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Report No.: 1604RSU01601
Report Version: V02
Issue Date: 05-06-2016

MEASUREMENT REPORT
FCC PART 15.247 / RSS-247 ZigBee 802.15.4

FCC ID:	2AGN8-Z02HUB
IC:	20888-Z02HUB
APPLICANT:	Sengled Co., Ltd.

Application Type:	Certification
Product:	Element hub
Model No.:	Z02-hub
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 D01v03r05
Test Date:	April 20 ~ May 06, 2016

Reviewed By : Robin Wu
(Robin Wu)

Approved By : Marlin Chen
(Marlin Chen)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

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 D01v03r05. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date
1604RSU01601	Rev. 01	Initial report	04-27-2016
1604RSU01601	Rev. 02	Revised the conducted band edge and out-of-band emissions & radiated spurious emission for channel 2475MHz	05-06-2016

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§2.1033 General Information

Applicant:	Sengled Co., Ltd.
Applicant Address:	Room 201/15, Building 1, No. 498, Guoshoujing Road, Pilot Free Trade Zone, Shanghai, China
Manufacturer:	Sengled Co., Ltd.
Manufacturer Address:	Room 201/15, Building 1, No. 498, Guoshoujing Road, Pilot Free Trade Zone, Shanghai, China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT FCC Registration No.:	809388
MRT IC Registration No.:	11384A
FCC Rule Part(s):	Part 15.247
IC Rule:	RSS-247 Issue 1
Model No.:	Z02-hub
FCC ID:	2AGN8-Z02HUB
IC:	20888-Z02HUB
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ 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.**

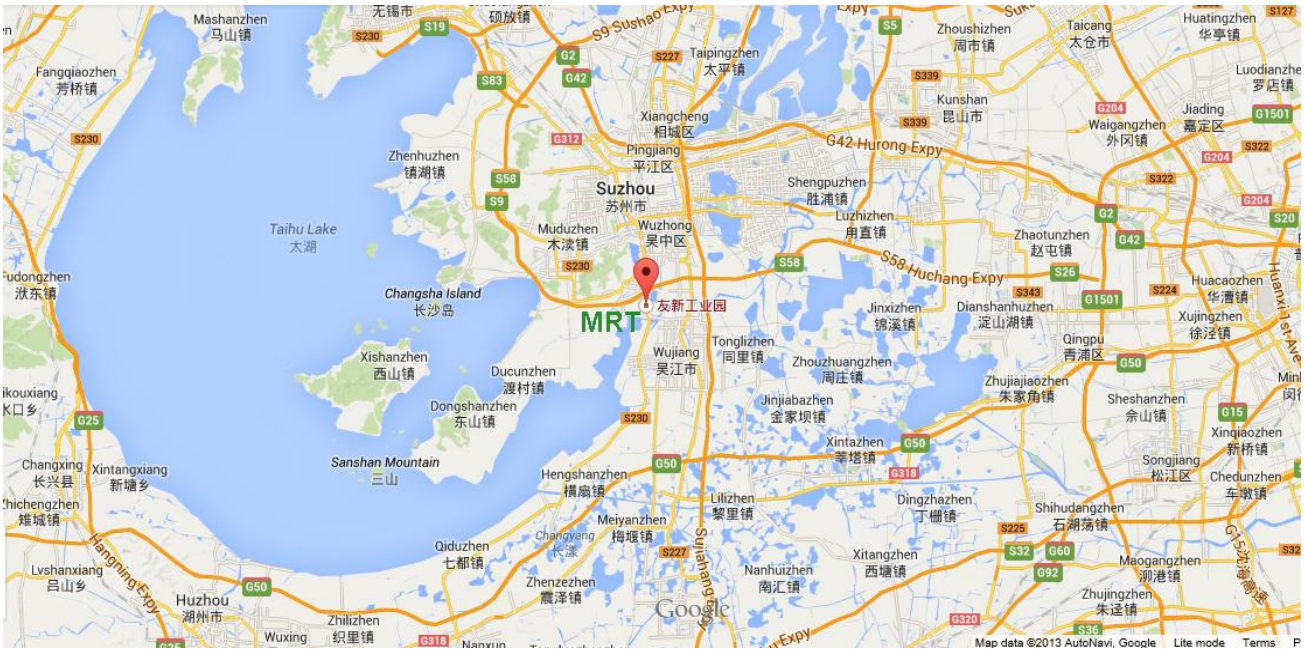
1. INTRODUCTION

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	Element hub
Model No.	Z02-hub
ZigBee Specification	802.15.4
Wi-Fi Specification	802.11b/g/n

2.2. Product Specification Subjective to this Report

Frequency Range	2405 ~ 2480 MHz
Maximum Peak Output Power	18.07dBm
Type of Modulation	O-QPSK
Antenna Gain	2.8dBi

Note: For other features of this EUT, test report will be issued separately.

2.3. 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	--	--	--	--

2.4. Test Mode

Test Mode	Mode 1: Transmit by 802.15.4

2.5. Test Software

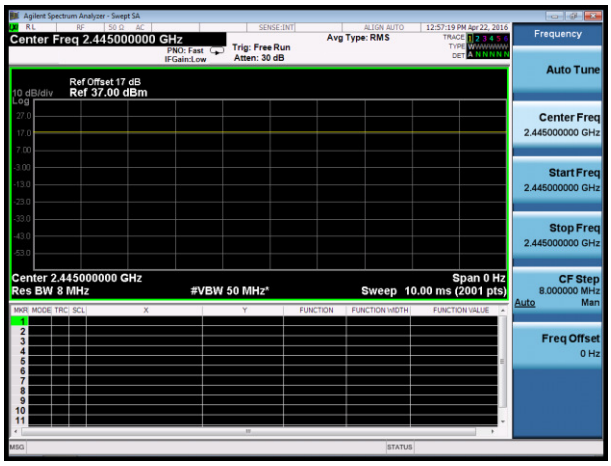
The test utility software used during testing was “SerialDebug.exe”.

2.6. Device Capabilities

This device contains the following capabilities:

2.4GHz ZigBee (DTS) & 2.4GHz WLAN (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%
	

2.7. Test Configuration

The **Element hub FCC ID: 2AGN8-Z02HUB** was tested per the guidance of KDB 558074 D01v03r05. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.8. EMI Suppression Device(s)/Modifications

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

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

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 D01v03r05 were used in the measurement of the **Element hub FCC ID: 2AGN8-Z02HUB.**

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

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 RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.8.

3.3. 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 Element hub is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **Element hub FCC ID: 2AGN8-Z02HUB** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions – SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2016/11/03
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06182	1 year	2016/12/20

Radiated Emission – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MRTSUE06028	1 year	2016/12/08
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2016/11/03
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2017/03/28
Preamplifier	Schwarzbeck	BBV9721	MRTSUE06121	1 year	2017/04/15
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2016/12/14
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2016/11/07
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

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	HTC-2	MRTSUE06180	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.

AC Conducted Emission Measurement – SR2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement – AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB

7. TEST RESULT

7.1. Summary

Company Name: **Sengled Co.,Ltd.**
FCC ID: **2AGN8-Z02HUB**
IC: **20888-Z02HUB**
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(a)(2)	RSS-247 [5.2]	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	≤ 1Watt & EIRP ≤ 4Watt		Pass	Section 7.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	≤ 8dBm / 3kHz		Pass	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc(Peak)		Pass	Section 7.5
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 7.6&7.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 7.8

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. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

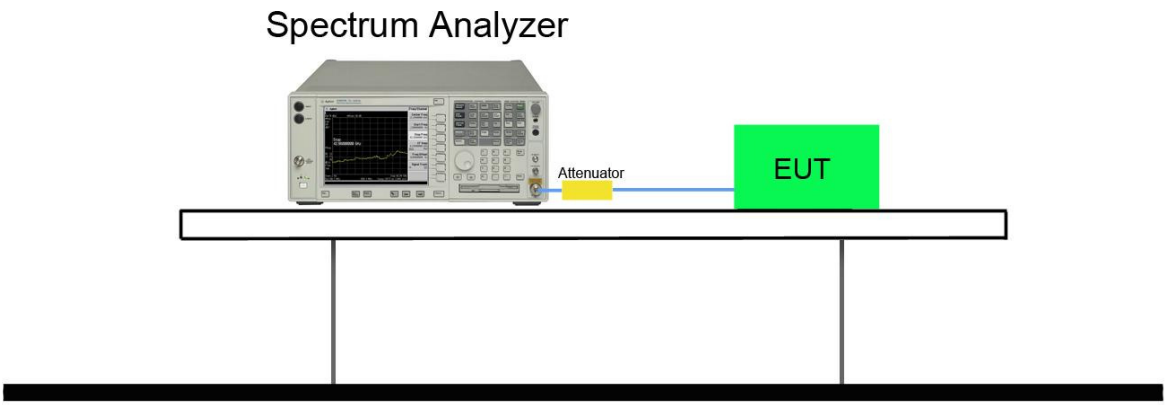
7.2.2. Test Procedure used

KDB 558074 D01v03r05 – Section 8.2 Option 2

7.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

7.2.4. Test Setup

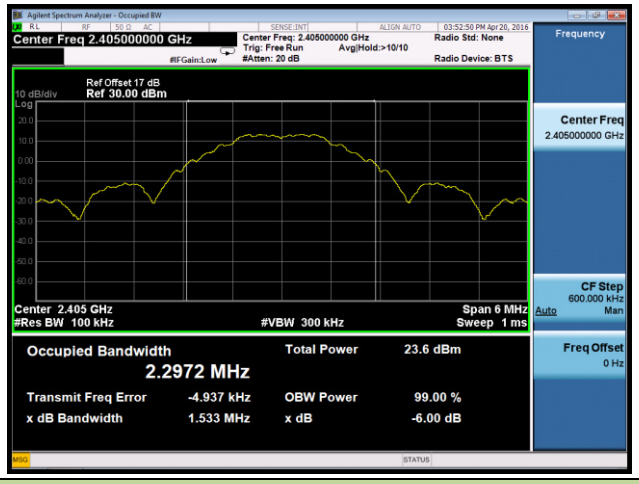


7.2.5. Test Result

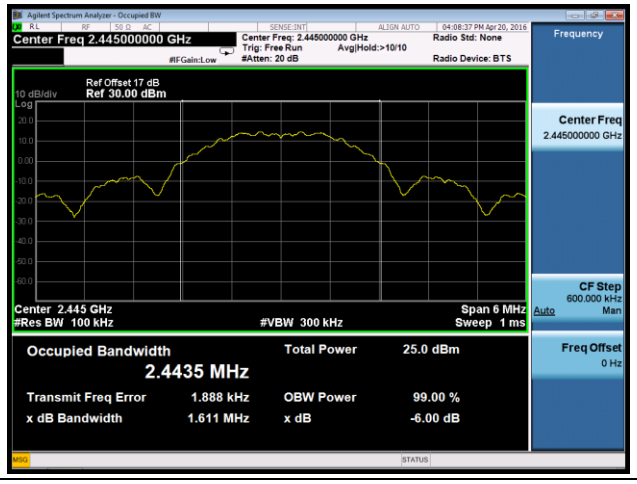
Test Mode	Modulation Mode	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.15.4	O-QPSK	11	2405	1.53	≥ 0.5	Pass
802.15.4	O-QPSK	19	2445	1.61	≥ 0.5	Pass
802.15.4	O-QPSK	26	2480	1.61	≥ 0.5	Pass

802.15.4 6dB Bandwidth

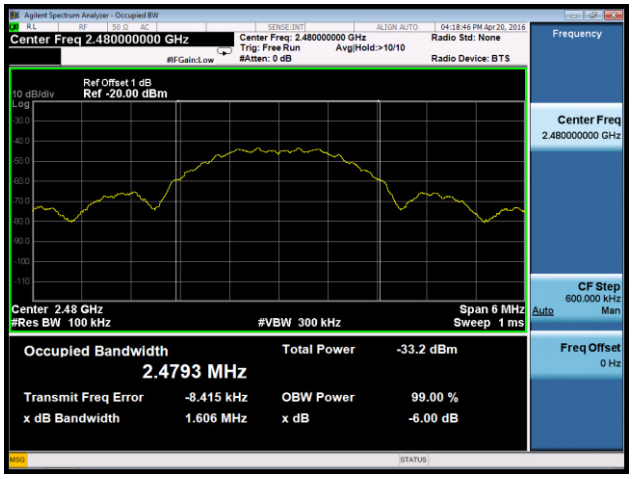
Channel 11 (2405MHz)



Channel 19 (2445MHz)



Channel 26 (2480MHz)



7.3. Output Power Measurement

7.3.1. 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).

