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

Report No.: 1410RSU00902
Report Version: V01
Issue Date: 10-29-2014

MEASUREMENT REPORT
FCC PART 15.247 / IC RSS-210 BLE

FCC ID:	2ABX8SH-000000005
IC:	12219A-00000000005
APPLICANT:	Zhejiang shenghui lighting Co., Ltd. Shanghai Branch
Application Type:	Certification
Product:	LED Lamp
FCC Model No.:	C01-A66XXE26(where X can be 0-9, A-Z, a-z or blank for different customer code which will not influence safety)
IC Model No.:	C01-A66NAE26
Brand Name:	sengled
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15.247
IC Rule(s):	RSS-210 Issue 8
Test Procedure(s):	KDB 558074 D01v03r02, KDB 662911 D01v02r01
Test Date:	Oct. 19 ~ 26, 2014

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 D01v03r02. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date
1410RSU00902	Rev. 01	Initial report	10-29-2014

CONTENTS

Description Page

§2.1033 General Information

Applicant:	Zhejiang shenghui lighting Co., Ltd. Shanghai Branch
Applicant Address:	Rm. 801, 1st Xinye Building,388 Tianlin Rd., Caohejing Development Zone, Shanghai, 200233, China
Manufacturer:	ZHEJIANG SHENGHUI LIGHTING Co., Ltd
Manufacturer Address:	South Jiachuang Rd., Xiuzhou Industrial Park Jiaxing, Zhejiang 314015 P.R. China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
FCC Registration No.:	809388
IC Registration No.:	11384A
FCC Rule Part(s):	Part 15.247
IC Rule(s):	RSS-210 Issue 8
FCC Model No.:	C01-A66XXE26(where X can be 0-9, A-Z, a-z or blank for different customer code which will not influence safety)
IC Model No.:	C01-A66NAE26
FCC ID:	2ABX8SH-000000005
IC:	12219A-00000000005
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)
Date(s) of Test:	Oct. 19 ~ 26, 2014
Test Report S/N:	1410RSU00902

Test Facility / Accreditations

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

- **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.**
- **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 and Industry Canada (11384A-1).**
- **MRT facility is an IC registered (11384A-1) test laboratory with the site description on file at Industry Canada.**

