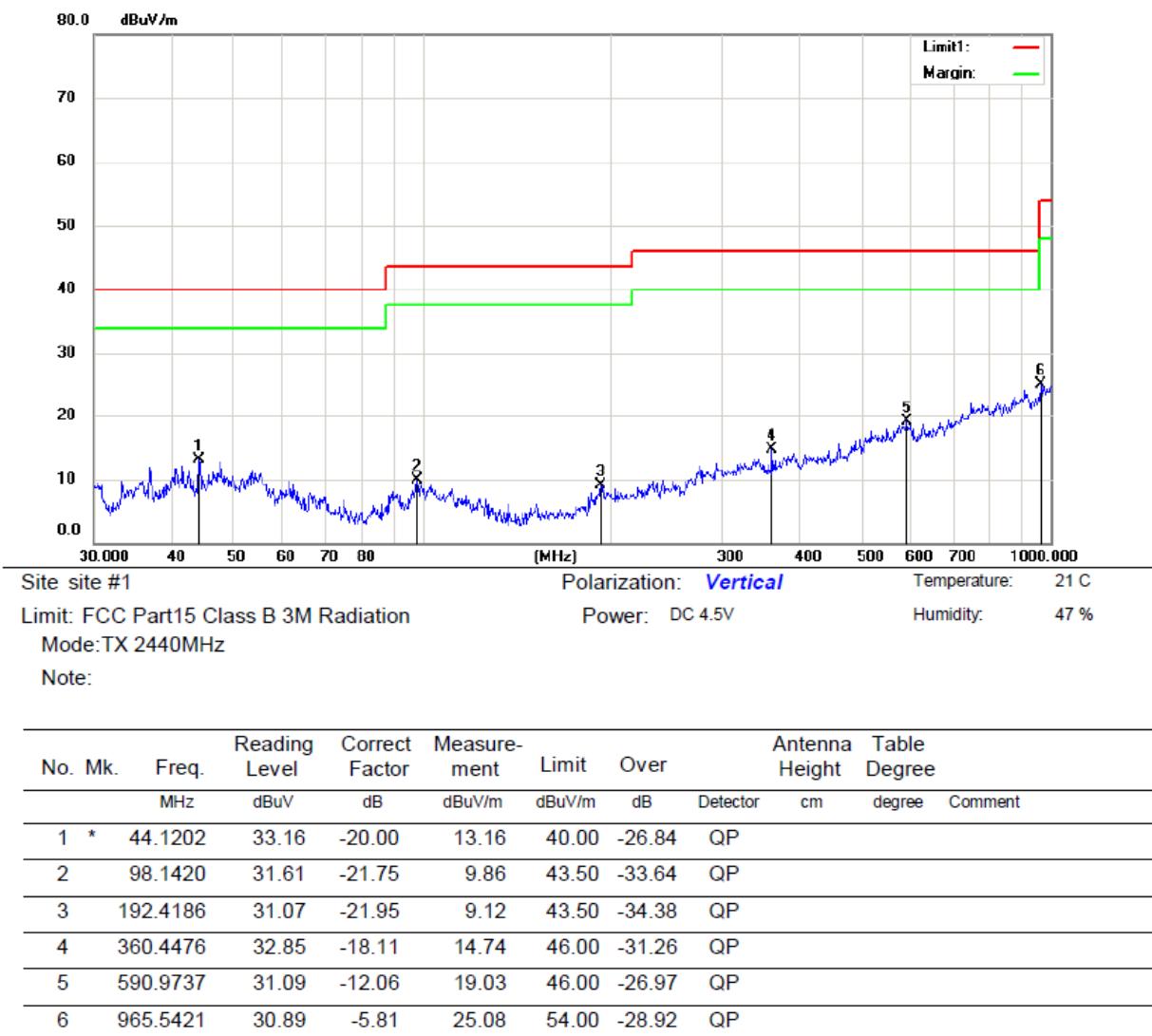
Mode:TX 2420MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
			Level	Factor	ment					
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1		47.8260	32.83	-19.86	12.97	40.00	-27.03	QP		
2		103.4421	31.25	-21.15	10.10	43.50	-33.40	QP		
3		193.7728	31.41	-21.80	9.61	43.50	-33.89	QP		
4		416.1791	31.22	-16.65	14.57	46.00	-31.43	QP		
5		574.6258	31.27	-11.81	19.46	46.00	-26.54	QP		
6	*	916.0687	31.04	-6.75	24.29	46.00	-21.71	QP		