7.3.2. Test Procedure Used

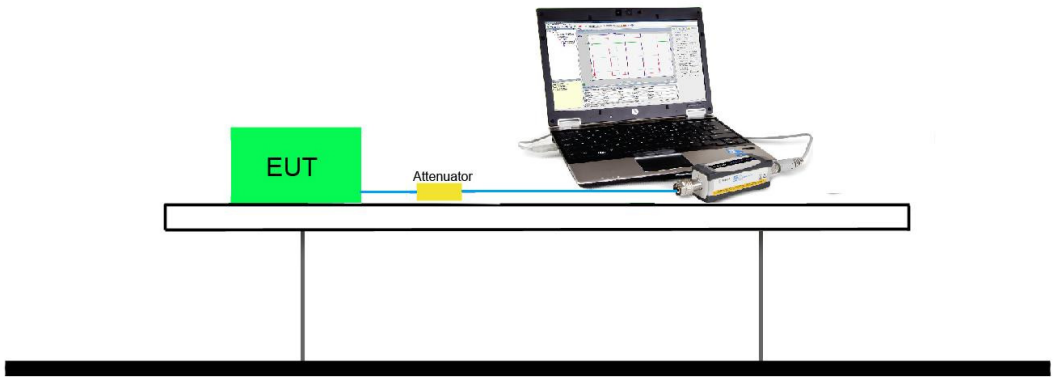
KDB 558074 D01v03r05 - Section 9.1.2 PKPM1 Peak Power Method (for signals with BW ≤ 50MHz)

7.3.3. Test Setting

Method PKPM1 (Peak Power Measurement of Signals with DTS BW ≤ 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.

7.3.4. Test Setup



7.3.5. 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	16.21	≤ 30	19.01	≤ 36	Pass
802.15.4	O-QPSK	19	2445	18.07	≤ 30	20.87	≤ 36	Pass
802.15.4	O-QPSK	25	2475	12.19	≤ 30	14.99	≤ 36	Pass
802.15.4	O-QPSK	26	2480	-18.87	≤ 30	-16.07	≤ 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	15.96	≤ 30	18.76	≤ 36	Pass
802.15.4	O-QPSK	19	2445	17.86	≤ 30	20.66	≤ 36	Pass
802.15.4	O-QPSK	25	2475	11.91	≤ 30	14.71	≤ 36	Pass
802.15.4	O-QPSK	26	2480	-37.09	≤ 30	-34.29	≤ 36	Pass

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

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band. 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.

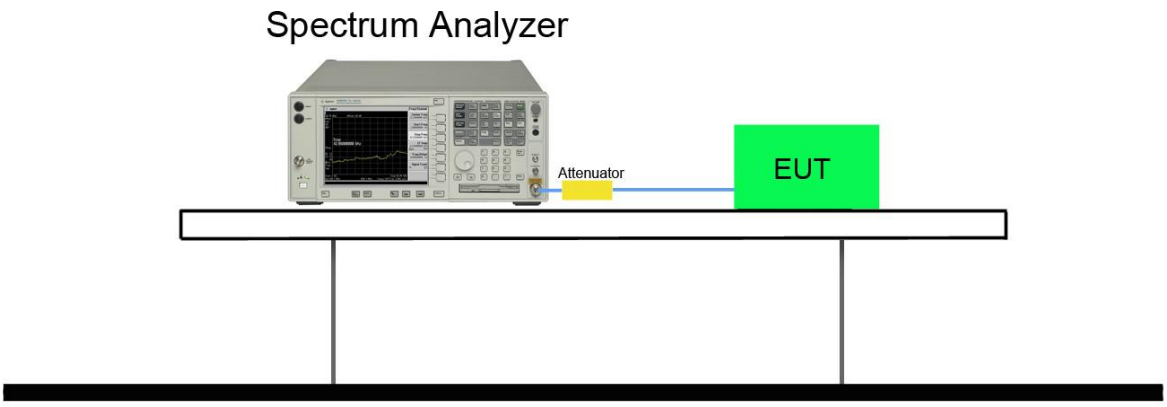
7.4.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 10.2 Method PKPSD

7.4.3. Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

7.4.4. Test Setup



7.4.5. Test Result of Power Spectral Density

Test Mode	Modulation Mode	Channel No.	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.15.4	O-QPSK	11	2405	2.96	≤ 8	Pass
802.15.4	O-QPSK	19	2445	3.98	≤ 8	Pass
802.15.4	O-QPSK	26	2480	-54.52	≤ 8	Pass

802.15.4 Power Density

Channel 11 (2405MHz)

Channel 19 (2445MHz)

Channel 26 (2480MHz)

7.5. Conducted Band Edge and Out-of-Band Emissions

7.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

7.5.2. Test Procedure Used

KDB 558074 D01v03r05 - Section 11.2 & Section 11.3

7.5.3. Test Settitng

1. Reference level measurement

(a) Set instrument center frequency to DTS channel center frequency

(b) Set the span to ≥ 1.5 times the DTS bandwidth

(c) Set the RBW = 100 kHz

(d) Set the VBW ≥ 3 x RBW

(e) Detector = peak

(f) Sweep time = auto couple

(g) Trace mode = max hold

(h) Allow trace to fully stabilize

2. Emission level measurement

(a) Set the center frequency and span to encompass frequency range to be measured

(b) RBW = 100kHz

(c) VBW = 300kHz

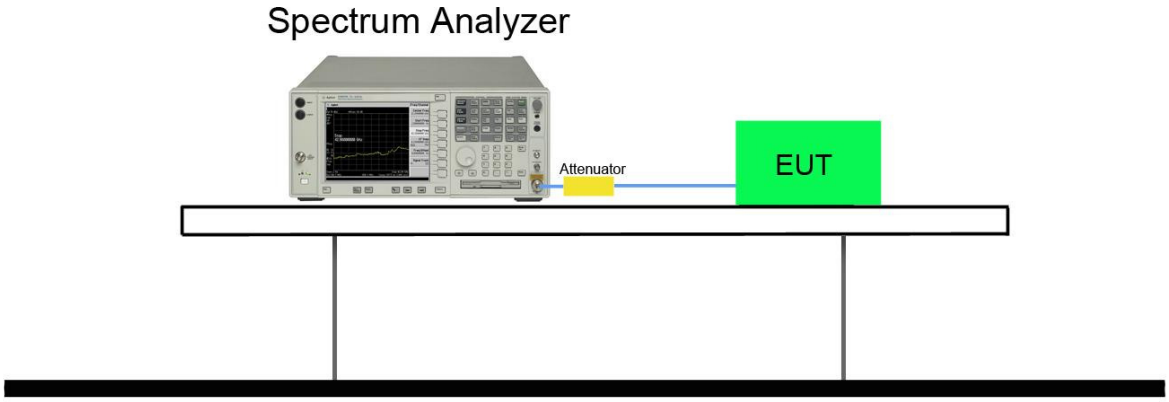
(d) Detector = Peak

(e) Trace mode = max hold

(f) Sweep time = auto couple

(g) The trace was allowed to stabilize

7.5.4. Test Setup



7.5.5. Test Result

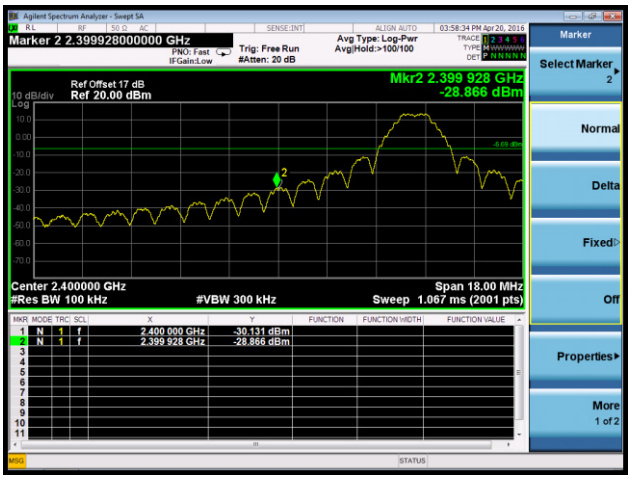
Test Mode	Modulation Mode	Channel No.	Frequency (MHz)	Limit	Result
802.15.4	O-QPSK	11	2405	20dBc	Pass
802.15.4	O-QPSK	19	2445	20dBc	Pass
802.15.4	O-QPSK	25	2475	20dBc	Pass
802.15.4	O-QPSK	26	2480	20dBc	Pass

802.15.4 Out-of-Band Emissions

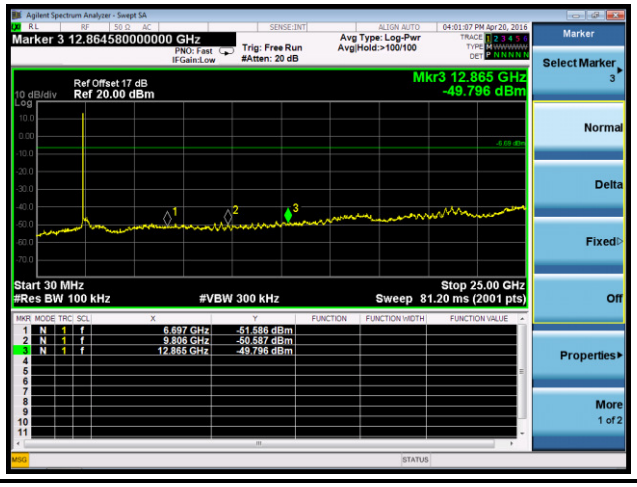
Channel 11 (2405MHz)

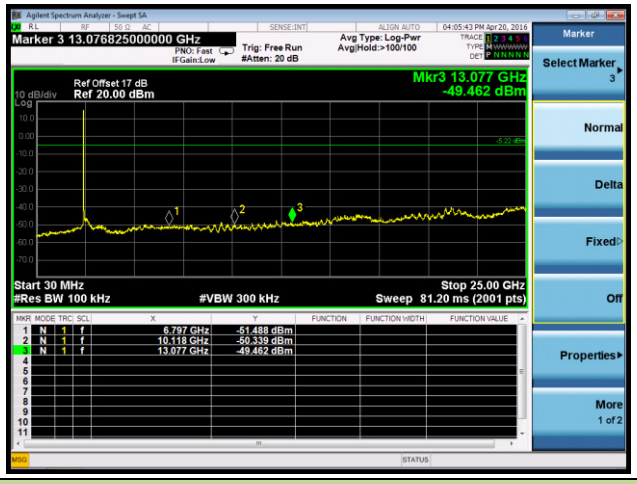
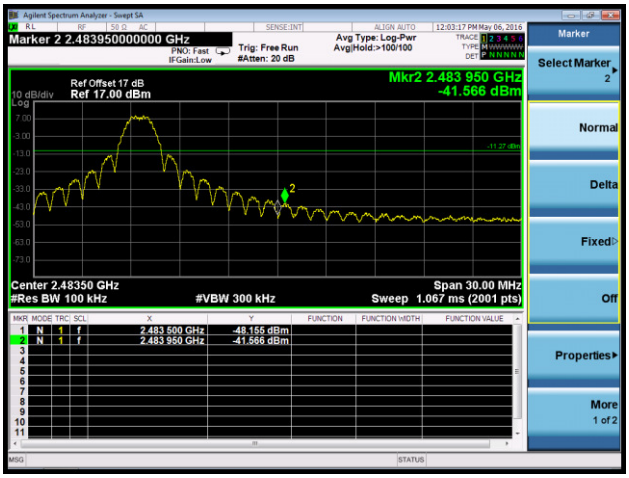
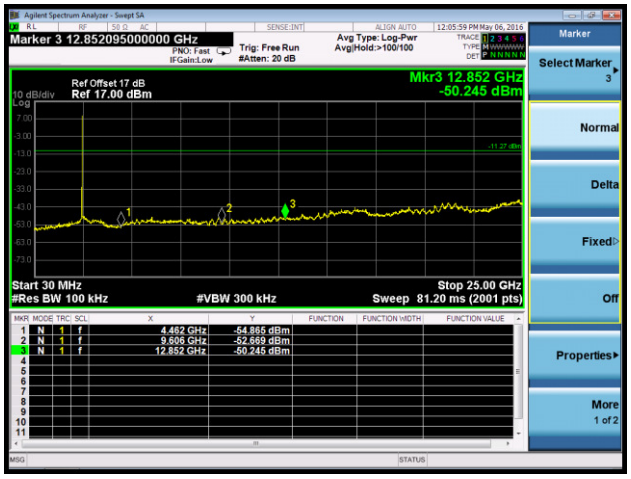
100kHz PSD Reference Level