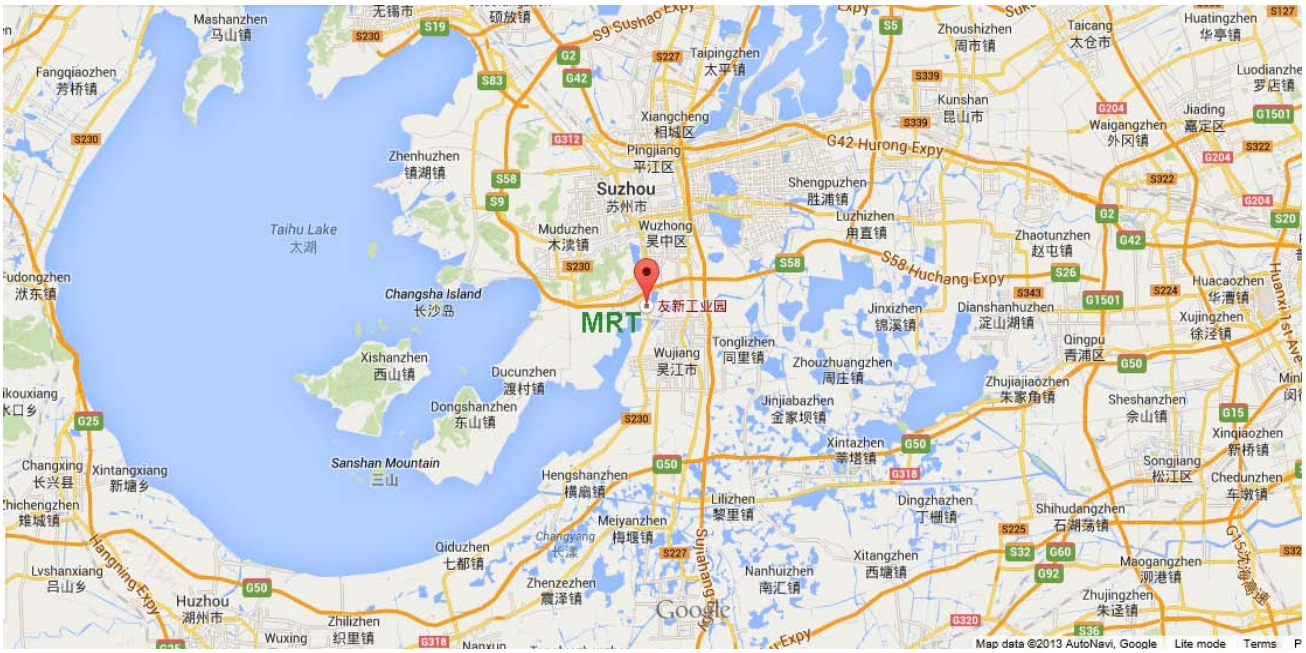
1. INTRODUCTION

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, 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	LED Lamp
FCC Model No.	C01-A66XXE26(where X can be 0-9, A-Z, a-z or blank for different customer code which will not influence safety)
IC Model No.	C01-A60NAE26
BLE	
Power Type	AC 100~240V 50/60Hz
Bluetooth Frequency	2402~2480MHz
Bluetooth Version	V4.0
Type of modulation	FHSS
Data Rate	1Mbps(GFSK)
Antenna Type	PCB Antenna
Antenna Gain	1.35dBi

Note1: The difference of models is for different marketing requirement.

2.2. Frequency / Channel Operation

Channel List for BLE

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	N/A	N/A	N/A	N/A

2.3. Test Mode

Test Mode	Mode 1: Transmit by BLE

2.4. Test Software

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

2.5. Device Capabilities

This device contains the following capabilities:
Bluetooth (1x, EDR), Bluetooth (BLE)

2.6. Test Configuration

The LED Lamp **FCC ID: 2ABX8SH-000000005** was tested per the guidance of KDB 558074 D01v03r02. ANSI C63.4-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.7. EMI Suppression Device(s)/Modifications

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

2.8. 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 trade name and 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 C63.10-2009), and the guidance provided in KDB 558074 D01v03r02 were used in the measurement of the **LED Lamp FCC ID: 2ABX8SH-000000005.**
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 C63.10-2009 at Clause 4.3.
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 was placed on top of the 0.8 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 LED Lamp is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **LED Lamp FCC ID: 2ABX8SH-000000005** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	1 year	2014/11/08
Two-Line V-Network	R&S	ENV216	101683	1 year	2014/11/08
Two-Line V-Network	R&S	ENV216	101684	1 year	2014/11/08
Temperature/ Meter Humidity	Anymetre	TH101B	SR2-01	1 year	2014/11/15

Radiated Emission

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY51440164	1 year	2015/01/04
EMI Test Receiver	R&S	ESR7	101209	1 year	2014/11/08
Preamplifier	MRT	AP18G40	1310001	1 year	2015/10/06
Preamplifier	MRT	AP01G18	1310002	1 year	2015/10/06
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	1 year	2014/11/24
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2014/11/24
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	1 year	2014/11/24
Broadband Horn Antenna	Schwarzbeck	BBHA9170	9170-549	1 year	2014/12/11
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2014/11/15

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
Power Sensor	Agilent	U2021XA	MY52450003	1 year	2014/12/14
Temperature/Humidity Meter	Anymetre	TH101B	TR3-01	1 year	2014/11/15

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
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: ± 3.46dB
Radiated Emission Measurement
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: **Zhejiang shenghui lighting Co., Ltd. Shanghai Branch**
FCC ID: **2ABX8SH-000000005**
IC: **12219A-00000000005**
FCC Classification: **Digital Transmission System (DTS)**
Data Rate(s) Tested: **1Mbps(GFSK)**

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-210 [A8.2]	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	RSS-210 [A8.4]	Output Power	≤ 1Watt & EIRP ≤ 4Watt		Pass	Section 7.3
15.247(e)	RSS-210 [A8.2]	Power Spectral Density	≤ 8dBm / 3kHz Band		Pass	Section 7.4
15.247(d)	RSS-210 [A8.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc(Peak)		Pass	Section 7.5
15.205 15.209	RSS-210 [A8.5]	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 [7.2.4]	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.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

