



MRT Technology (Suzhou) Co., Ltd  
Phone: +86-512-66308358  
Fax: +86-512-66308368  
Web: www.mrt-cert.com

Report No.: 1603RSU00301  
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## MEASUREMENT REPORT

### FCC PART 15.247 / RSS-247 ZigBee 802.15.4

**FCC ID:** 2ABX8SH-000000010

**IC:** 12219A-00000000010

**APPLICANT:** Zhejiang shenghui lighting Co., Ltd. Shanghai Branch

**Application Type:** Certification (Class II Permissive Change)

**Product:** sengled element

**Model No.:** Z01-A19NAE26

**Trademark:** sengled

**FCC Classification:** Digital Transmission System (DTS)

**FCC Rule Part(s):** Part 15.247

**IC Rule(s):** RSS-247 Issue 1

**Test Procedure(s):** ANSI C63.10-2013, KDB 558074 D01v03r04

**Test Date:** March 04 ~ 13, 2016

Reviewed By : Robin Wu  
\_\_\_\_\_  
( Robin Wu )

Approved By : Marlinchen  
\_\_\_\_\_  
( Marlin Chen )



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 558074 D01v03r04. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

## Revision History

Report No.	Version	Description	Issue Date
1603RSU00301	Rev. 01	Initial report	03-14-2016

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## §2.1033 General Information

<b>Applicant:</b>	Zhejiang shenghui lighting Co., Ltd. Shanghai Branch
<b>Applicant Address:</b>	Rm. 801, 1st Xinye Building, 388 Tianlin Rd., Caohejing Development Zone, Shanghai, 200233, China
<b>Manufacturer:</b>	ZHEJIANG SHENGHUI LIGHTING Co., Ltd
<b>Manufacturer Address:</b>	South Jiachuang Rd., Xiuzhou Industrial Park Jiaxing, Zhejiang 314015 P.R. China
<b>Test Site:</b>	MRT Technology (Suzhou) Co., Ltd
<b>Test Site Address:</b>	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
<b>MRT FCC Registration No.:</b>	809388
<b>MRT IC Registration No.:</b>	11384A
<b>FCC Rule Part(s):</b>	Part 15.247
<b>IC Rule:</b>	RSS-247 Issue 1
<b>Model No.:</b>	Z01-A19NAE26
<b>FCC ID:</b>	2ABX8SH-000000010
<b>IC:</b>	12219A-00000000010
<b>Test Device Serial No.:</b>	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

### Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



## 1. INTRODUCTION

## 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

## 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

Product Name	sengled element
Model No.	Z01-A19NAE26
ZigBee Specification	802.15.4
Frequency Range	2405 ~ 2480 MHz
Maximum Peak Output Power	5.77dBm
Type of Modulation	O-QPSK
Antenna Type	PIFA Antenna
Antenna Gain	3.66dBi

### 2.2. Operation Frequency / Channel List

Channel	Frequency	Channel	Frequency	Channel	Frequency
11	2405 MHz	12	2410 MHz	13	2415 MHz
14	2420 MHz	15	2425 MHz	16	2430 MHz
17	2435 MHz	18	2440 MHz	19	2445 MHz
20	2450 MHz	21	2455 MHz	22	2460 MHz
23	2465 MHz	24	2470 MHz	25	2475 MHz
26	2480 MHz	--	--	--	--

### 2.3. Test Mode

Test Mode	Mode 1: Transmit by 802.15.4
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### 2.4. Test Software

The test utility software used during testing was “sscom32.exe”.

## 2.5. Device Capabilities

This device contains the following capabilities:

2.4GHz ZigBee (DTS)

**Note:** 2.4GHz ZigBee (DTS) operation is possible in 5MHz channel bandwidth. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
802.15.4	100%

□

## 2.6. Test Configuration

The **sengled element FCC ID: 2ABX8SH-000000010** was tested per the guidance of KDB 558074 D01v03r04. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing.

## 2.7. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

### 3. DESCRIPTION OF TEST

#### 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01v03r04 were used in the measurement of the **sengled element FCC ID: 2ABX8SH-000000010**.

**Deviation from measurement procedure.....None**

#### 3.2. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable

containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

## 4. ANTENNA REQUIREMENTS

### **Excerpt from §15.203 of the FCC Rules/Regulations:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the sengled element is **permanently attached**.
- There are no provisions for connection to an external antenna.

### **Conclusion:**

The **sengled element FCC ID: 2ABX8SH-000000010** unit complies with the requirement of §15.203.

## 5. TEST EQUIPMENT CALIBRATION DATE

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2016/05/08
USB Wideband Power Sensor	Boonton	55006	MRTSUE06109	1 year	2016/05/08
Temperature/Humidity Meter	Yuhuaze	N/A	MRTSUE06180	1 year	2016/12/20

Radiated Emission - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MRTSUE06124	1 year	2016/06/23
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2016/11/03
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2016/04/16
Preamplifier	Agilent	83017A	MRTSUE06019	1 year	2016/03/29
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2016/12/14
TRILOG Antenna	Schwarzbeck	VULB9168	MRTSUE06172	1 year	2016/12/11
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2016/11/07
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2017/01/04
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2016/12/20

Software	Version	Function
e3	V8.3.5	EMI Test Software

## 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2U_{c(y)}$ ):
9kHz ~ 1GHz: 4.18dB
1GHz ~ 25GHz: 4.76dB

## 7. TEST RESULT

### 7.1. Summary

**Company Name:** Zhejiang shenghui lighting Co., Ltd. Shanghai Branch  
**FCC ID:** 2ABX8SH-000000010  
**IC:** 12219A-00000000010  
**FCC Classification:** Digital Transmission System (DTS)  
**Data Rate(s) Tested:** 250kbps

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	≤ 1Watt & EIRP ≤ 4Watt	Conducted	Pass	Section 7.2
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.3&7.4

**Notes:**

- 1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

## 7.2. Output Power Measurement

### 7.2.1. Test Limit

#### For FCC

The maximum output power shall be less 1 Watt (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### For IC

The maximum conducted output power shall be exceed 1 Watt (30dBm) and the E.I.R.P shall not exceed 4 Watt (36dBm).

### 7.2.2. Test Procedure Used

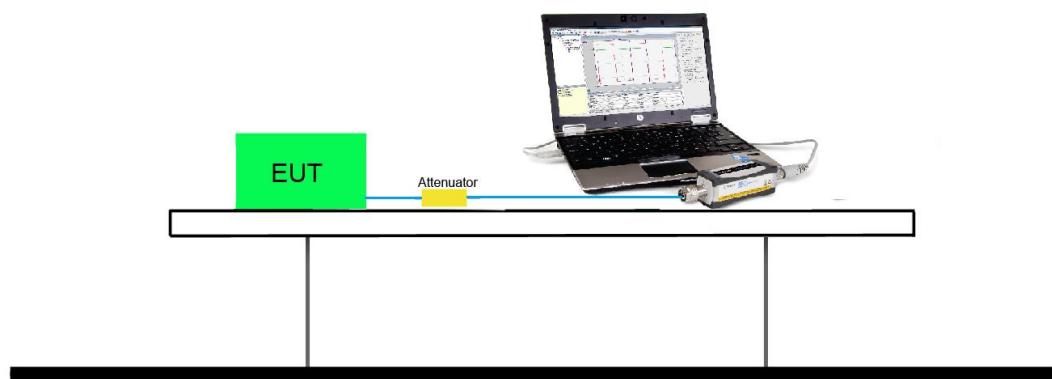
KDB 558074 D01v03r03 - Section 9.1.2 PKPM1 Peak Power Method (for signals with BW  $\leq$  50MHz)

### 7.2.3. Test Setting

#### Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

### 7.2.4. Test Setup



### 7.2.5. Test Result of Peak Output Power

Test Mode	Modulation Mode	Channel No.	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	Limit (dBm)	Result
802.15.4	O-QPSK	11	2405	5.77	≤ 30	9.43	≤ 36	Pass
802.15.4	O-QPSK	19	2445	4.75	≤ 30	8.41	≤ 36	Pass
802.15.4	O-QPSK	25	2475	3.56	≤ 30	7.22	≤ 36	Pass
802.15.4	O-QPSK	26	2480	-2.07	≤ 30	1.59	≤ 36	Pass

Note: E.I.R.P. (dBm) = Peak Output Power (dBm) + Antenna Gain (dBi).

### Test Result of Average Output Power for Report Only

Test Mode	Modulation Mode	Channel No.	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	Limit (dBm)	Result
802.15.4	O-QPSK	11	2405	5.66	≤ 30	9.32	≤ 36	Pass
802.15.4	O-QPSK	19	2445	4.60	≤ 30	8.26	≤ 36	Pass
802.15.4	O-QPSK	25	2475	3.38	≤ 30	7.04	≤ 36	Pass
802.15.4	O-QPSK	26	2480	-2.33	≤ 30	1.33	≤ 36	Pass

Note: E.I.R.P. (dBm) = Average Output Power (dBm) + Antenna Gain (dBi).