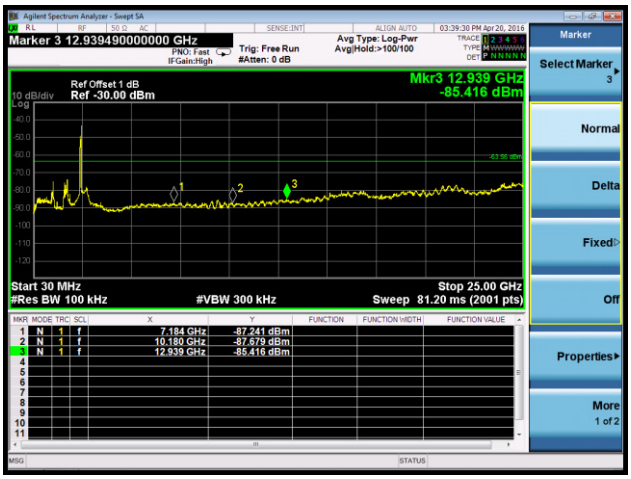
Low Band Edge



Spurious Emission



Channel 19 (2445MHz)	
100kHz PSD Reference Level	**Spurious Emission**
	
Channel 25 (2475MHz)	
100kHz PSD Reference Level	**Low Band Edge**
	
Spurious Emission	
	

802.15.4 Out-of-Band Emissions	
Channel 26 (2480MHz)	
100kHz PSD Reference Level	Low Band Edge
	
Spurious Emission	
	

7.6. Radiated Spurious Emission Measurement

7.6.1. 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

7.6.2. Test Procedure Used

KDB 558074 D01v03r05 – Section 12.2.3 (quasi-peak measurements)

KDB 558074 D01v03r05 – Section 12.2.4 (peak power measurements)

KDB 558074 D01v03r05 – Section 12.2.5 (average power measurements)

7.6.3. Test Setting

Peak Field Strength Measurements per Section 12.2.4 of KDB 558074 D01v03r05

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

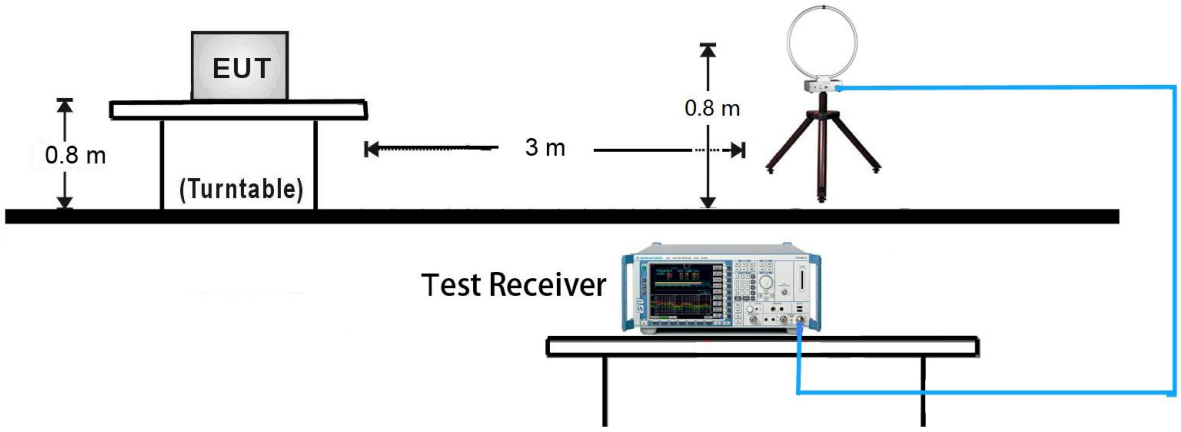
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements per Section 12.2.5.3 of KDB 558074 D01v03r05

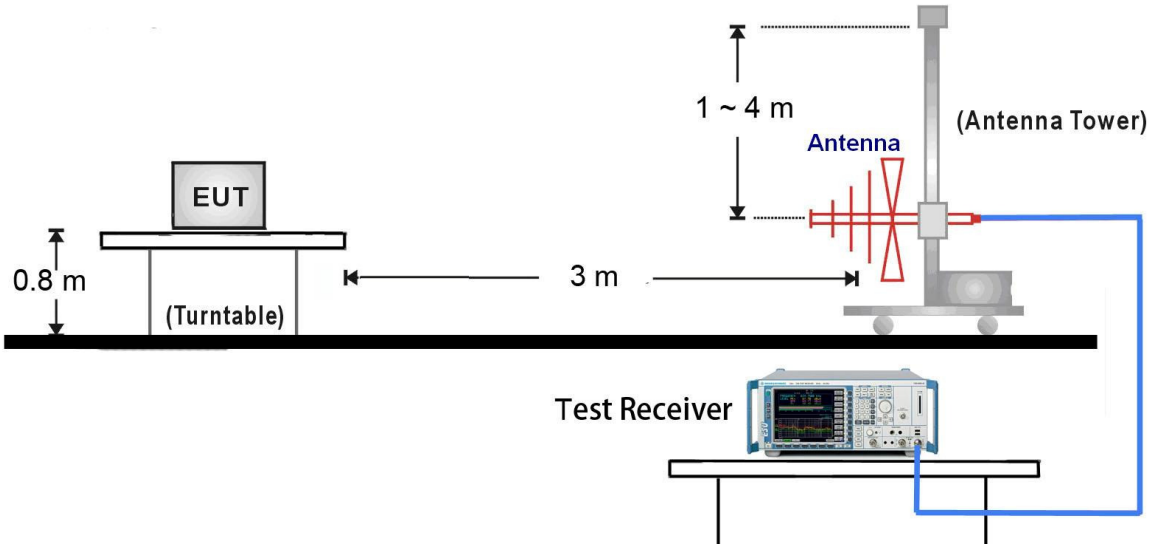
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW ≥ 1/T
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). 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

7.6.4. Test Setup

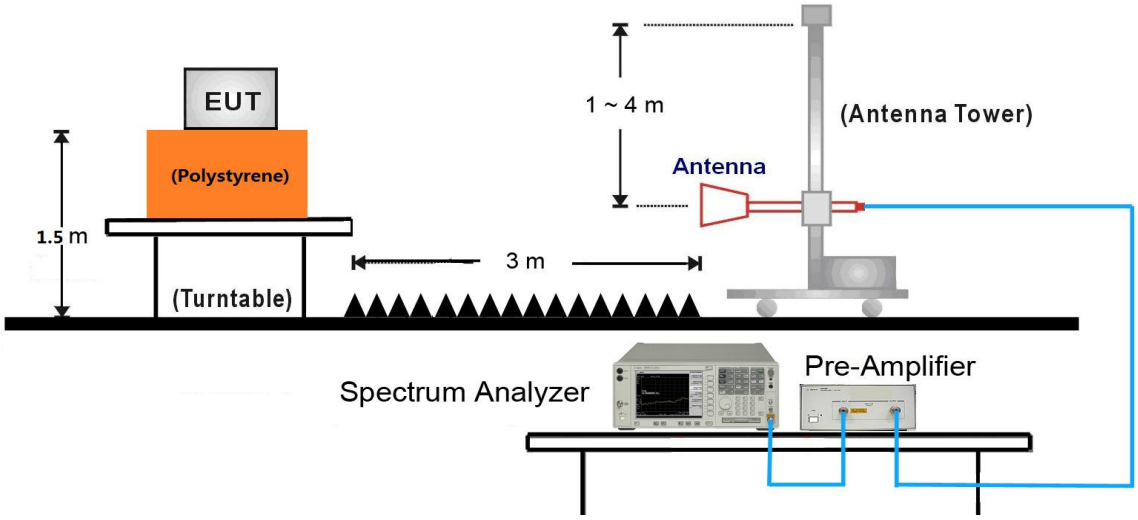
9kHz ~ 30MHz Test Setup:



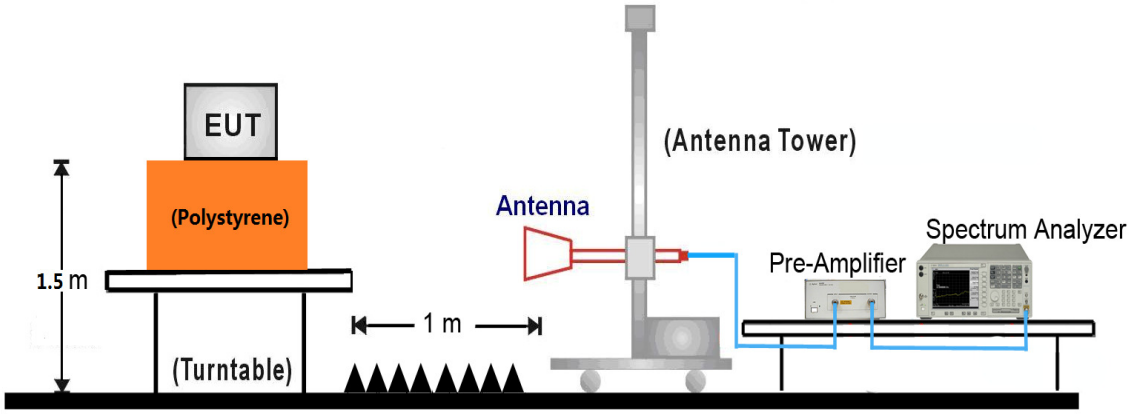
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