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

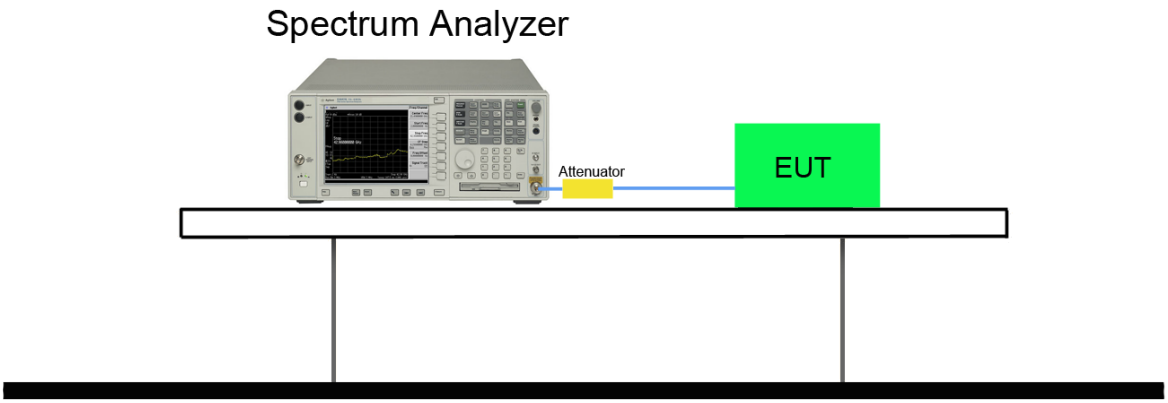
7.2.2. Test Procedure used

KDB 558074 D01v03r02 – 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

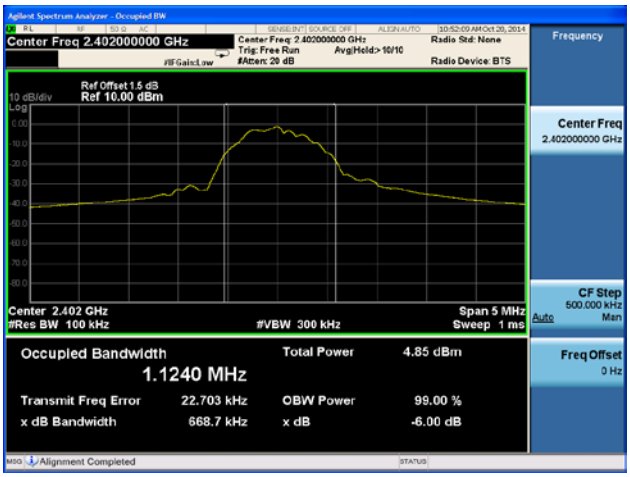


7.2.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	99% Bandwidth (MHz)	Result
BLE	1	00	2402	0.669	≥0.5	1.124	Pass
BLE	1	19	2440	0.662	≥0.5	1.125	Pass
BLE	1	39	2480	0.656	≥0.5	1.121	Pass

802.11b 6dB Bandwidth

Channel 00 (2402MHz)



Channel 19 (2440MHz)

Channel 39 (2480MHz)

7.3. Output Power Measurement

7.3.1. Test Limit

For FCC

The maximum out power shall be less 1 Watt (30dBm).

For IC

For systems employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W, the EIRP shall not exceed 4 W.

7.3.2. Test Procedure Used

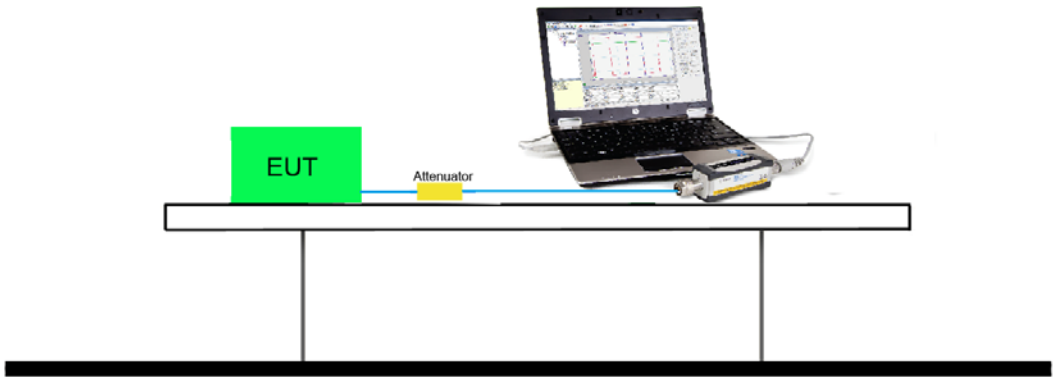
KDB 558074 D01v03r02 - Section 9.1.2 PKPM1 Peak Power Method (for signals with BW ≤ 50MHz)

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 Output Power

Test Result of Peak Output Power

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BLE	1	1	00	2400	0.73	30.00	Pass
BLE	1	1	19	2440	0.92	30.00	Pass
BLE	1	1	39	2480	1.42	30.00	Pass

Note1: The max EIRP power = 2.77 dBm < 36 dBm.