### 7.3. Radiated Spurious Emission Measurement

#### 7.3.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [V/m]	Measured Distance [Meters]
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

#### 7.3.2. Test Procedure Used

KDB 558074 D01v03r04 – Section 12.2.3 (quasi-peak measurements)

KDB 558074 D01v03r04 – Section 12.2.4 (peak power measurements)

KDB 558074 D01v03r04 – Section 12.2.5 (average power measurements)

#### 7.3.3. Test Setting

##### Peak Field Strength Measurements per Section 12.2.4 of KDB 558074 D01v03r04

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple

6. Trace mode = max hold
7. Trace was allowed to stabilize

**Table 1 - RBW as a Function of Frequency**

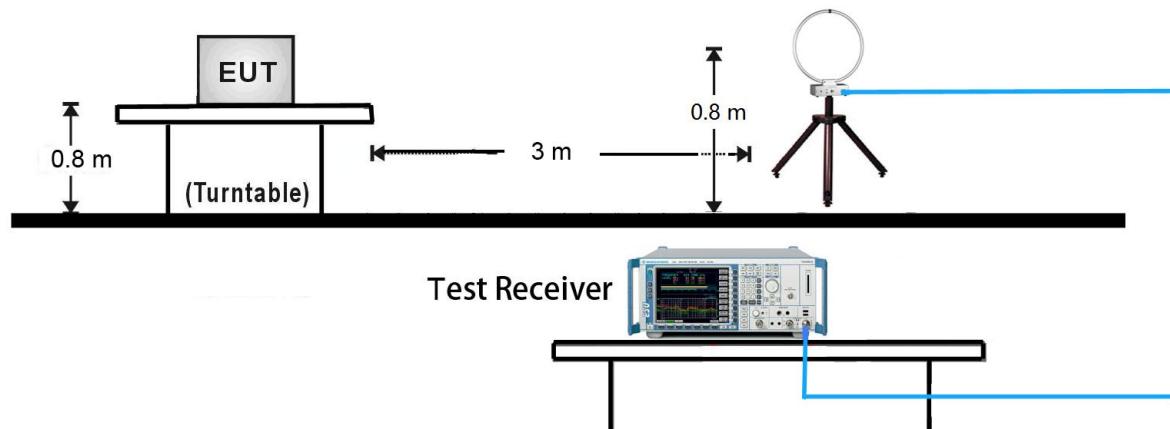
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

**Average Field Strength Measurements per Section 12.2.5.3 of KDB 558074 D01v03r04**

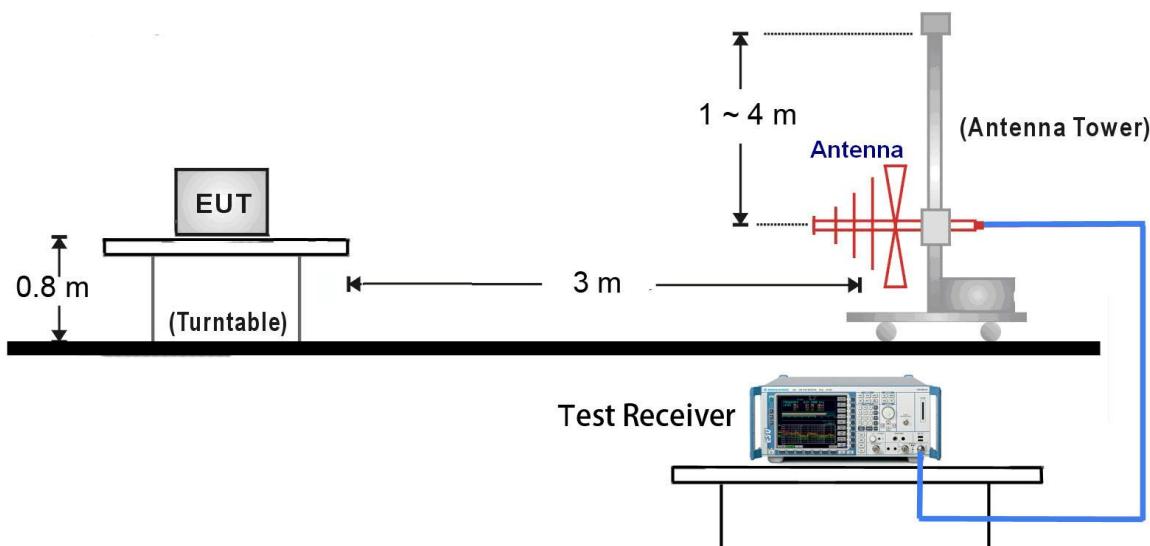
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW  $\geq 1/T$
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

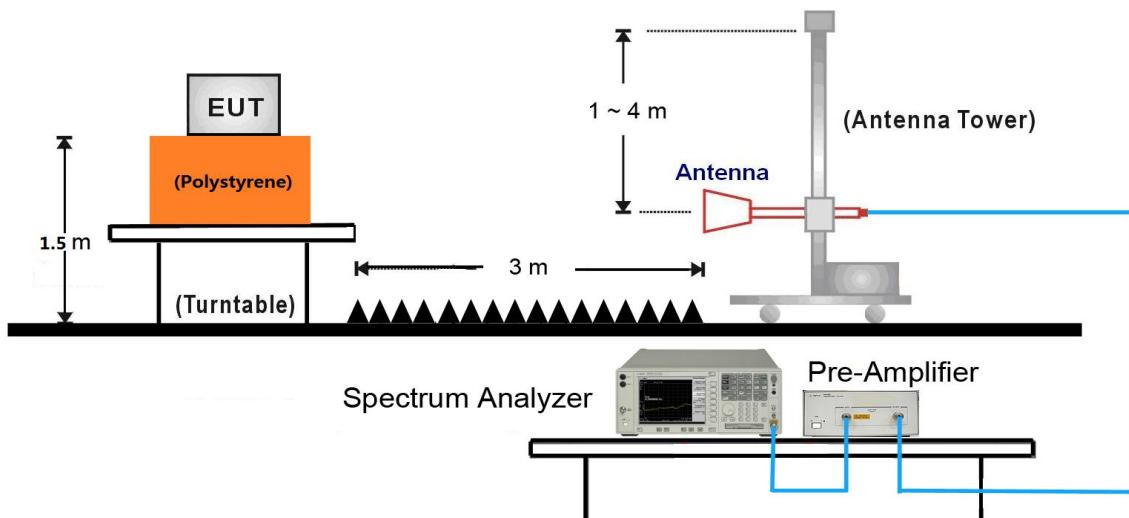
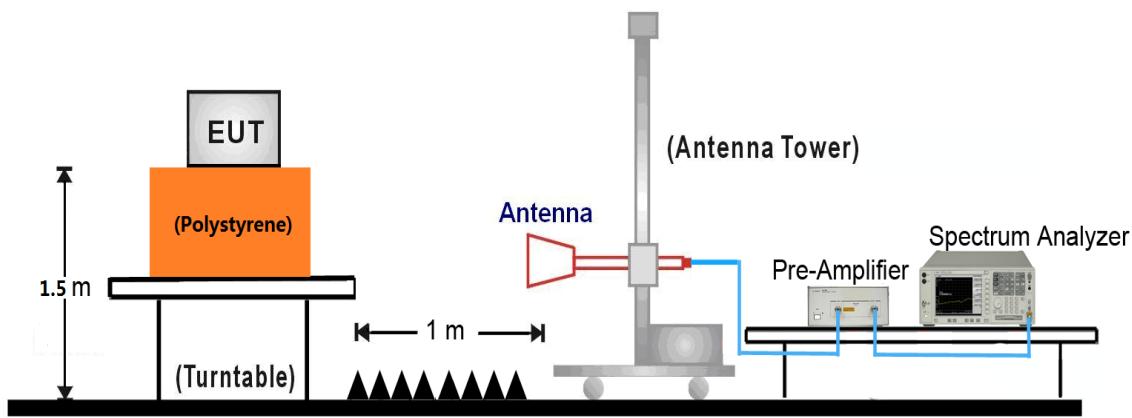
### 7.3.4. Test Setup

#### 9kHz ~ 30MHz Test Setup:



#### 30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:

18GHz ~25GHz Test Setup:


### 7.3.5. Test Result

Test Mode:	802.15.4	Test Site:	AC1
Test Channel:	11	Test Engineer:	Vince Yu
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dB $\mu$ V)	Factor (dB)	Measure Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Detector	Polarization
*	3558.5	38.9	-0.8	38.1	79.0	-40.9	Peak	Horizontal
*	4425.5	35.8	1.5	37.3	79.0	-41.7	Peak	Horizontal
	4808.0	38.5	2.7	41.2	74.0	-32.8	Peak	Horizontal
	7264.5	36.3	7.9	44.2	74.0	-29.8	Peak	Horizontal
*	3524.5	38.0	-1.0	37.0	79.0	-42.0	Peak	Vertical
*	4485.0	37.3	1.6	38.9	79.0	-40.1	Peak	Vertical
	4808.0	38.7	2.7	41.4	74.0	-32.6	Peak	Vertical
	7519.5	36.4	8.3	44.7	74.0	-29.3	Peak	Vertical

Note 1: “\*” is not in restricted band, its limit is 20dBc of the fundamental emission level (99.0dB $\mu$ V/m) or 15.209 which is higher.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre-Amplifier Gain (dB)

Test Mode:	802.15.4	Test Site:	AC1
Test Channel:	19	Test Engineer:	Vince Yu
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dB $\mu$ V)	Factor (dB)	Measure Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Detector	Polarization
*	3490.5	38.8	-1.2	37.6	73.5	-35.9	Peak	Horizontal
*	4476.5	36.6	1.6	38.2	73.5	-35.3	Peak	Horizontal
	4884.5	41.7	2.7	44.4	74.0	-29.6	Peak	Horizontal
	7468.5	36.4	8.1	44.5	74.0	-29.5	Peak	Horizontal
*	3550.0	37.6	-0.9	36.7	73.5	-36.8	Peak	Vertical
*	4434.0	36.6	1.5	38.1	73.5	-35.4	Peak	Vertical
	4782.5	38.6	2.7	41.3	74.0	-32.7	Peak	Vertical
	7468.5	37.1	8.1	45.2	74.0	-28.8	Peak	Vertical