7.6.5. 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 (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
*	3526.0	38.8	-1.0	37.8	91.0	-53.2	Peak	Horizontal
*	4418.0	35.9	1.4	37.3	91.0	-53.7	Peak	Horizontal
	4808.0	42.5	2.7	45.2	74.0	-28.8	Peak	Horizontal
	7250.0	35.4	7.9	43.3	74.0	-30.7	Peak	Horizontal
*	3526.0	37.8	-1.0	36.8	91.0	-54.2	Peak	Vertical
*	4408.0	35.7	1.4	37.1	91.0	-53.9	Peak	Vertical
	4808.0	41.9	2.7	44.6	74.0	-29.4	Peak	Vertical
	7385.0	35.4	7.9	43.3	74.0	-30.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (111.0dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + 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 (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
*	3526.0	37.9	-1.0	36.9	91.3	-54.4	Peak	Horizontal
*	4418.0	35.2	1.4	36.6	91.3	-54.7	Peak	Horizontal
	4876.0	43.5	2.7	46.2	74.0	-27.8	Peak	Horizontal
	7324.0	37.3	8.0	45.3	74.0	-28.7	Peak	Horizontal
*	3526.0	37.8	-1.0	36.8	91.3	-54.5	Peak	Vertical
*	4429.0	35.8	1.5	37.3	91.3	-54.0	Peak	Vertical
	4876.0	42.9	2.7	45.6	74.0	-28.4	Peak	Vertical
	7324.0	38.5	8.0	46.5	74.0	-27.5	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (111.3dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + 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 (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
*	3523.0	38.8	-1.0	37.8	85.5	-47.7	Peak	Horizontal
*	4445.0	36.7	1.5	38.2	85.5	-47.3	Peak	Horizontal
	4952.5	46.6	2.9	49.5	74.0	-24.5	Peak	Horizontal
	7425.0	37.3	8.0	45.3	74.0	-28.7	Peak	Horizontal
*	3434.0	38.6	-1.5	37.1	85.5	-48.4	Peak	Vertical
*	4413.0	36.8	1.4	38.2	85.5	-47.3	Peak	Vertical
	4952.5	43.4	2.9	46.3	74.0	-27.7	Peak	Vertical
	7426.0	39.1	8.0	47.1	74.0	-26.9	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (105.5dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + 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 (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
*	3526.0	38.7	-1.0	37.7	74.0	-36.3	Peak	Horizontal
*	4425.0	36.4	1.4	37.8	74.0	-36.2	Peak	Horizontal
	4961.0	46.6	2.9	49.5	74.0	-24.5	Peak	Horizontal
	7362.0	35.4	7.9	43.3	74.0	-30.7	Peak	Horizontal
*	3526.0	38.7	-1.0	37.7	74.0	-36.3	Peak	Vertical
*	4418.0	36.5	1.4	37.9	74.0	-36.1	Peak	Vertical
	4961.0	43.0	2.9	45.9	74.0	-28.1	Peak	Vertical
	7443.0	39.1	8.0	47.1	74.0	-26.9	Peak	Vertical

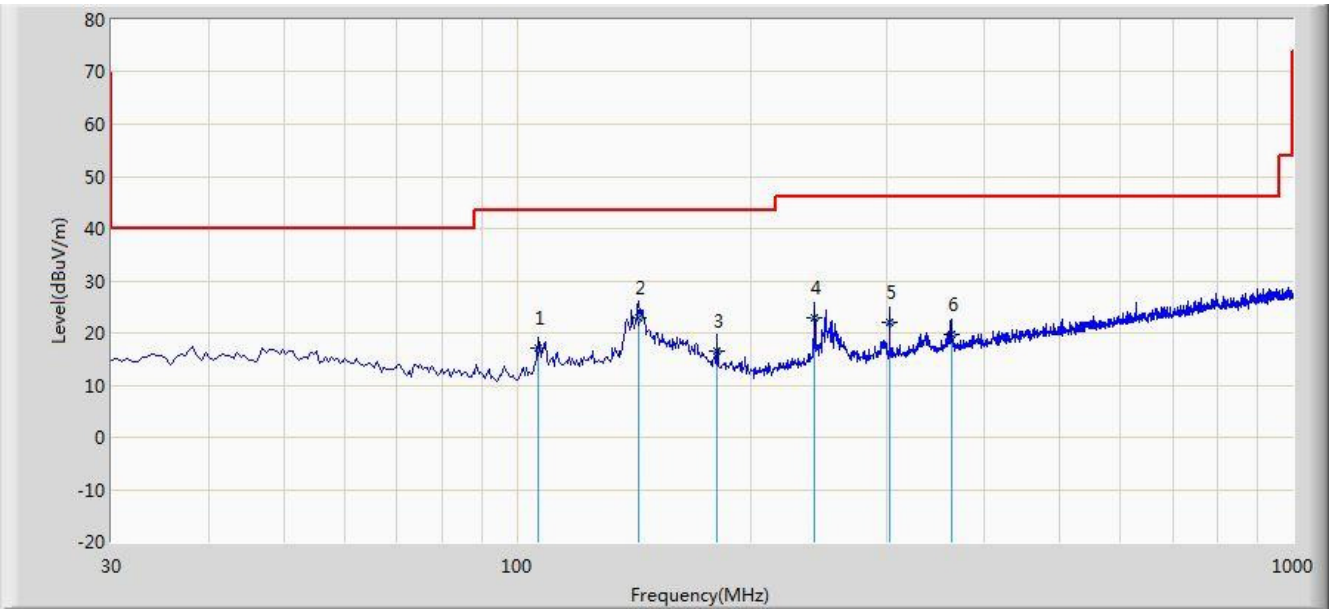
Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (63.4dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

The worst case of Radiated Emission below 1GHz:

Site: AC 1	Time: 2016/04/25 - 11:19
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Worse Case Mode: Transmit by 802.15.4 at channel 2405MHz	

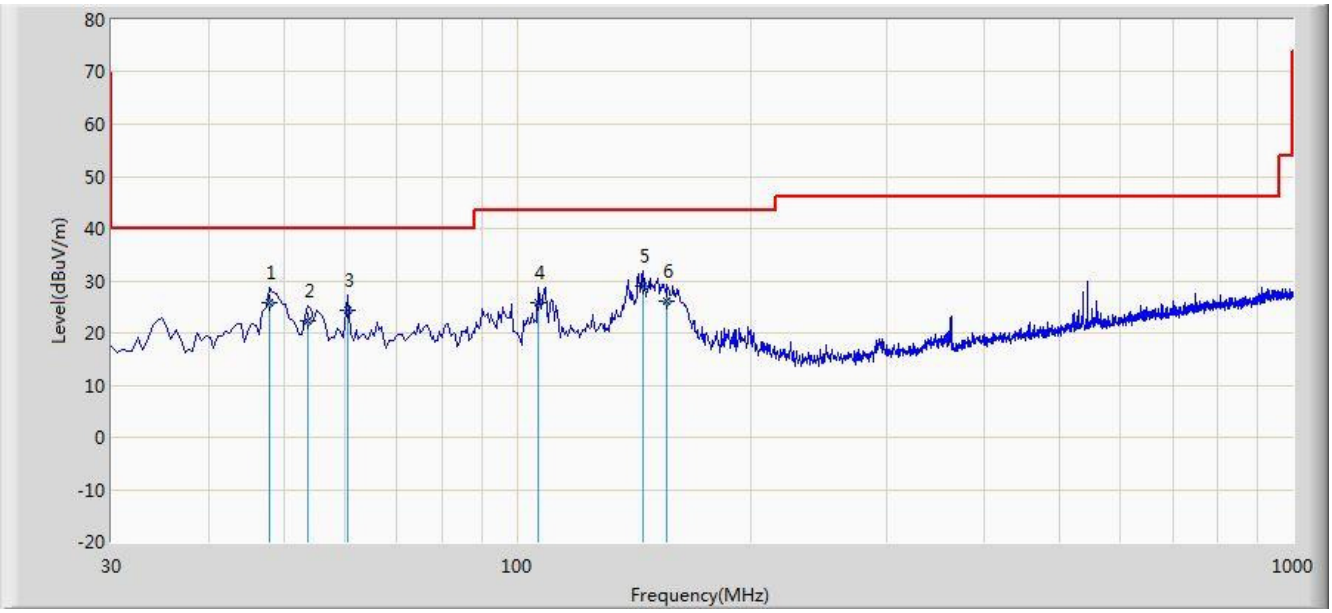


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			106.630	17.183	5.539	-26.317	43.500	11.644	QP
2		*	143.490	22.948	8.219	-20.552	43.500	14.729	QP
3			181.320	16.595	3.950	-26.905	43.500	12.645	QP
4			241.950	22.807	10.013	-23.193	46.000	12.794	QP
5			302.085	21.941	7.585	-24.059	46.000	14.356	QP
6			362.710	19.666	3.939	-26.334	46.000	15.727	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/25 - 11:21
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Worse Case Mode: Transmit by 802.15.4 at channel 2405MHz	

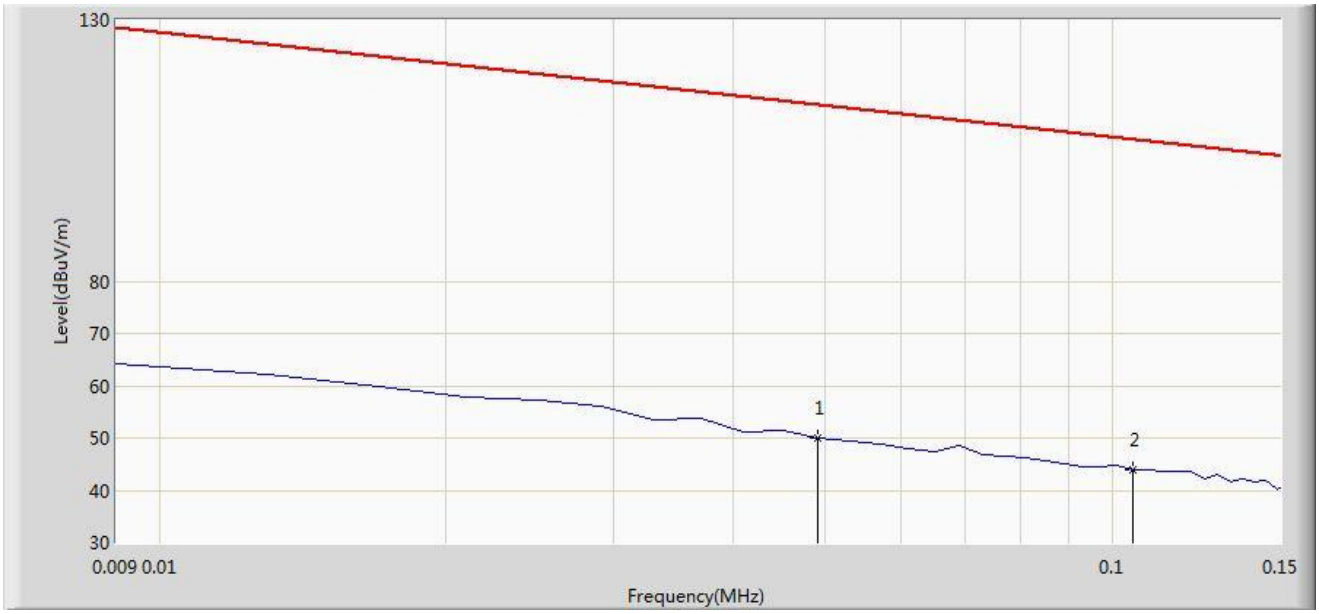


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	47.945	25.775	11.664	-14.225	40.000	14.111	QP
2			53.765	22.253	8.458	-17.747	40.000	13.795	QP
3			60.555	24.384	11.150	-15.616	40.000	13.234	QP
4			106.630	25.837	14.193	-17.663	43.500	11.644	QP
5			145.430	28.859	13.990	-14.641	43.500	14.869	QP
6			155.615	26.224	11.040	-17.276	43.500	15.184	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC1	Time: 2016/04/20 - 18:12
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: Element hub	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 9kHz~30MHz.	