7.3.6. Test Result of Average Output Power (Reporting Only)

Test Result of Average Output Power

Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Average Power (dBm)	Limit (dBm)	Result
BLE	1	1	00	2400	-3.14	30.00	Pass
BLE	1	1	19	2440	-2.96	30.00	Pass
BLE	1	1	39	2480	-2.53	30.00	Pass

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

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

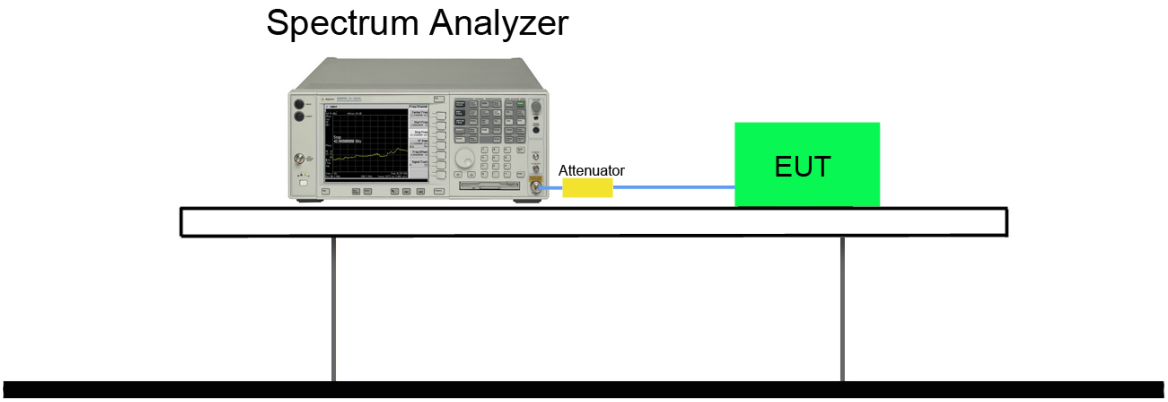
7.4.2. Test Procedure Used

KDB 558074 D01v03r02 - 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

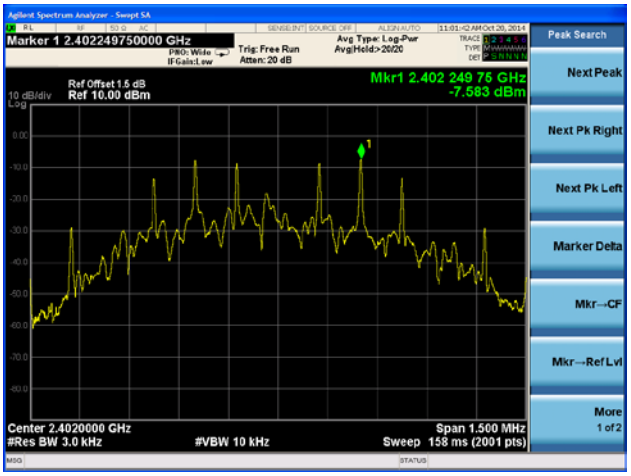


7.4.5. Test Result

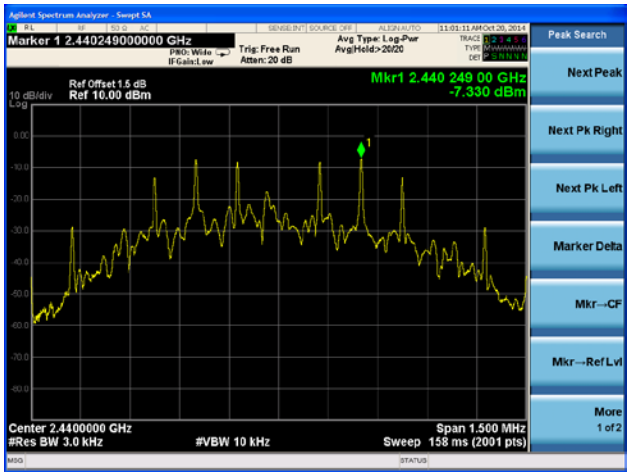
Test Mode	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	PSD (dBm)	Limit (dBm / 3kHz)	Result
BLE	1	1	00	2400	-7.583	8.00	Pass
BLE	1	1	19	2440	-7.330	8.00	Pass
BLE	1	1	39	2480	-6.943	8.00	Pass

BLE PSD

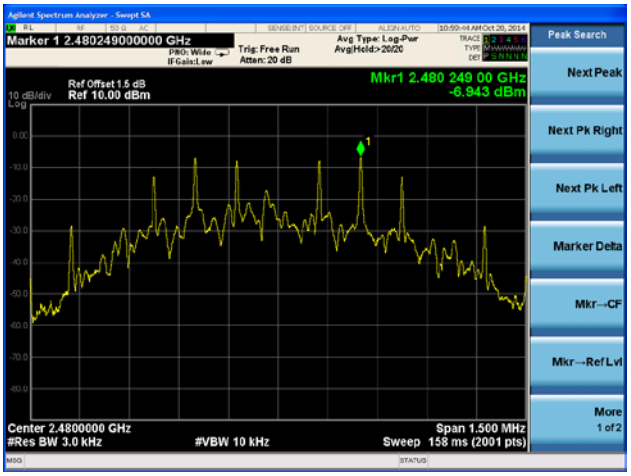
Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (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 100kHz bandwidth per the PSD procedure.