Note 1: “\*” is not in restricted band, its limit is 20dBc of the fundamental emission level (93.5dB $\mu$ V/m) or 15.209 which is higher.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre-Amplifier Gain (dB)

Test Mode:	802.15.4	Test Site:	AC1
Test Channel:	25	Test Engineer:	Vince Yu
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dB $\mu$ V)	Factor (dB)	Measure Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Detector	Polarization
*	3575.5	38.9	-0.8	38.1	72.8	-34.7	Peak	Horizontal
*	4476.5	36.0	1.6	37.6	72.8	-35.2	Peak	Horizontal
	4952.5	42.7	2.9	45.6	74.0	-28.4	Peak	Horizontal
	7417.5	37.8	8.0	45.8	74.0	-28.2	Peak	Horizontal
*	3490.5	38.5	-1.2	37.3	72.8	-35.5	Peak	Vertical
*	4425.5	36.7	1.5	38.2	72.8	-34.6	Peak	Vertical
	4952.5	37.3	2.9	40.2	74.0	-33.8	Peak	Vertical
	7528.0	37.1	8.3	45.4	74.0	-28.6	Peak	Vertical

Note 1: “\*” is not in restricted band, its limit is 20dBc of the fundamental emission level (92.8dB $\mu$ V/m) or 15.209 which is higher.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre-Amplifier Gain (dB)

Test Mode:	802.15.4	Test Site:	AC1
Test Channel:	26	Test Engineer:	Vince Yu
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dB $\mu$ V)	Factor (dB)	Measure Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Detector	Polarization
*	3201.5	42.7	-1.6	41.1	72.4	-31.3	Peak	Horizontal
*	3499.0	38.3	-1.1	37.2	72.4	-35.2	Peak	Horizontal
	4961.0	38.2	2.9	41.1	74.0	-32.9	Peak	Horizontal
	7366.5	36.6	7.9	44.5	74.0	-29.5	Peak	Horizontal
*	3482.0	39.2	-1.2	38.0	72.4	-34.4	Peak	Vertical
*	4485.0	36.0	1.6	37.6	72.4	-34.8	Peak	Vertical
	4961.0	42.3	2.9	45.2	74.0	-28.8	Peak	Vertical
	7298.5	37.4	8.0	45.4	74.0	-28.6	Peak	Vertical

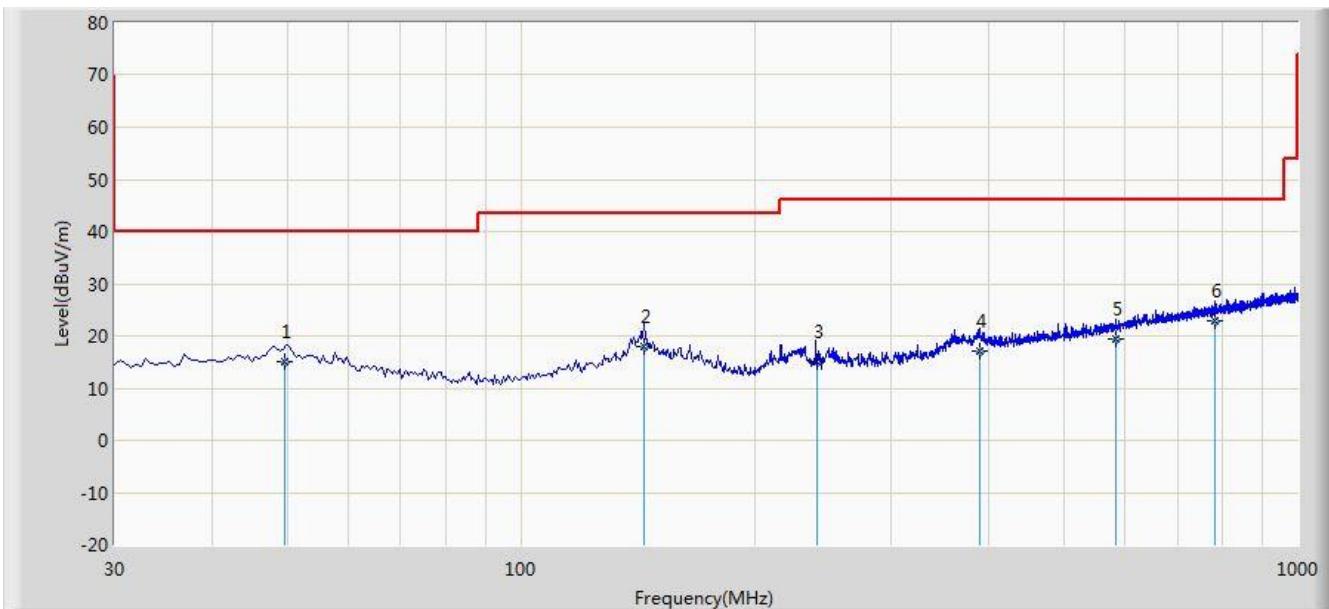
Note 1: “\*” is not in restricted band, its limit is 20dBc of the fundamental emission level (92.4dB $\mu$ V/m) or 15.209 which is higher.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre-Amplifier Gain (dB)

**The worst case of radiated emission below 1GHz:**

Site: AC1	Time: 2016/03/09 - 09:59
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
<b>Worse Case Mode:</b> Transmit at channel 2445MHz by 802.15.4	

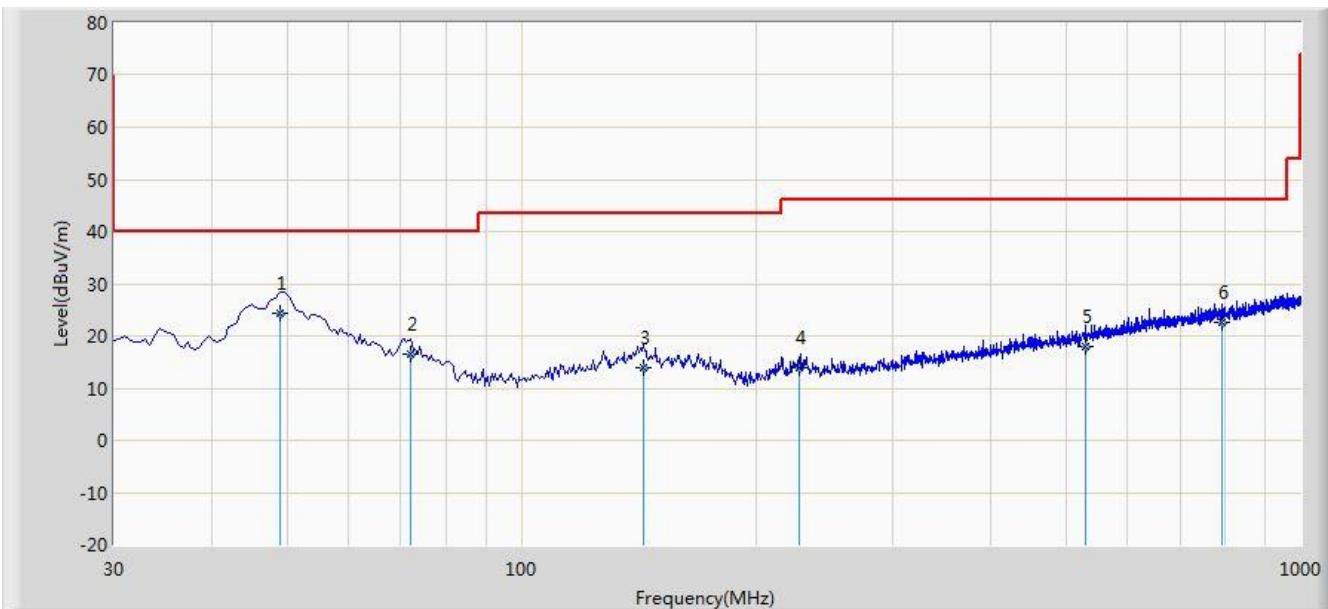


No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dB $\mu$ V/m)	Factor (dB)	Type
1			49.650	15.132	1.050	-24.868	40.000	14.082	QP
2			144.050	18.039	3.270	-25.461	43.500	14.768	QP
3			240.100	15.134	2.370	-30.866	46.000	12.763	QP
4			390.120	17.136	0.840	-28.864	46.000	16.296	QP
5			584.450	19.523	-0.620	-26.477	46.000	20.143	QP
6	*		782.420	22.847	-0.250	-23.153	46.000	23.097	QP

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/08 - 11:15
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
<b>Worse Case Mode:</b> Transmit at channel 2445MHz by 802.15.4	