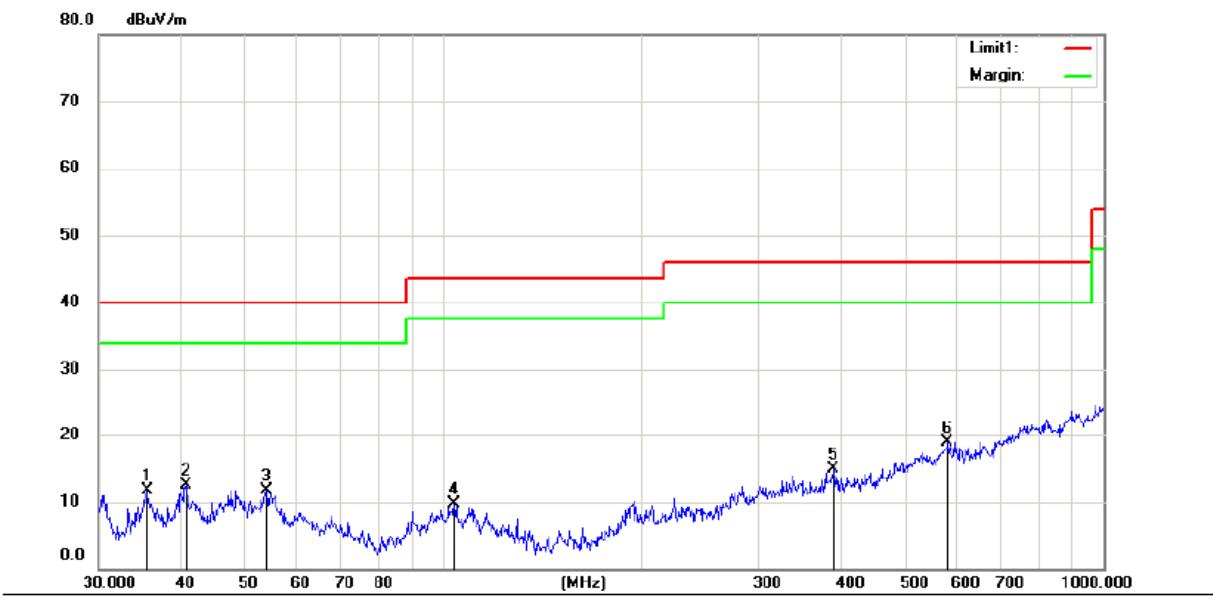
*:Maximum data x:Over limit !:over margin