7.5.2. Test Procedure Used

KDB 558074 D01v03r02 – 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

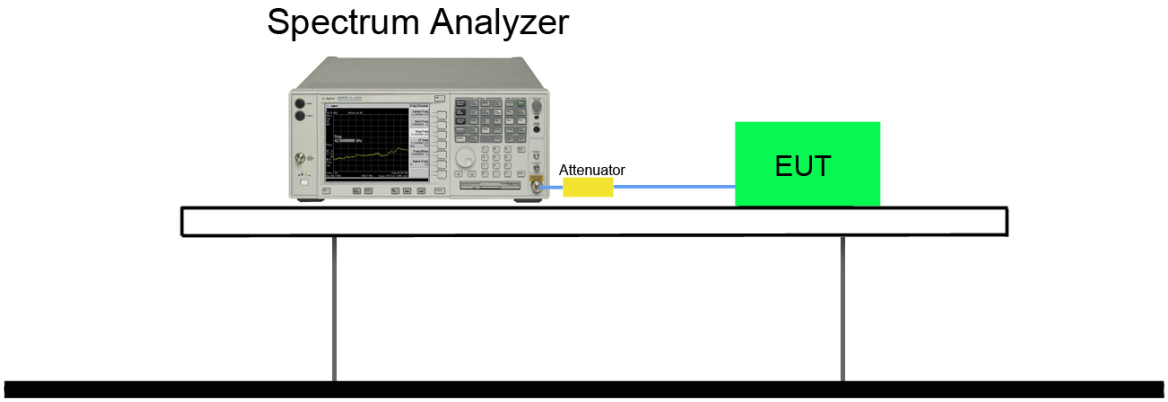
(d) Detector = Peak

(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

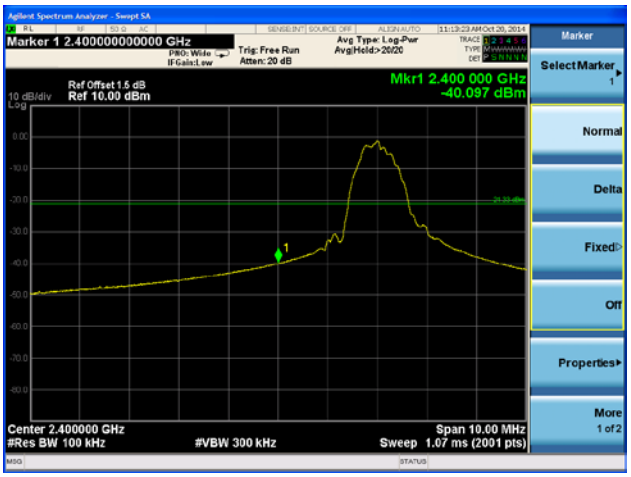
Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit	Result
BLE	1	00	2402	20dBc	Pass
BLE	1	19	2440	20dBc	Pass
BLE	1	39	2480	20dBc	Pass