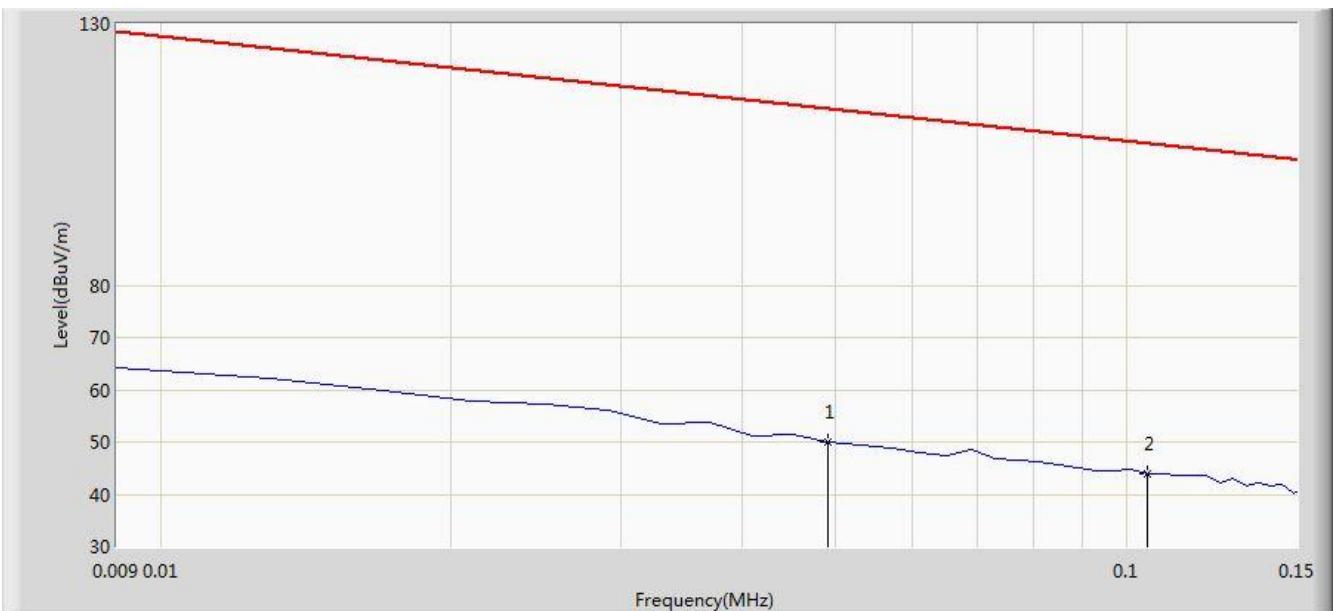


No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dB $\mu$ V/m)	Factor (dB)	Type
1		*	49.020	24.445	10.350	-15.555	40.000	14.095	QP
2			72.240	16.399	5.250	-23.601	40.000	11.150	QP
3			143.570	13.774	-0.960	-29.726	43.500	14.734	QP
4			227.620	13.786	1.420	-32.214	46.000	12.366	QP
5			530.130	18.109	-0.980	-27.891	46.000	19.089	QP
6			794.420	22.683	-0.520	-23.317	46.000	23.203	QP

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/08 - 16:18
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: sengled element	Power: AC 120V/60Hz
<b>Note: There is the ambient noise within frequency range 9kHz~30MHz.</b>	



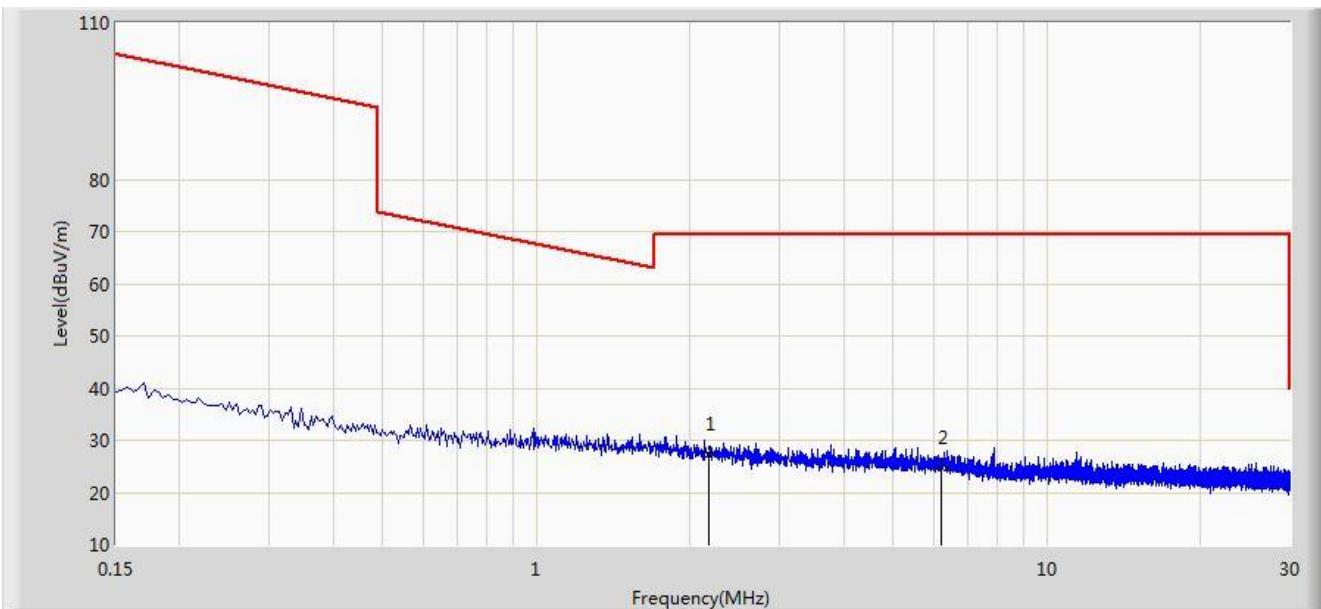
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			0.049	50.112	29.552	-63.688	113.800	20.560	AV
2		*	0.105	44.043	23.845	-63.137	107.180	20.198	QP

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Limit@3m =  $20 \cdot \log((2400/49)\mu\text{V}/\text{m}) + 40 \cdot \log(300\text{m}/3\text{m}) = 113.800\text{dB}\mu\text{V}/\text{m}$  (Average detector)

Site: AC1	Time: 2016/03/08 - 16:19
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: sengled element	Power: AC 120V/60Hz
<b>Note: There is the ambient noise within frequency range 9kHz~30MHz.</b>	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2.175	27.371	6.960	-42.129	69.500	20.412	QP
2			6.216	24.786	4.701	-44.714	69.500	20.085	QP

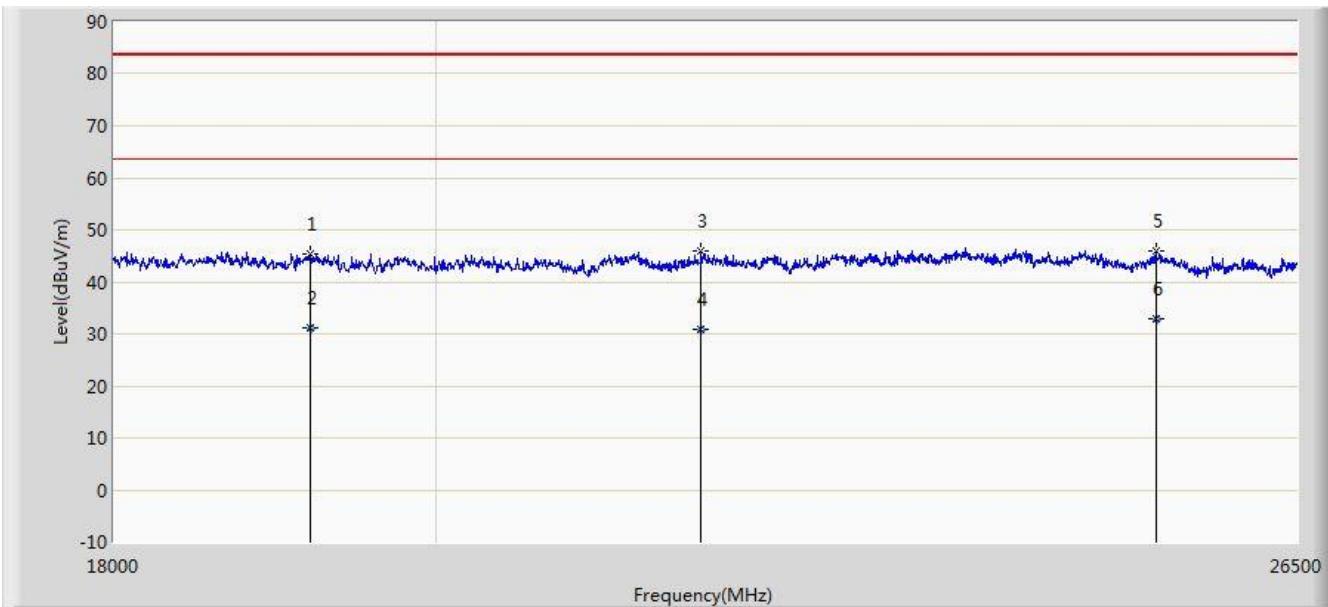
Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Limit@3m =  $20 \cdot \log(30\mu\text{V}/\text{m}) + 20 \cdot \log(30\text{m}/3\text{m}) = 49.5\text{dB}\mu\text{V}/\text{m}$  (Average detector), and  $69.5\text{dB}\mu\text{V}/\text{m}$

(Quasi-Peak detector).