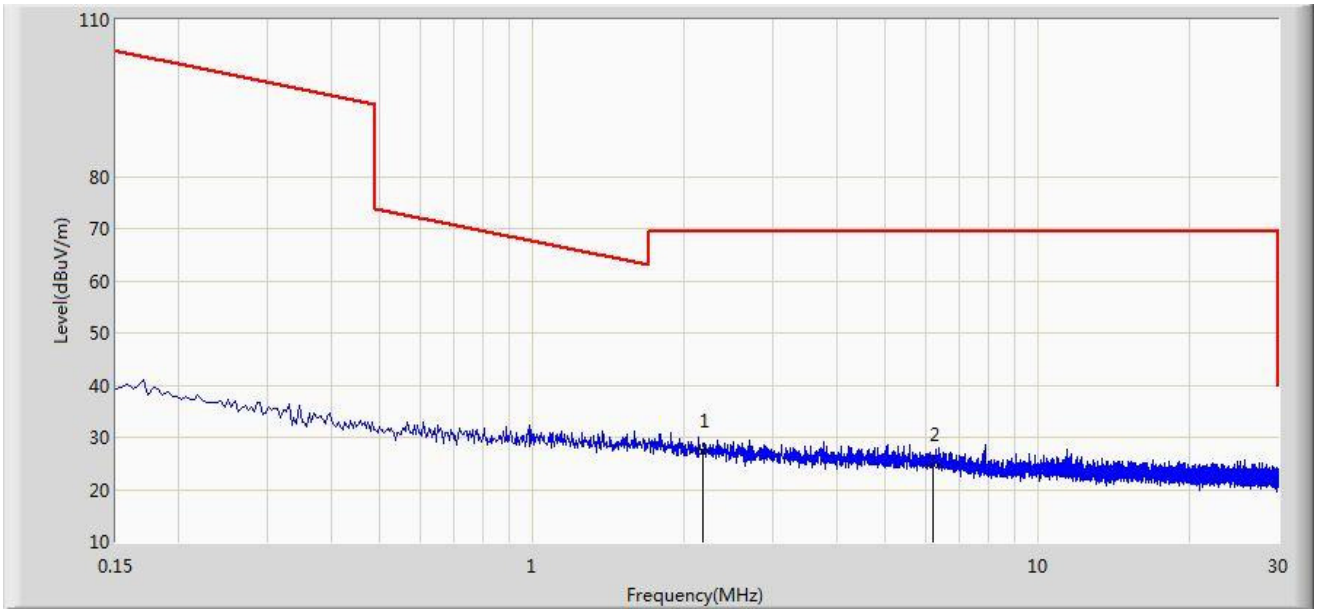
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			0.049	50.112	29.552	-63.688	113.800	20.560	AV
2		*	0.105	44.043	23.845	-63.137	107.180	20.198	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor. (dB).

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

Limit@3m = 20*Log((2400/49)uV/m) + 40*Log(300m/3m) = 113.800dBμv/m (Average detector)

Site: AC1	Time: 2016/04/20 - 18:16
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: Element hub	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 9kHz~30MHz.	



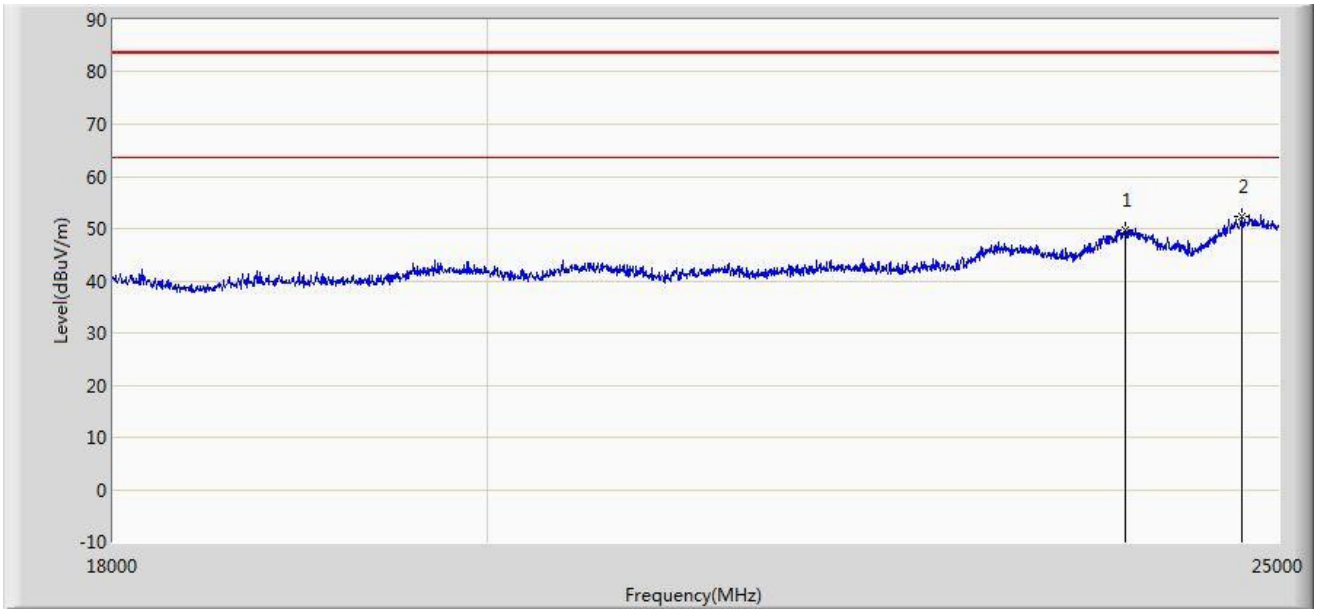
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2.175	27.371	6.960	-42.129	69.500	20.412	QP
2			6.216	24.786	4.701	-44.714	69.500	20.085	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

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

Limit@3m = 20*Log(30uV/m) + 20*Log(30m/3m) = 49.5dBμv/m (Average detector), and 69.5dBμv/m (Quasi-Peak detector).

Site: AC1	Time: 2016/04/20- 21:20
Limit: FCC_Part15.209_RE(1m)	Engineer: Vince Yu
Probe: BBHA9170_18-40GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 18GHz~25GHz.	



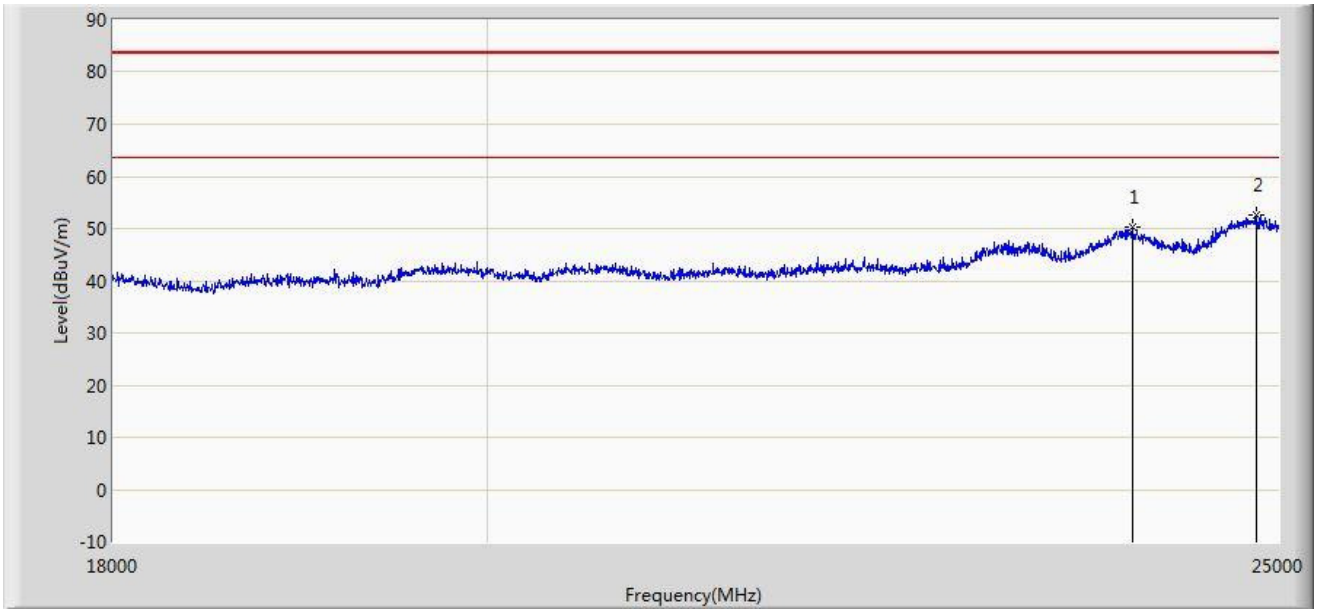
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			23943.000	49.776	35.866	-33.724	83.500	13.910	PK
2		*	24741.000	52.375	37.681	-31.125	83.500	14.694	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Limit@1m = 20*Log(500uV/m) + 20*Log(3m/1m) = 63.5dBμv/m (Average detector), and 83.5dBμv/m (Peak detector).

Site: AC1	Time: 2016/04/20 - 21:32
Limit: FCC_Part15.209_RE(1m)	Engineer: Vince Yu
Probe: BBHA9170_18-40GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 18GHz~25GHz.	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			23999.000	50.379	36.435	-33.121	83.500	13.944	PK
2		*	24846.000	52.503	37.735	-30.997	83.500	14.768	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

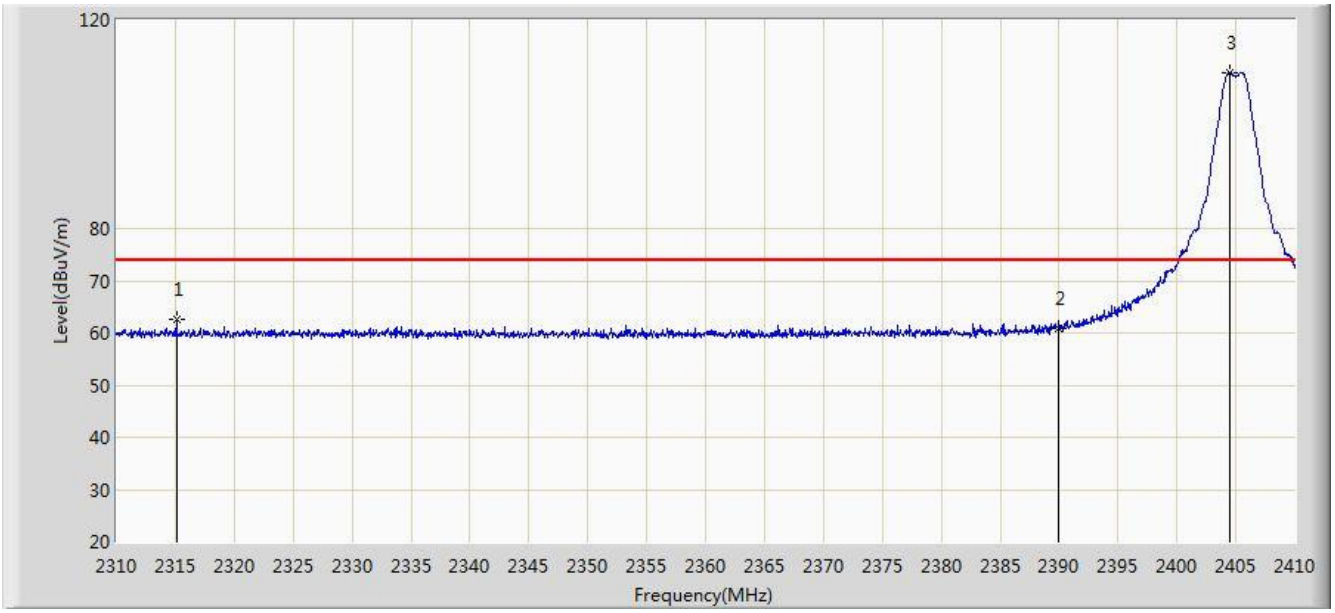
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre-Amplifier Gain (dB)

Limit@1m = 20*Log(500uV/m) + 20*Log(3m/1m) = 63.5dBμv/m (Average detector), and 83.5dBμv/m (Peak detector).