BLE Out-of-Band Emissions

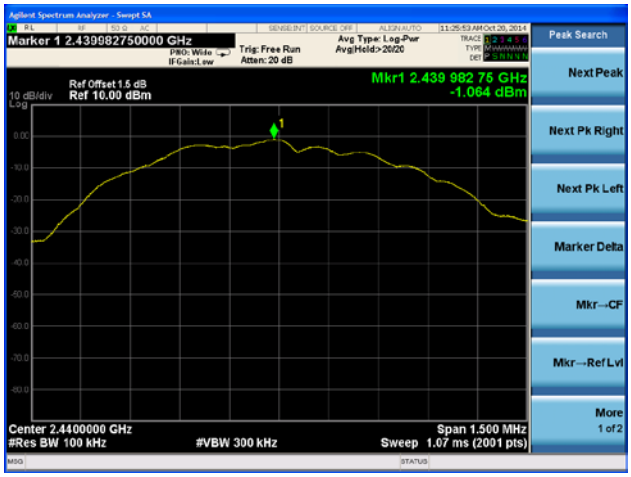
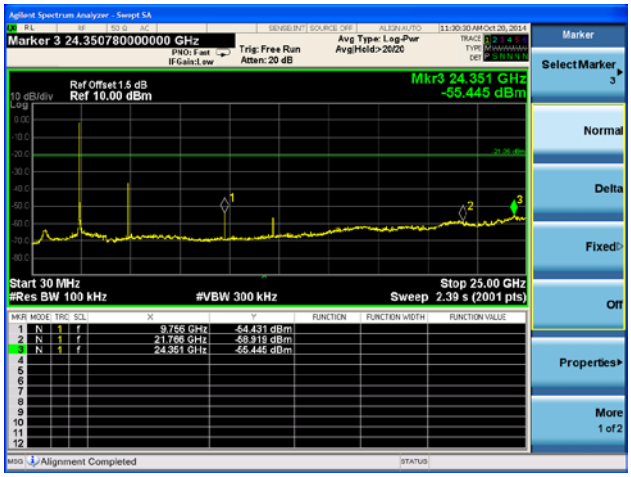
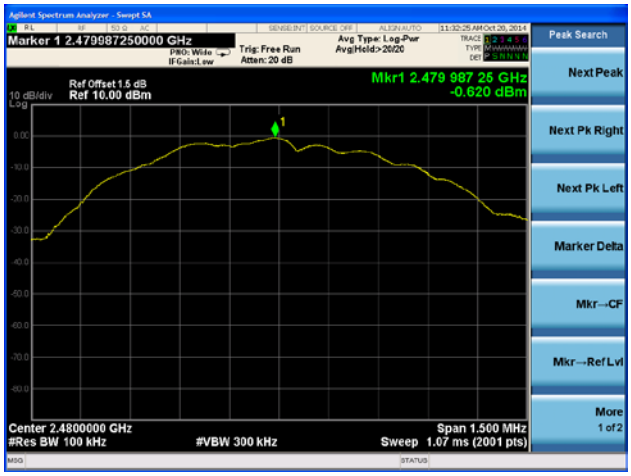
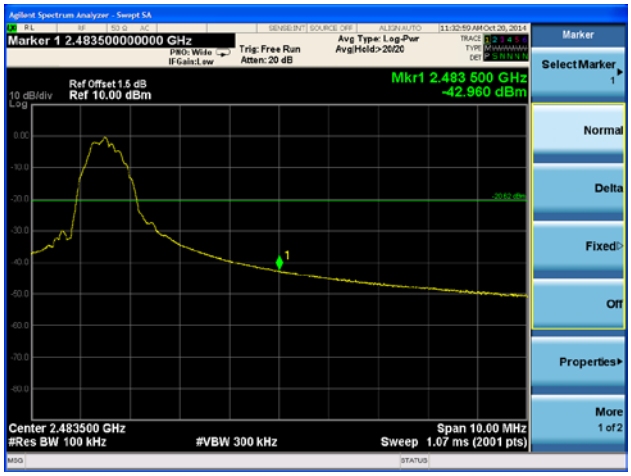
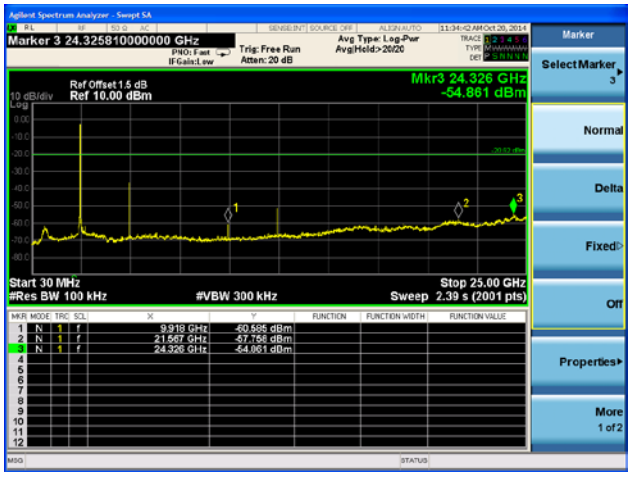
Channel 00 (2402MHz)

100kHz PSD Reference Level

Low Band Edge



Spurious Emission

Channel 19 (2440MHz)	
100kHz PSD Reference Level	**Spurious Emission**
	
Channel 39 (2480MHz)	
100kHz PSD Reference Level	**High 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 D01v03r02 – Section 12.2.3 (quasi-peak measurements)

KDB 558074 D01v03r02 – Section 12.2.4 (peak power measurements)

KDB 558074 D01v03r02 – Section 12.2.5 (average power measurements)

7.6.3. Test Setting

Peak Field Strength Measurements per Section 12.2.4 of KDB 558074 D01v03r02

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

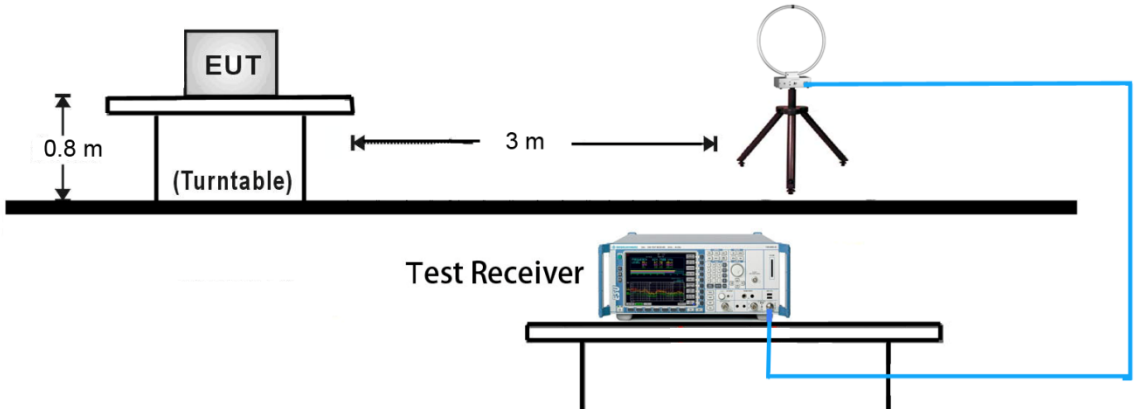
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements per Section 12.2.5.3 of KDB 558074 D01v03r02