Site: AC1	Time: 2016/03/08 - 16:25
Limit: FCC_Part15.209_RE(1m)	Engineer: Vince Yu
Probe: BBHA9170_18-40GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
<b>Note: There is the ambient noise within frequency range 18GHz~25GHz.</b>	



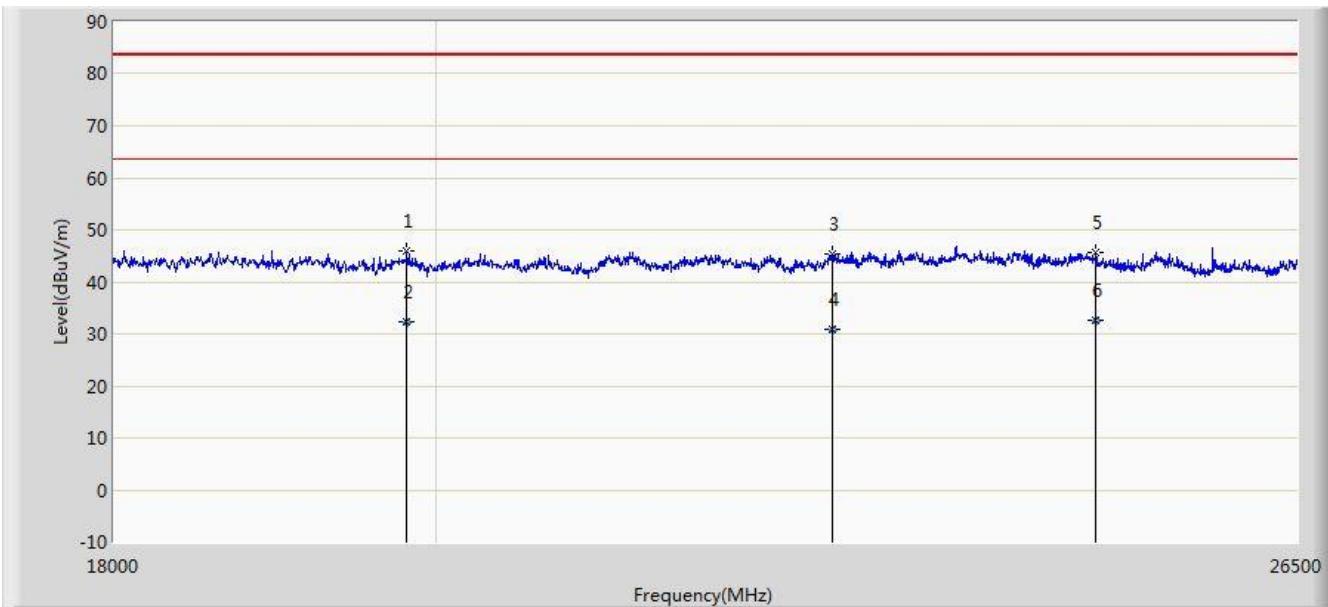
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			19194.250	45.350	44.174	-38.150	83.500	1.176	PK
2			19194.250	31.296	30.120	-32.204	63.500	1.176	AV
3			21812.250	45.806	45.995	-37.694	83.500	-0.189	PK
4			21812.250	31.001	31.190	-32.499	63.500	-0.189	AV
5			25310.000	45.892	43.365	-37.608	83.500	2.527	PK
6	*		25310.000	32.957	30.430	-30.543	63.500	2.527	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB)

Limit@1m =  $20 \log(500 \mu\text{V}/\text{m}) + 20 \log(3\text{m}/1\text{m}) = 63.5 \text{dB}\mu\text{V}/\text{m}$  (Average detector), and  $83.5 \text{dB}\mu\text{V}/\text{m}$  (Peak detector).

Site: AC1	Time: 2016/03/08 - 16:31
Limit: FCC_Part15.209_RE(1m)	Engineer: Vince Yu
Probe: BBHA9170_18-40GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
<b>Note: There is the ambient noise within frequency range 18GHz~25GHz.</b>	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			19810.500	46.028	45.623	-37.472	83.500	0.405	PK
2			19810.500	32.225	31.820	-31.275	63.500	0.405	AV
3			22764.250	45.366	44.798	-38.134	83.500	0.568	PK
4			22764.250	30.798	30.230	-32.702	63.500	0.568	AV
5			24812.750	45.794	43.064	-37.706	83.500	2.730	PK
6	*		24812.750	32.620	29.890	-30.880	63.500	2.730	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

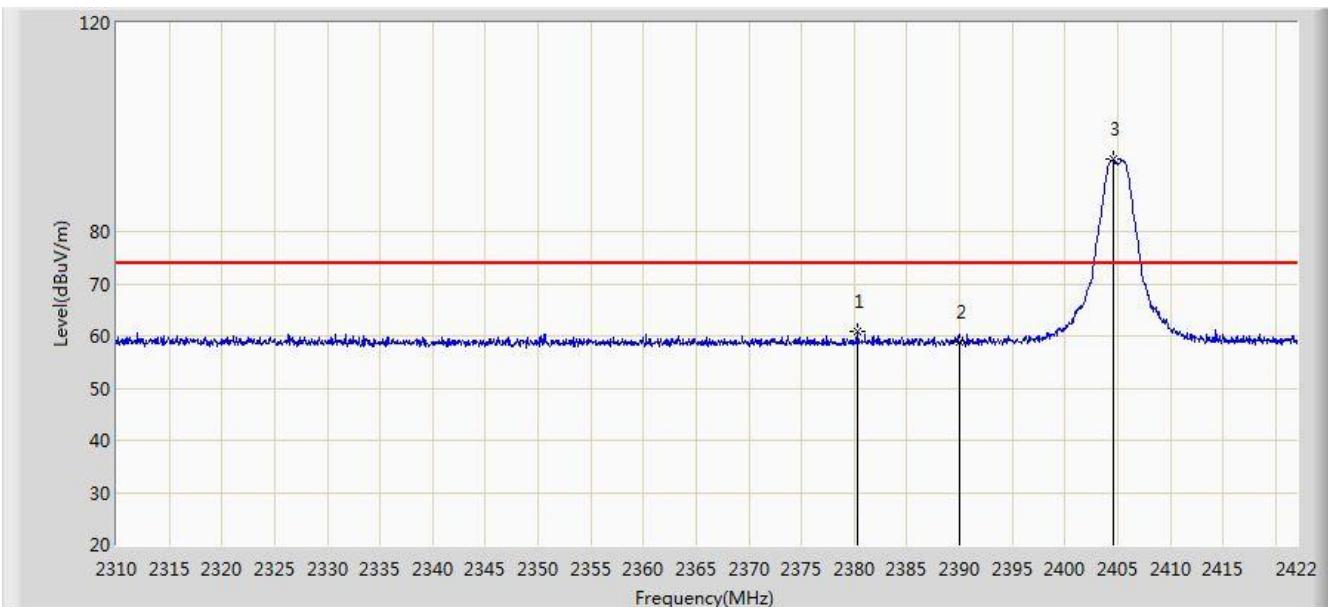
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB)

Limit@1m =  $20 \log(500 \mu\text{V}/\text{m}) + 20 \log(3\text{m}/1\text{m}) = 63.5 \text{dB}\mu\text{V}/\text{m}$  (Average detector), and  $83.5 \text{dB}\mu\text{V}/\text{m}$  (Peak detector).

## 7.4. Radiated Restricted Band Edge Measurement

### 7.4.1. Test Result

Site: AC1	Time: 2016/03/07 - 17:31
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2405MHz by 802.15.4	

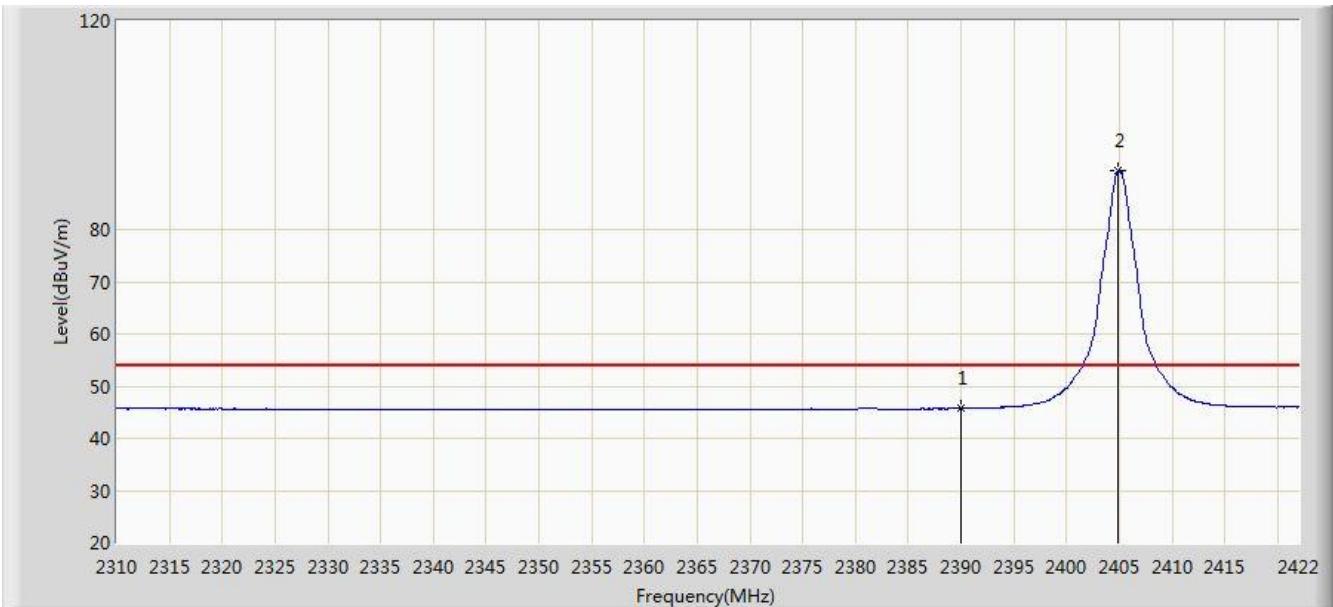


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2380.280	60.940	29.719	-13.060	74.000	31.221	PK
2			2390.000	58.908	27.705	-15.092	74.000	31.203	PK
3	*	*	2404.584	93.780	62.600	N/A	N/A	31.180	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:35
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2405MHz by 802.15.4	