7.7. Radiated Restricted Band Edge Measurement

7.7.1. Test Result

Site: AC 1	Time: 2016/04/19 - 17:52
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	

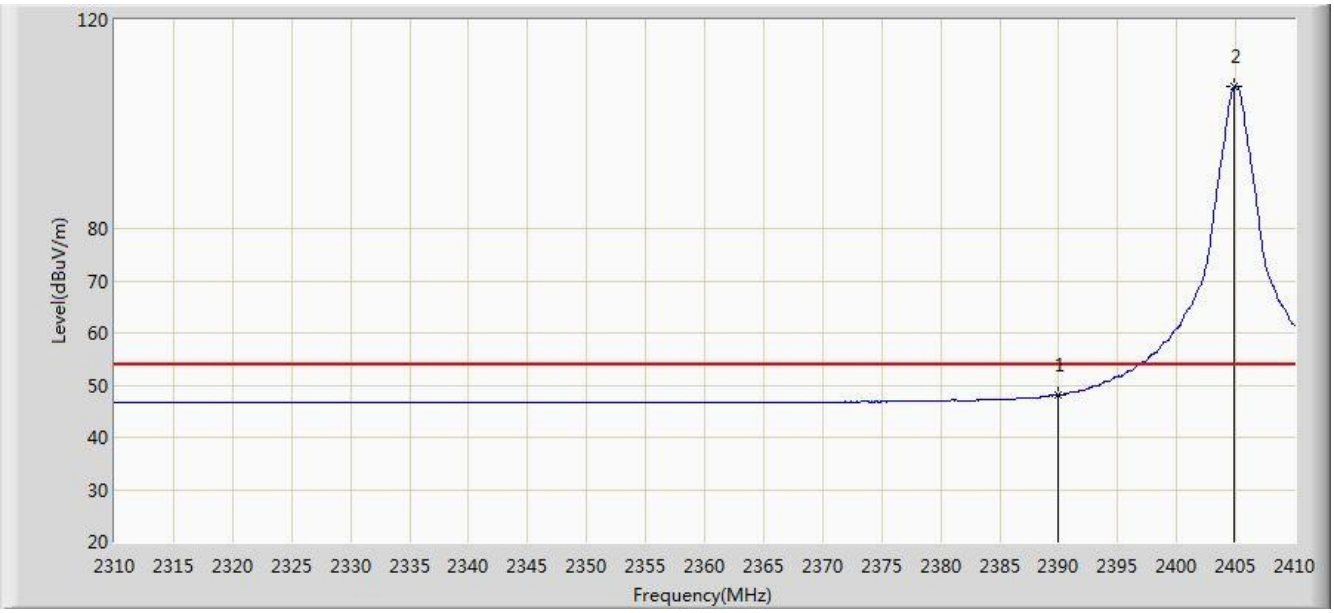


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2315.100	62.575	31.136	-11.425	74.000	31.440	PK
2			2390.000	61.013	29.810	-12.987	74.000	31.203	PK
3		*	2404.500	109.986	78.805	N/A	N/A	31.180	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 17:57
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	

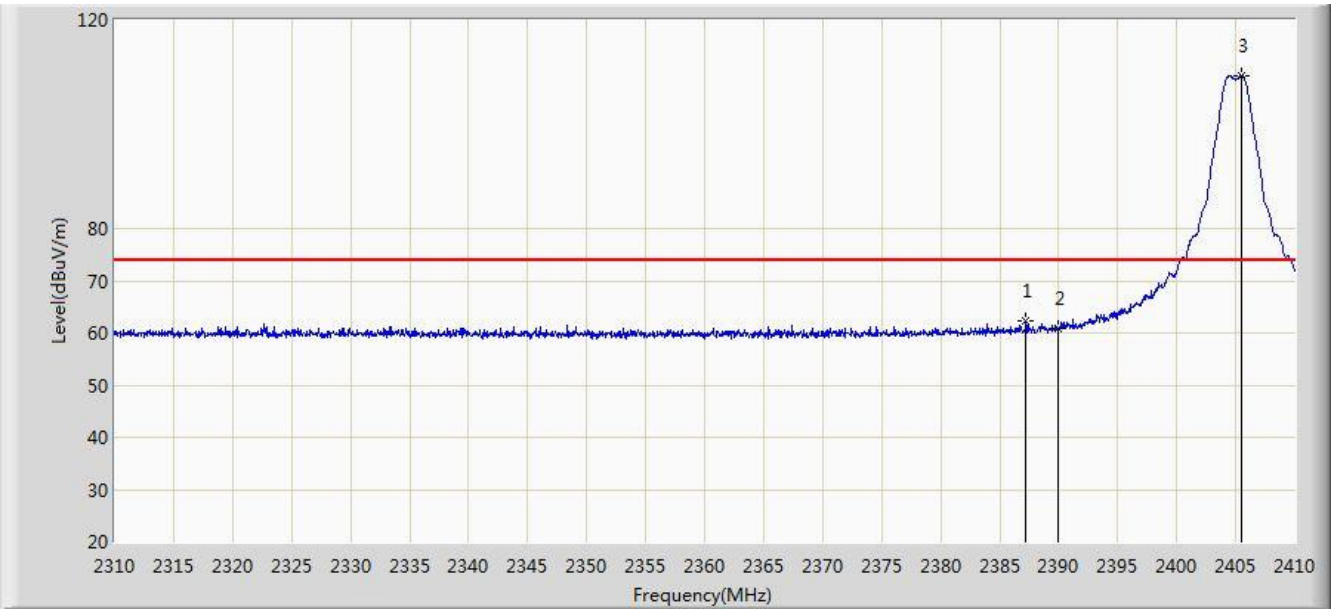


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	48.111	16.908	-5.889	54.000	31.203	AV
2		*	2404.850	107.136	75.956	N/A	N/A	31.180	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 17:58
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	

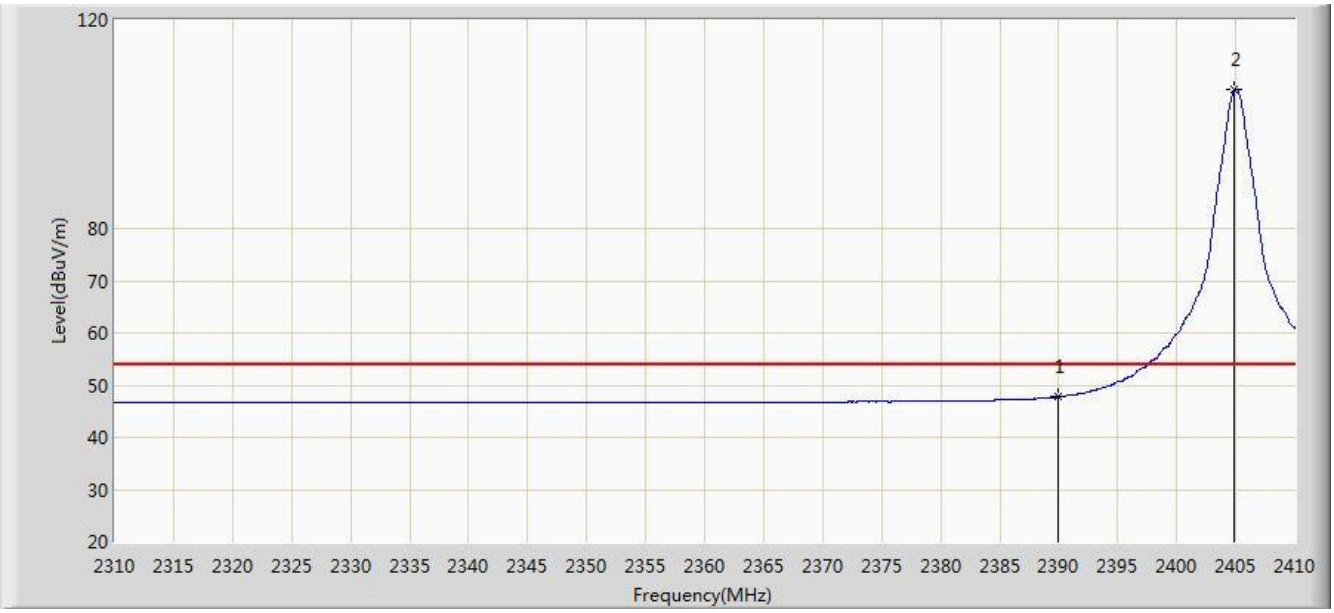


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2387.250	62.186	30.978	-11.814	74.000	31.208	PK
2			2390.000	60.933	29.730	-13.067	74.000	31.203	PK
3		*	2405.500	109.296	78.117	N/A	N/A	31.179	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:01
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	

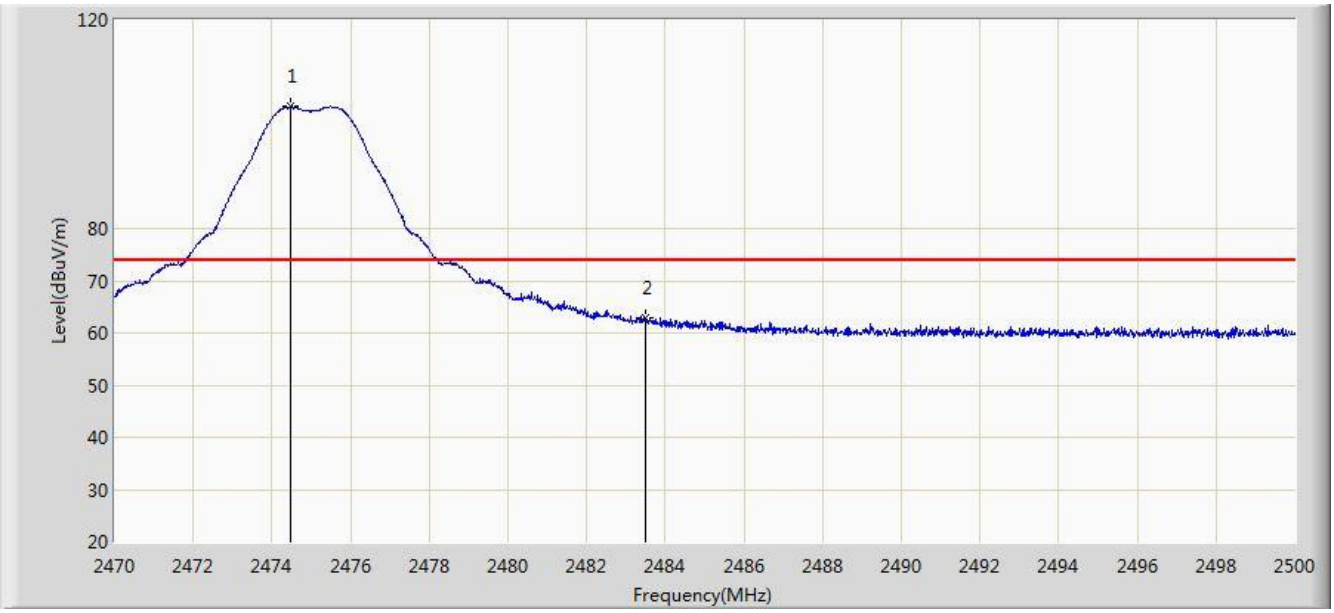


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			2390.000	47.803	16.600	-6.197	54.000	31.203	AV
2		*	2404.900	106.585	75.405	N/A	N/A	31.180	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:45
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2475MHz	