Operator: KK



*:Maximum data x:Over limit !:over margin

Operator: KK



Site site #1

Polarization: **Horizontal**

Temperature: 21 C

Limit: FCC Part15 Class B 3M Radiation

Power: DC 4.5V

Humidity: 47 %

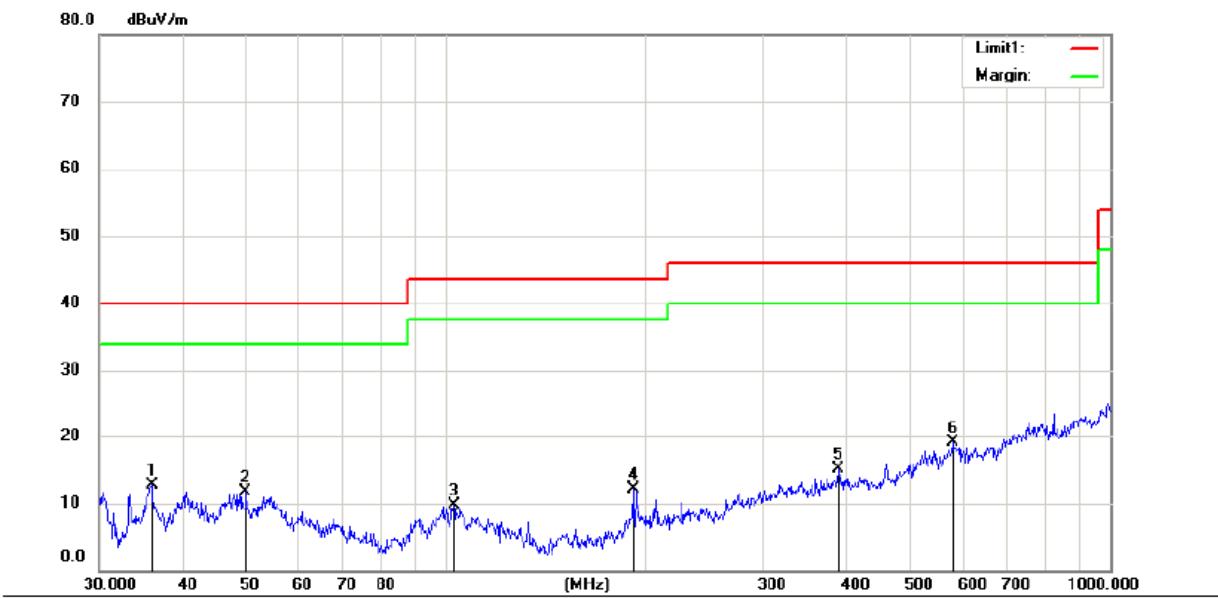
Mode:TX 2440MHz

Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table		
			Level	Factor	ment				Height	Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	
1		35.4993	34.20	-22.55	11.65	40.00	-28.35	QP			
2		40.7016	33.07	-20.53	12.54	40.00	-27.46	QP			
3		53.8818	31.29	-19.55	11.74	40.00	-28.26	QP			
4		103.8055	30.95	-21.17	9.78	43.50	-33.72	QP			
5		389.3550	31.63	-16.79	14.84	46.00	-31.16	QP			
6	*	580.7026	30.44	-11.49	18.95	46.00	-27.05	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK

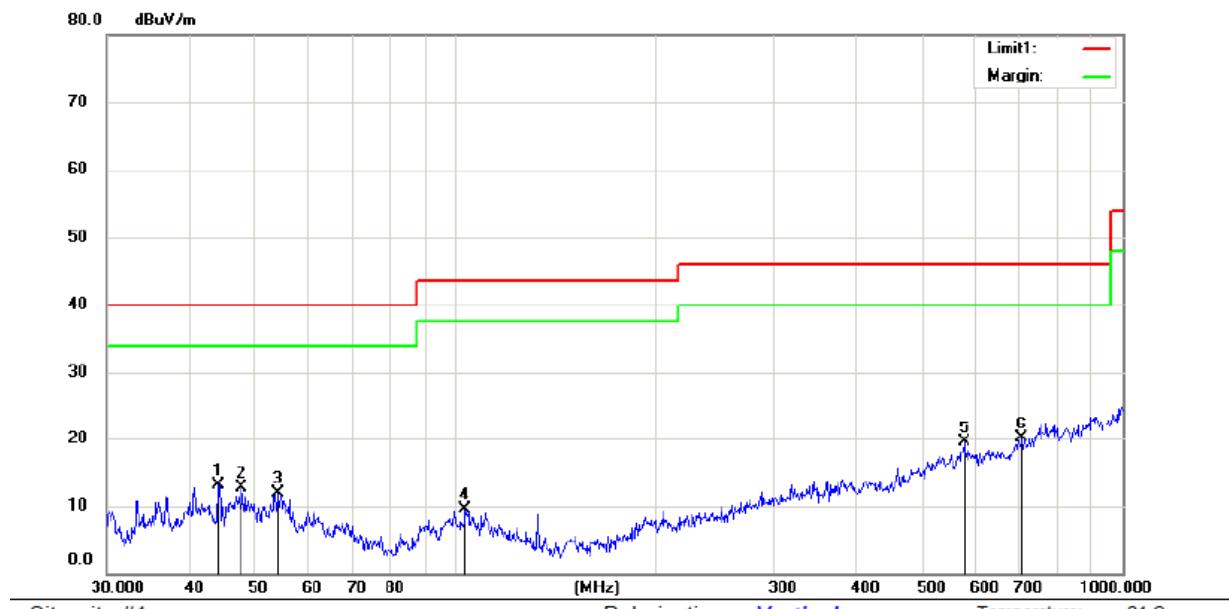


Note:

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
			Level	Factor	ment				Height	Degree
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1	36.0007	35.29	-22.62	12.67	40.00	-27.33	QP			
2	49.8814	30.93	-19.32	11.61	40.00	-28.39	QP			
3	102.7192	30.87	-21.10	9.77	43.50	-33.73	QP			
4	191.0738	34.27	-22.08	12.19	43.50	-31.31	QP			
5	389.3550	31.84	-16.79	15.05	46.00	-30.95	QP			
6	*	578.6700	30.57	-11.55	19.02	46.00	-26.98	QP		

*:Maximum data x:Over limit !:over margin

Operator: KK



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	Degree
			Level	Factor	ment			Height	Height	
		MHz	dBuV	dB	dBuV/m	dB	Detector	cm	degree	Comment
1		44.1202	33.18	-20.00	13.18	40.00	-26.82	QP		
2		47.8260	32.58	-19.86	12.72	40.00	-27.28	QP		
3		54.0711	31.40	-19.57	11.83	40.00	-28.17	QP		
4		103.4421	30.59	-21.15	9.44	43.50	-34.06	QP		
5		578.6700	31.14	-11.55	19.59	46.00	-26.41	QP		
6	*	706.7000	30.38	-10.35	20.03	46.00	-25.97	QP		

*:Maximum data x:Over limit !:over margin

Operator: KK

8.4 ANTENNA APPLICATION

8.4.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

8.4.2 Result

The EUT's antenna integrated on PCB, The antenna's gain is 0 dBi and meets the requirement