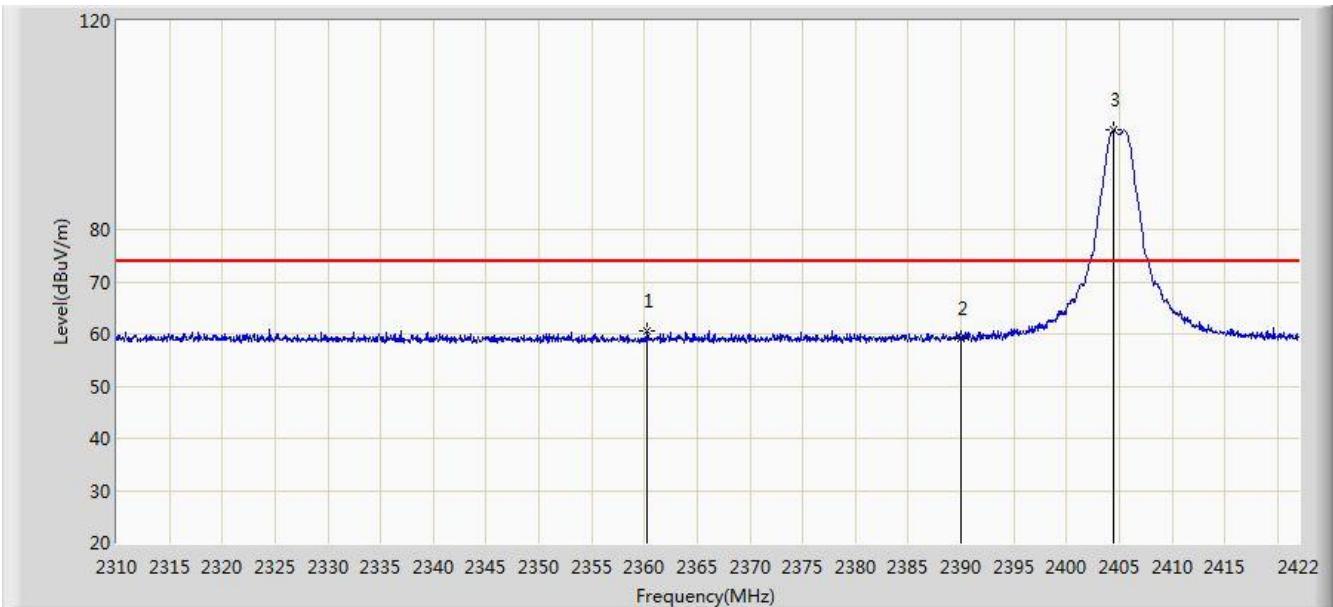


No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	45.723	14.520	-8.277	54.000	31.203	AV
2		*	2404.920	91.361	60.181	N/A	N/A	31.180	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:30
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2405MHz by 802.15.4	

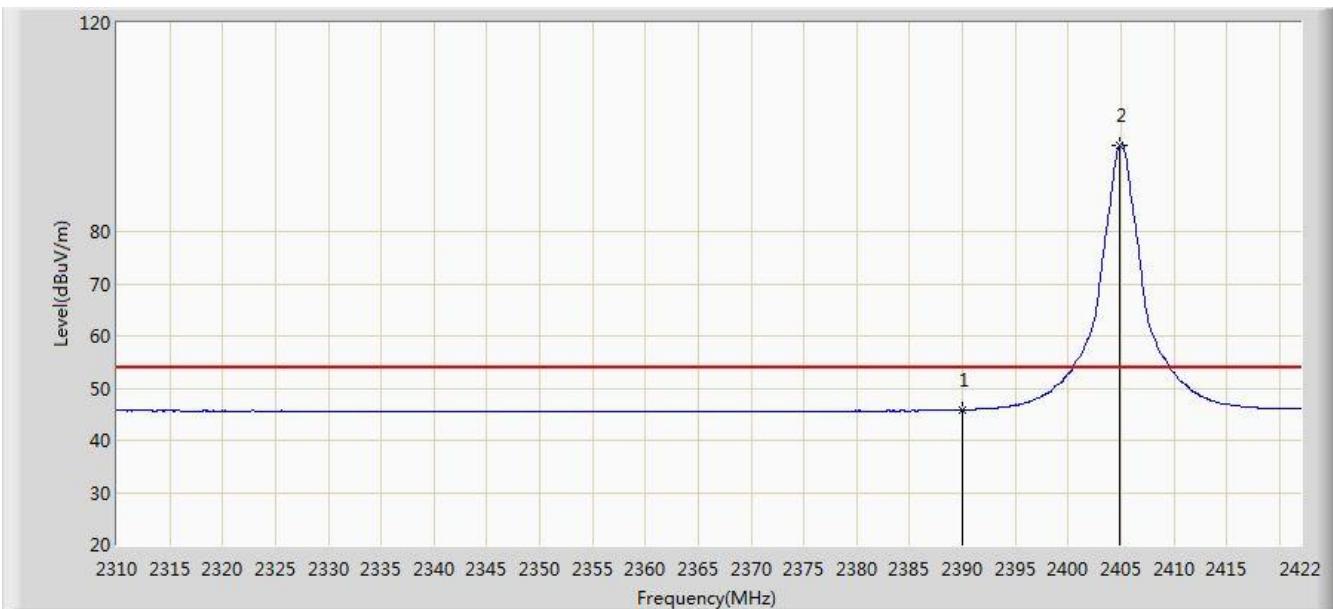


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2360.176	60.663	29.405	-13.337	74.000	31.258	PK
2			2390.000	59.119	27.916	-14.881	74.000	31.203	PK
3	*		2404.472	99.038	67.857	N/A	N/A	31.180	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:31
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2405MHz by 802.15.4	

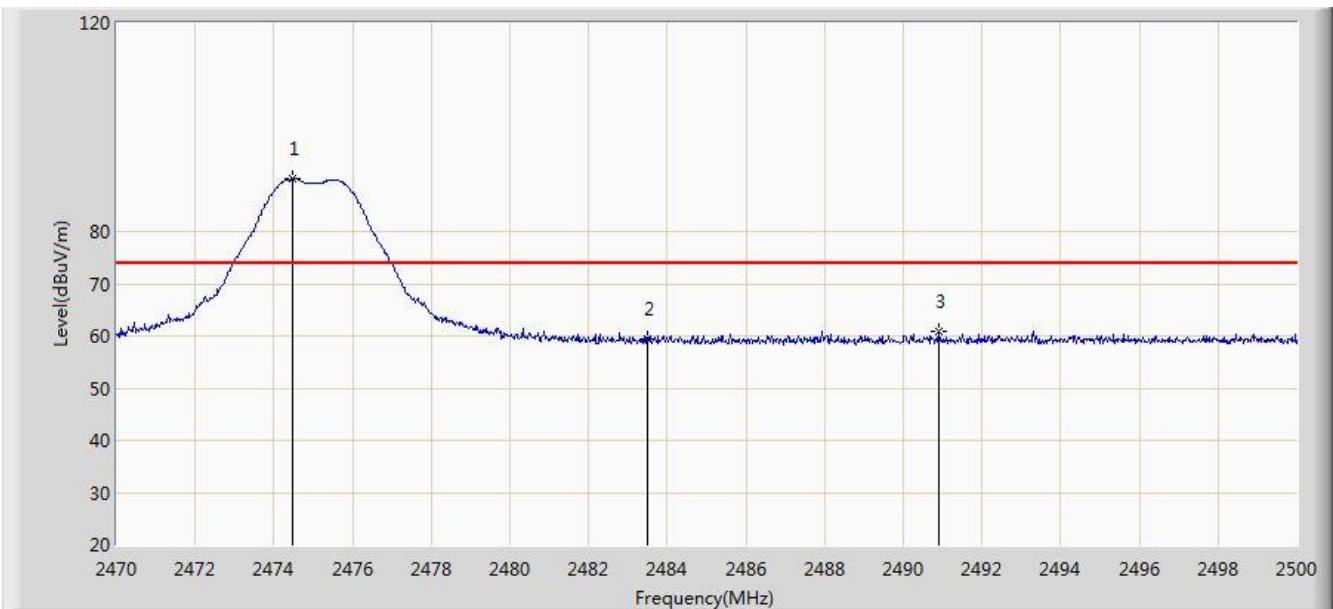


No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	45.786	14.583	-8.214	54.000	31.203	AV
2	*	*	2404.920	96.633	65.453	N/A	N/A	31.180	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:39
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2475MHz by 802.15.4	