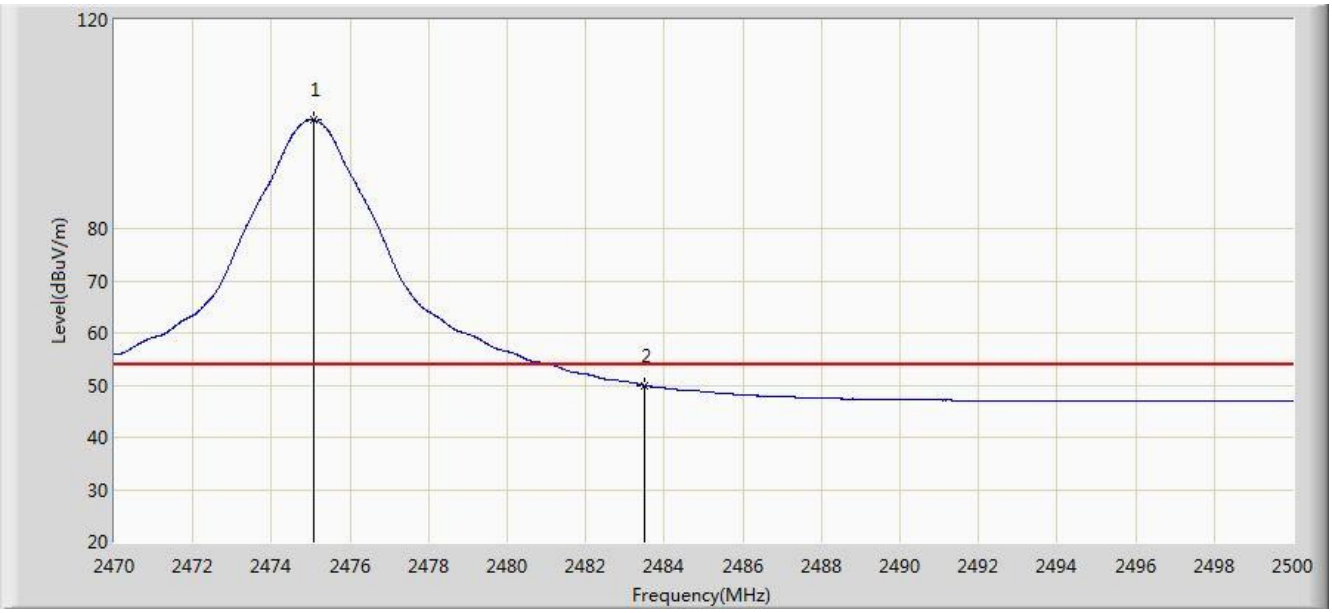


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2474.470	103.347	72.178	N/A	N/A	31.168	PK
2			2483.500	62.854	31.661	-11.146	74.000	31.194	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:49
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2475MHz	

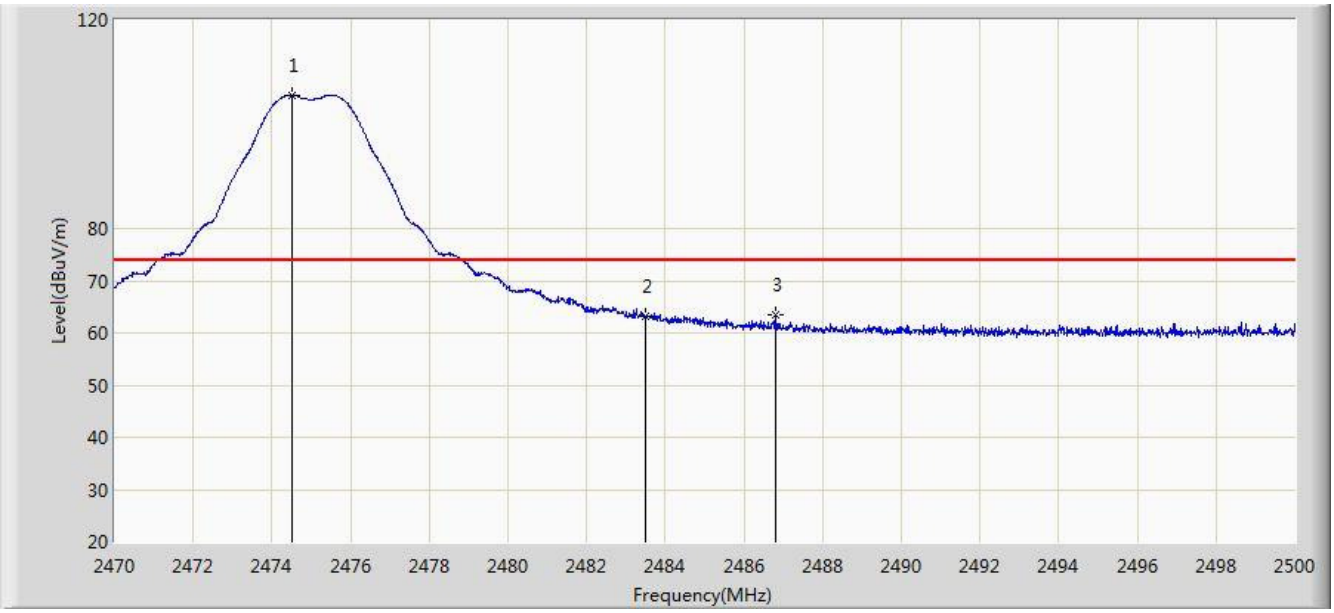


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2475.070	100.820	69.650	N/A	N/A	31.170	AV
2			2483.500	49.946	18.753	-4.054	54.000	31.194	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:49
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2475MHz	

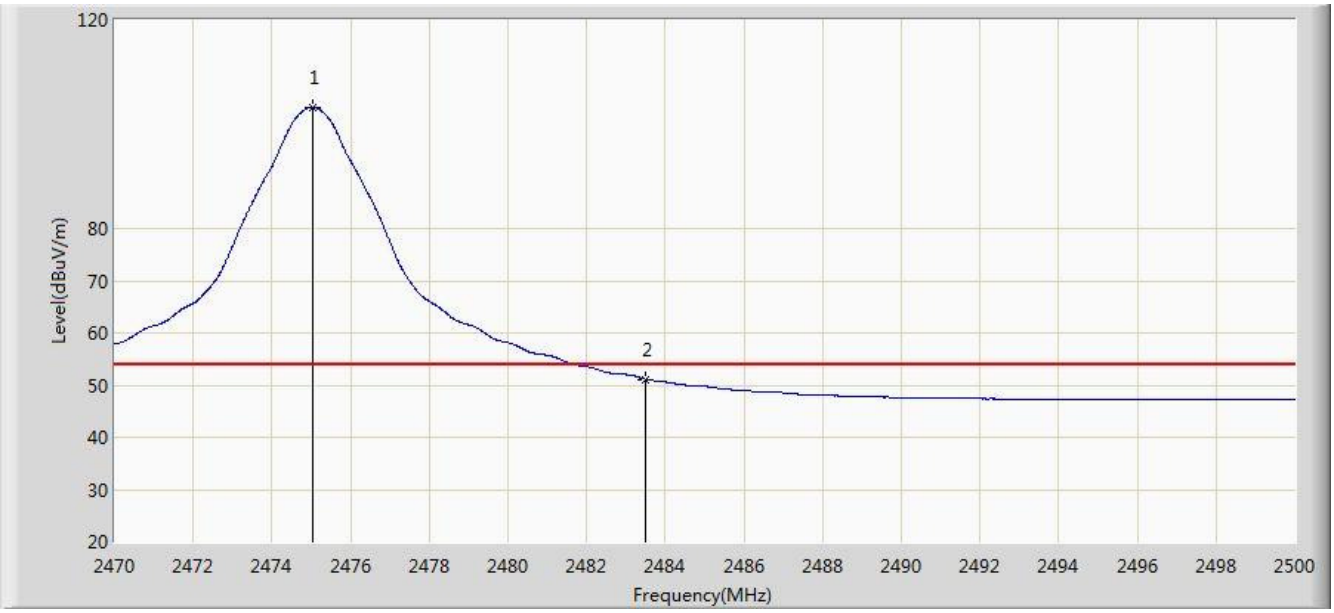


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2474.515	105.546	74.377	N/A	N/A	31.169	PK
2			2483.500	63.099	31.906	-10.901	74.000	31.194	PK
3			2486.800	63.400	32.198	-10.600	74.000	31.202	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:51
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2475MHz	

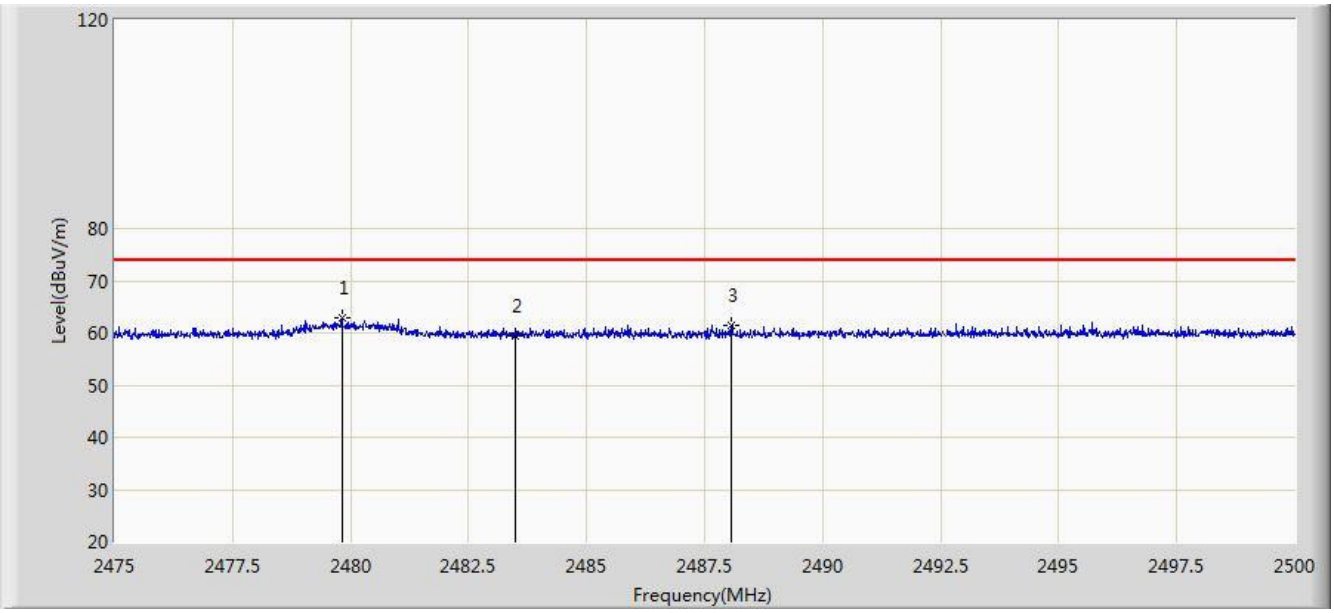


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2475.025	103.215	72.045	N/A	N/A	31.170	AV
2			2483.500	51.117	19.924	-2.883	54.000	31.194	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Site: AC 1	Time: 2016/04/19 - 18:52
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2480MHz	



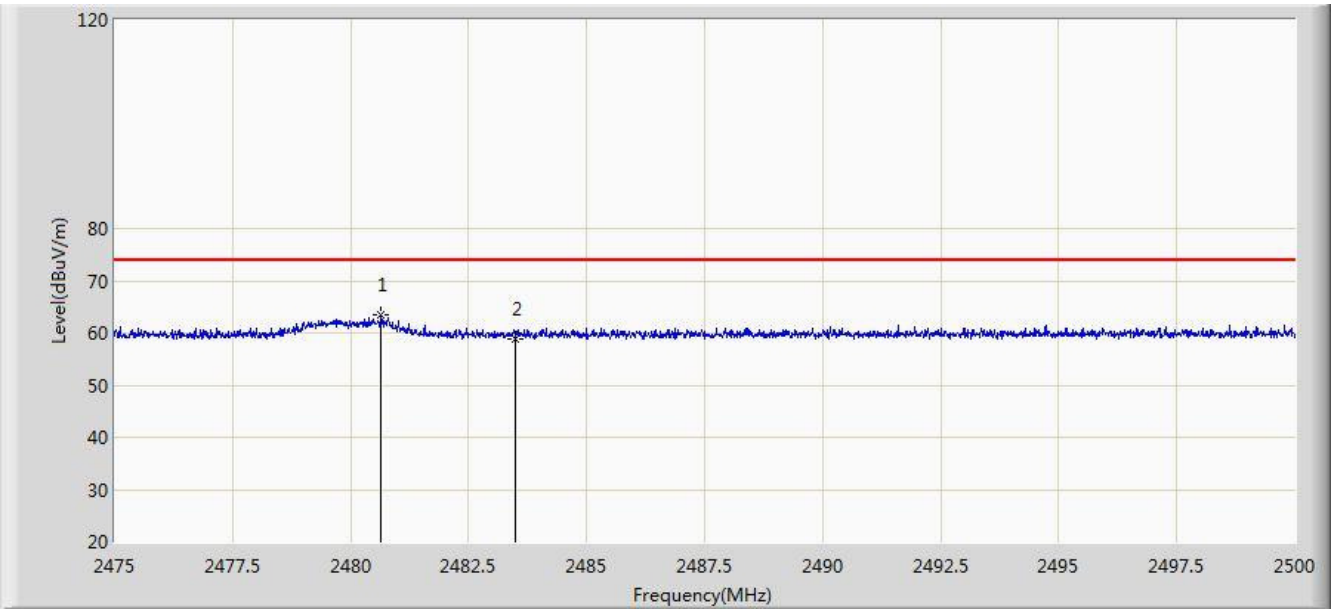
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.812	62.805	31.621	N/A	N/A	31.184	PK
2			2483.500	59.525	28.332	-14.475	74.000	31.194	PK
3			2488.062	61.498	30.293	-12.502	74.000	31.205	PK

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Note 2: Average measurement was not performed due to peak level lower than peak limit.