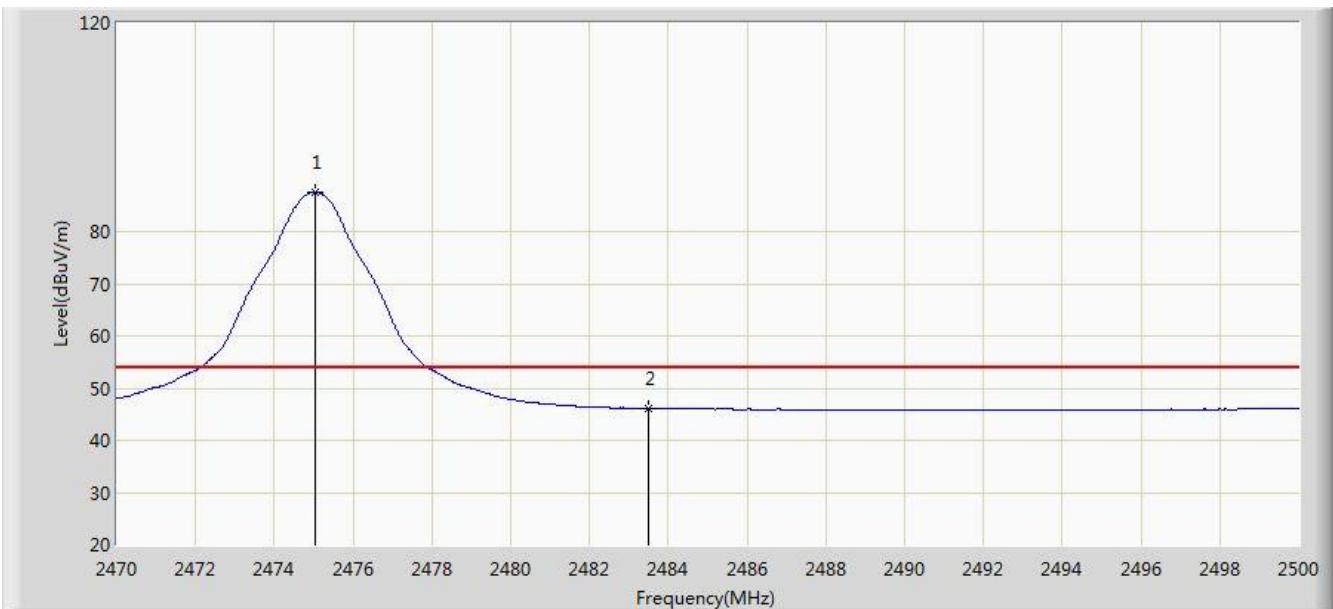


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2474.464	90.072	58.903	N/A	N/A	31.168	PK
2			2483.500	59.359	28.166	-14.641	74.000	31.194	PK
3			2490.904	60.961	29.748	-13.039	74.000	31.213	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:43
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2475MHz by 802.15.4	

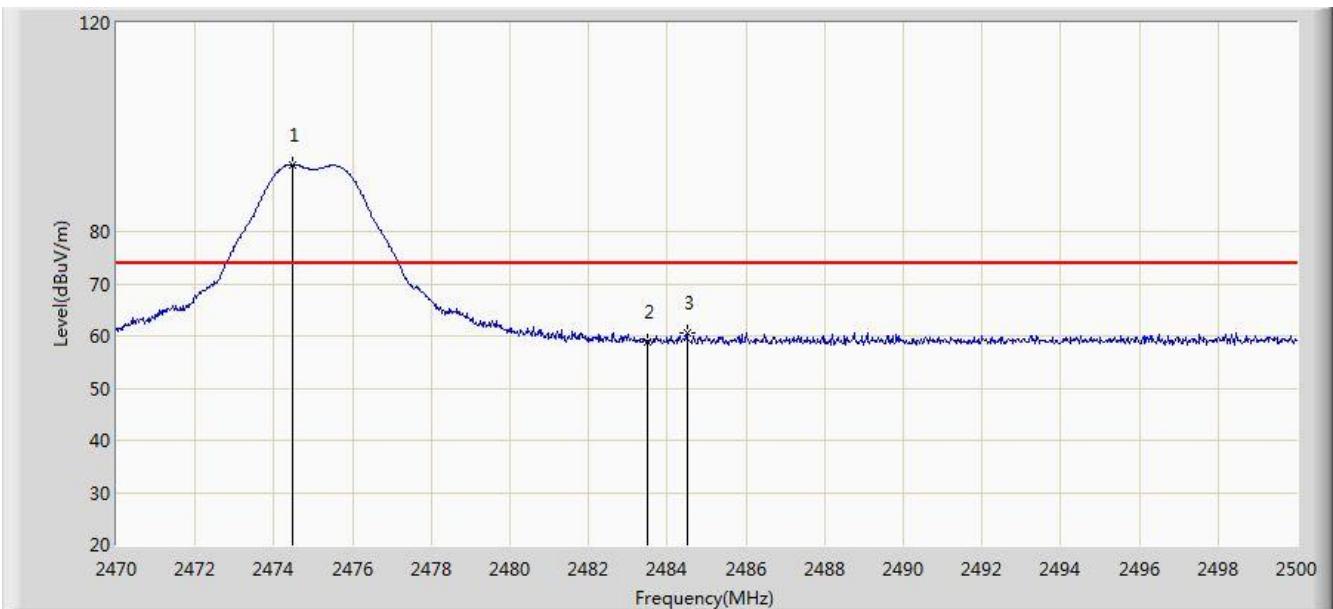


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2475.040	87.548	56.378	N/A	N/A	31.170	AV
2			2483.500	46.132	14.939	-7.868	54.000	31.194	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:43
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2475MHz by 802.15.4	

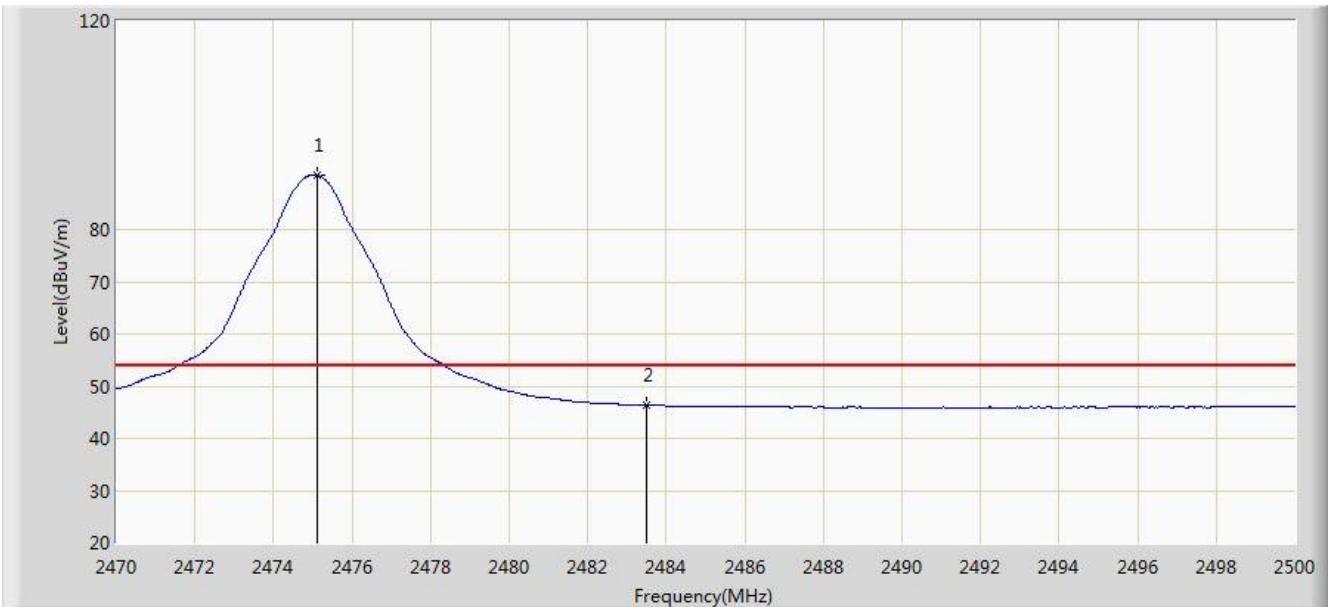


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2474.464	92.832	61.663	N/A	N/A	31.168	PK
2			2483.500	58.977	27.784	-15.023	74.000	31.194	PK
3			2484.496	60.586	29.390	-13.414	74.000	31.196	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/07 - 17:46
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2475MHz by 802.15.4	

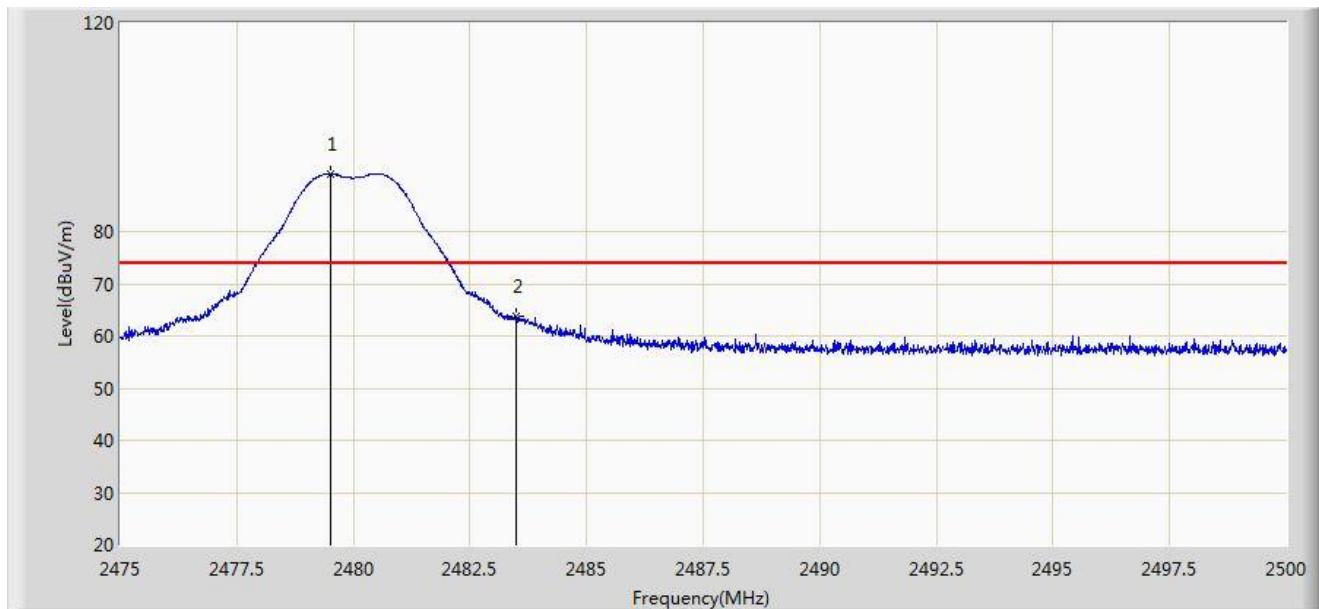


No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dB $\mu$ V/m)	Factor (dB)	Type
1		*	2475.112	90.438	59.267	N/A	N/A	31.170	AV
2			2483.500	46.307	15.114	-7.693	54.000	31.194	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/12 - 18:01
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2480MHz by 802.15.4	