Site: AC 1	Time: 2016/04/19 - 18:57
Limit: FCC_Part15.209_RE(3m)	Engineer: Vince Yu
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2480MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.637	63.354	32.168	N/A	N/A	31.185	PK
2			2483.500	58.919	27.726	-15.081	74.000	31.194	PK

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

Note 2: Average measurement was not performed due to peak level lower than peak limit.

7.8. AC Conducted Emissions Measurement

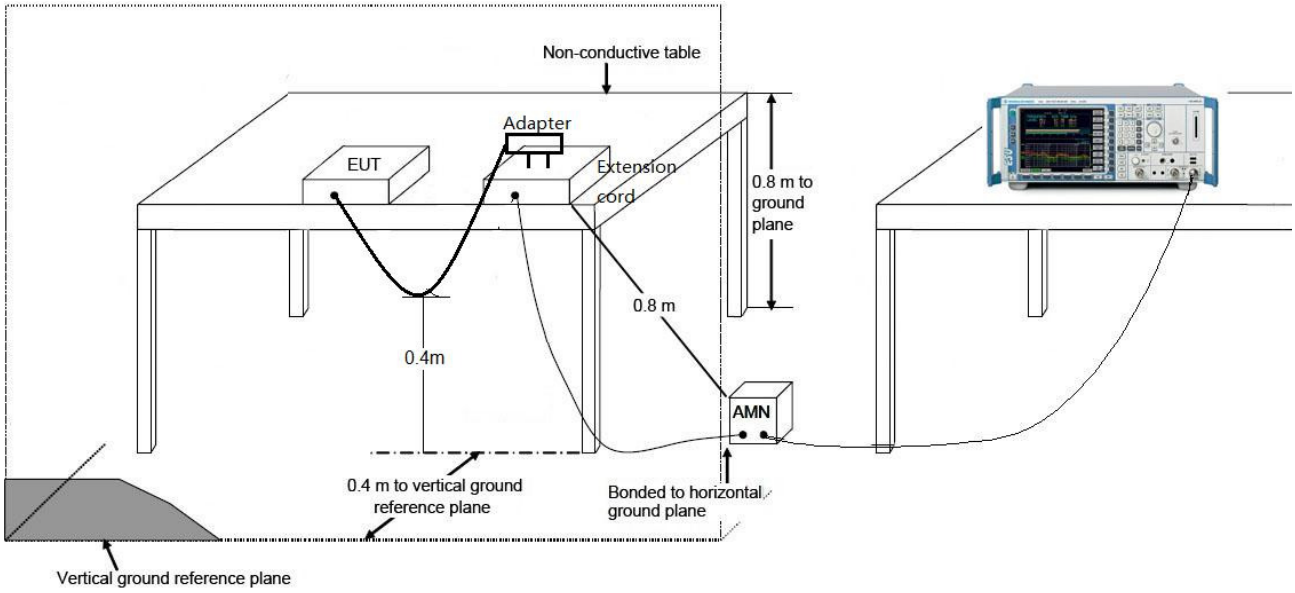
7.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

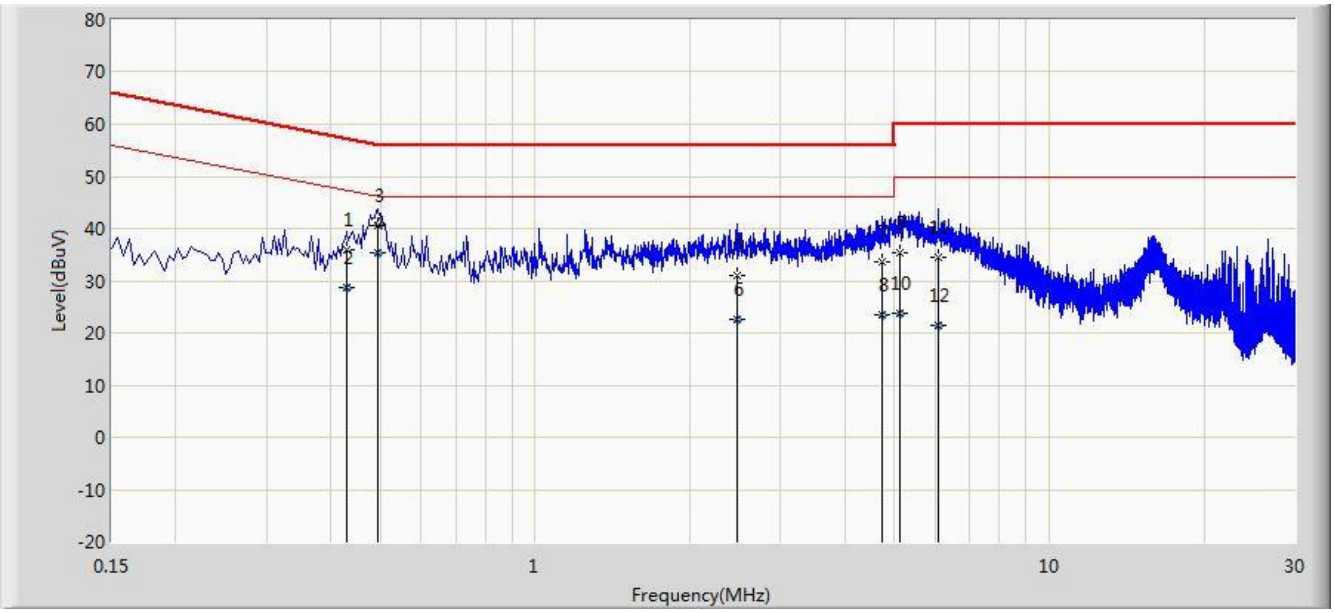
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.8.2. Test Setup



7.8.3. Test Result

Site: SR2	Time: 2016/04/19 - 14:09
Limit: FCC_Part15.207_CE_AC Power	Engineer: Zero Cao
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	

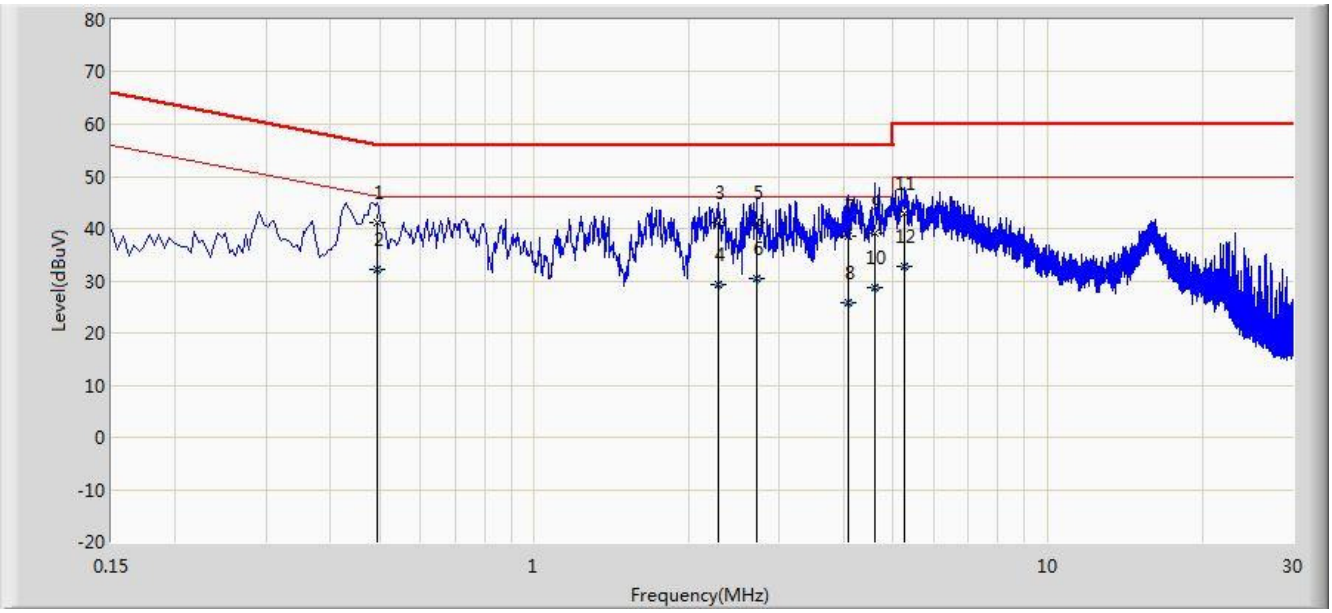


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.430	36.052	25.942	-21.201	57.253	10.110	QP
2			0.430	28.615	18.505	-18.638	47.253	10.110	AV
3			0.494	40.624	30.466	-15.476	56.100	10.158	QP
4		*	0.494	35.480	25.322	-10.620	46.100	10.158	AV
5			2.466	31.156	21.298	-24.844	56.000	9.858	QP
6			2.466	22.565	12.707	-23.435	46.000	9.858	AV
7			4.742	33.582	23.566	-22.418	56.000	10.016	QP
8			4.742	23.583	13.567	-22.417	46.000	10.016	AV
9			5.110	35.472	25.423	-24.528	60.000	10.049	QP
10			5.110	23.668	13.619	-26.332	50.000	10.049	AV
11			6.082	34.484	24.366	-25.516	60.000	10.118	QP
12			6.082	21.476	11.358	-28.524	50.000	10.118	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

Site: SR2	Time: 2016/04/19 - 14:16
Limit: FCC_Part15.207_CE_AC Power	Engineer: Zero Cao
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: Element hub	Power: AC 120V/60Hz
Test Mode: Transmit by 802.15.4 at channel 2405MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.494	41.071	30.893	-15.029	56.100	10.178	QP
2		*	0.494	32.281	22.102	-13.819	46.100	10.178	AV
3			2.286	41.212	31.345	-14.788	56.000	9.866	QP
4			2.286	29.144	19.278	-16.856	46.000	9.866	AV
5			2.706	41.150	31.295	-14.850	56.000	9.855	QP
6			2.706	30.457	20.602	-15.543	46.000	9.855	AV
7			4.098	38.539	28.562	-17.461	56.000	9.978	QP
8			4.098	25.927	15.949	-20.073	46.000	9.978	AV
9			4.614	39.193	29.186	-16.807	56.000	10.007	QP
10			4.614	28.764	18.756	-17.236	46.000	10.007	AV
11			5.254	42.754	32.699	-17.246	60.000	10.054	QP
12			5.254	32.636	22.582	-17.364	50.000	10.054	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **Element hub FCC ID:**

2AGN8-Z02HUB is in compliance with Part 15C of the FCC Rules.

The End