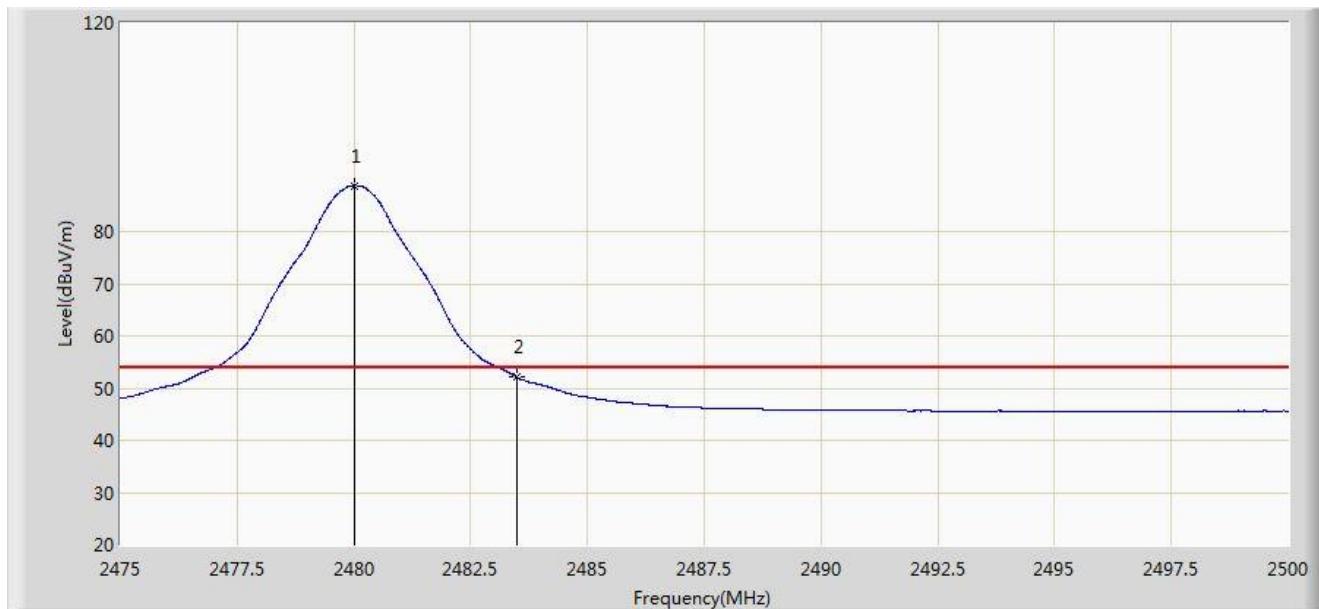


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.500	91.090	59.907	N/A	N/A	31.182	PK
2			2483.500	63.820	32.627	-10.180	74.000	31.194	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/12 - 18:00
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2480MHz by 802.15.4	

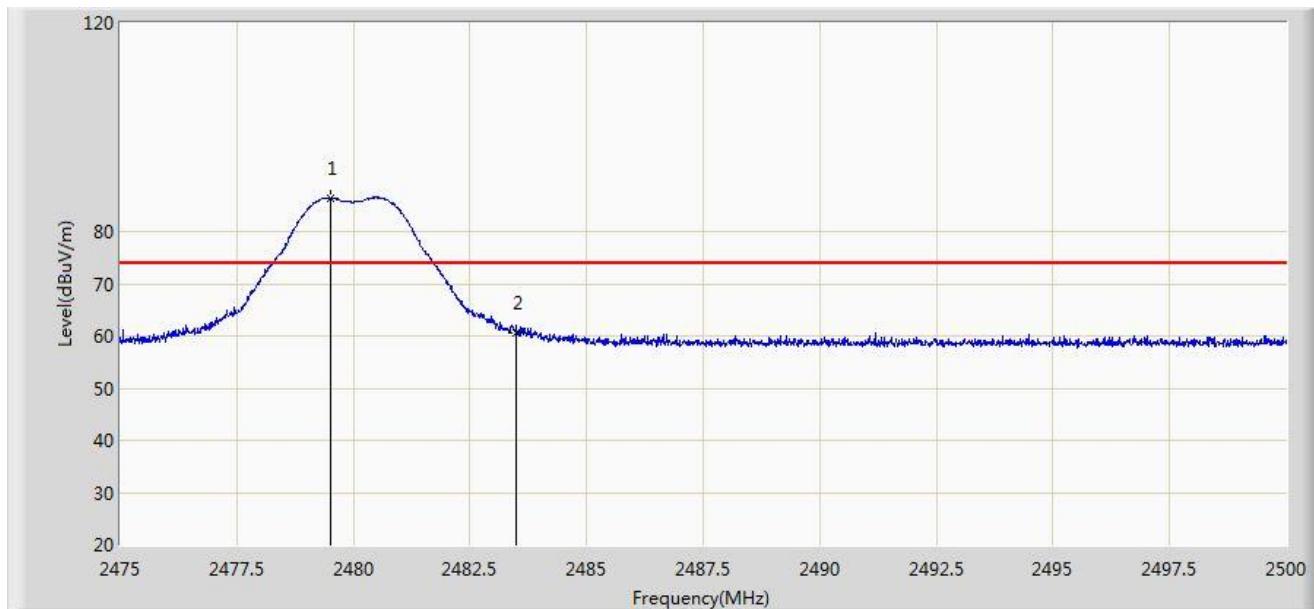


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.000	88.839	57.655	N/A	N/A	31.184	AV
2			2483.500	52.079	20.886	-1.921	54.000	31.194	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/12 - 18:01
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2480MHz by 802.15.4	

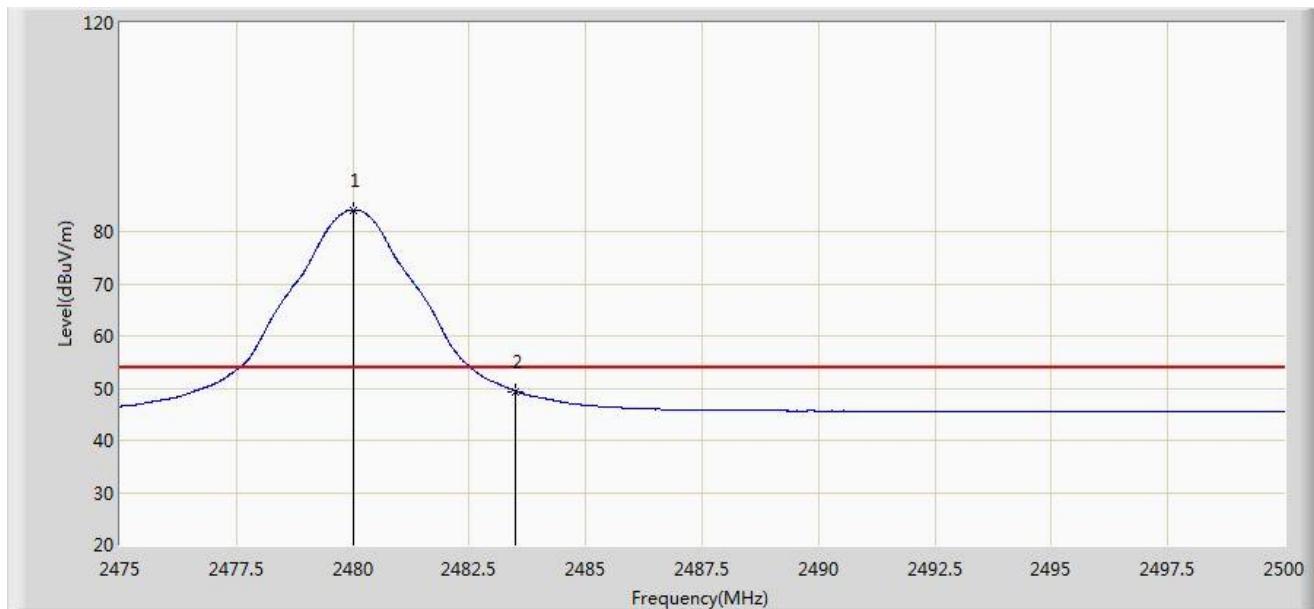


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.500	86.468	55.285	N/A	N/A	31.182	PK
2			2483.500	60.623	29.430	-13.377	74.000	31.194	PK

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC1	Time: 2016/03/12 - 18:04
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: sengled element	Power: AC 120V/60Hz
Test Mode: Transmit at Channel 2480MHz by 802.15.4	



No	Flag	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Over Limit (dB)	Limit (dB $\mu$ V/m)	Factor (dB)	Type
1		*	2480.000	84.178	52.994	N/A	N/A	31.184	AV
2			2483.500	49.375	18.182	-4.625	54.000	31.194	AV

Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

## 8. CONCLUSION

The data collected relate only the item(s) tested and show that the **sengled element FCC ID: 2ABX8SH-000000010** is in compliance with Part 15C of the FCC Rules.

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The End