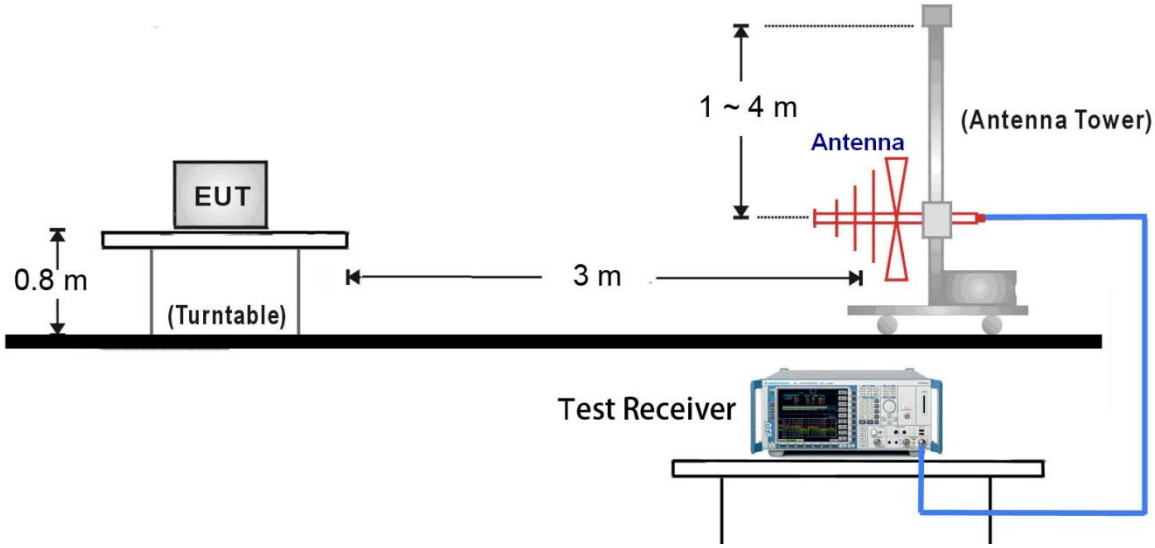
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW ≥ 1/T
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain).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

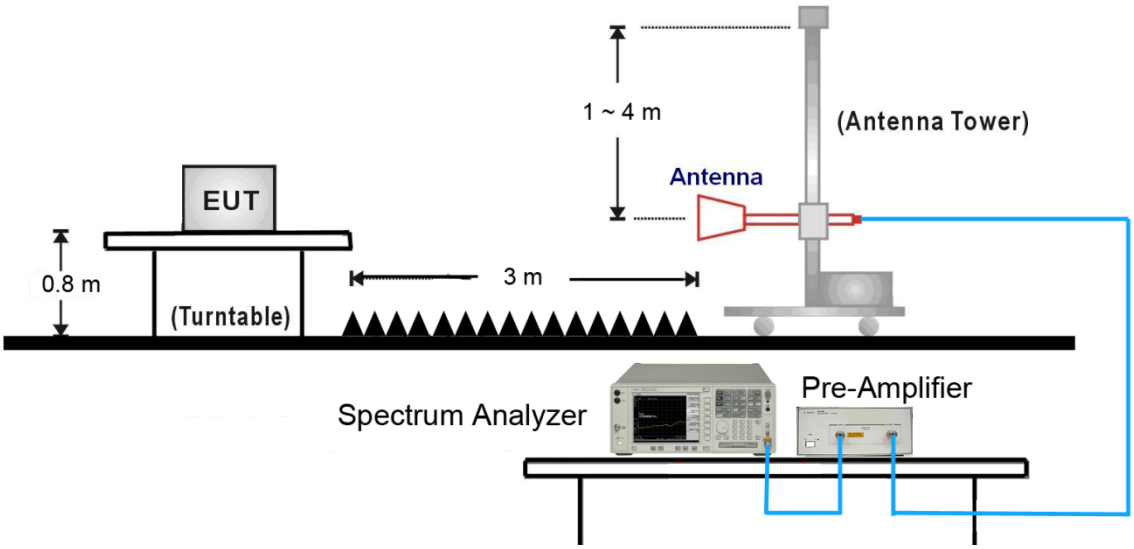
9kHz ~ 30MHz Test Setup:



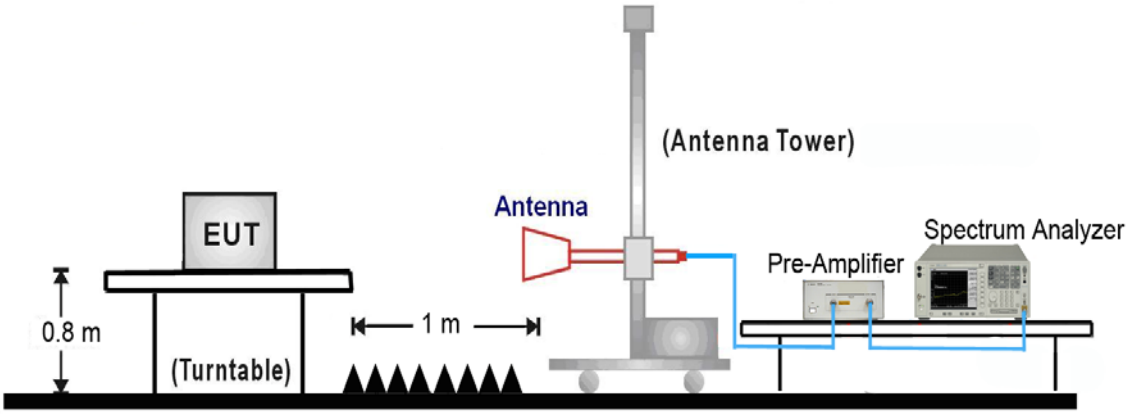
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



7.6.5. Test Result

Test Mode:	BLE	Test Site:	AC1
Test channel:	00	Test Engineer:	Andy Zhu
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
*	4219.00	38.29	4.88	43.17	64.9	-21.73	Peak	Horizontal
*	4315.00	38.07	5.33	43.40	64.9	-21.50	Peak	Horizontal
	4799.50	45.50	6.34	51.84	74.0	-22.16	Peak	Horizontal
	7369.00	36.31	14.05	50.36	74.0	-23.64	Peak	Horizontal
*	4158.00	37.83	4.63	42.46	64.9	-22.44	Peak	Vertical
*	4219.00	37.44	4.88	42.32	64.9	-22.58	Peak	Vertical
	4799.50	43.66	6.34	50.00	74.0	-24.00	Peak	Vertical
	7326.00	36.07	14.02	50.09	74.0	-23.91	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (84.9dBμV/m).

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:	BLE	Test Site:	AC1
Test channel:	19	Test Engineer:	Andy Zhu
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
*	4231.00	37.92	4.92	42.84	65.2	-22.36	Peak	Horizontal
*	4419.00	37.15	5.51	42.66	65.2	-22.54	Peak	Horizontal
	4884.50	46.32	6.65	52.97	74.0	-21.03	Peak	Horizontal
	7298.00	35.61	13.98	49.59	74.0	-24.41	Peak	Horizontal
*	4156.00	36.75	4.63	41.38	65.2	-23.82	Peak	Vertical
*	4324.00	37.12	5.33	42.45	65.2	-22.75	Peak	Vertical
	4876.00	49.02	6.62	55.64	74.0	-18.36	Peak	Vertical
	4879.99	37.96	6.63	44.59	54.0	-9.41	Average	Vertical
	7418.00	35.56	14.17	49.73	74.0	-24.27	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (85.2dBμV/m).

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:	BLE	Test Site:	AC1
Test channel:	39	Test Engineer:	Andy Zhu
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
*	4198.00	37.35	4.79	42.14	63.2	-21.06	Peak	Horizontal
*	4328.00	37.73	5.34	43.07	63.2	-20.13	Peak	Horizontal
	4961.00	48.91	6.79	55.70	74.0	-18.30	Peak	Horizontal
	4960.20	37.62	6.79	44.41	54.0	-9.59	Average	Horizontal
	7326.00	35.75	14.02	49.77	74.0	-24.23	Peak	Horizontal
*	4216.00	37.60	4.87	42.47	63.2	-20.73	Peak	Vertical
*	4269.00	37.53	5.07	42.60	63.2	-20.60	Peak	Vertical
	4961.00	49.33	6.79	56.12	74.0	-17.88	Peak	Vertical
	4960.01	38.22	6.79	45.01	54.0	-8.99	Average	Vertical
	7329.00	35.23	14.02	49.25	74.0	-24.75	Peak	Vertical

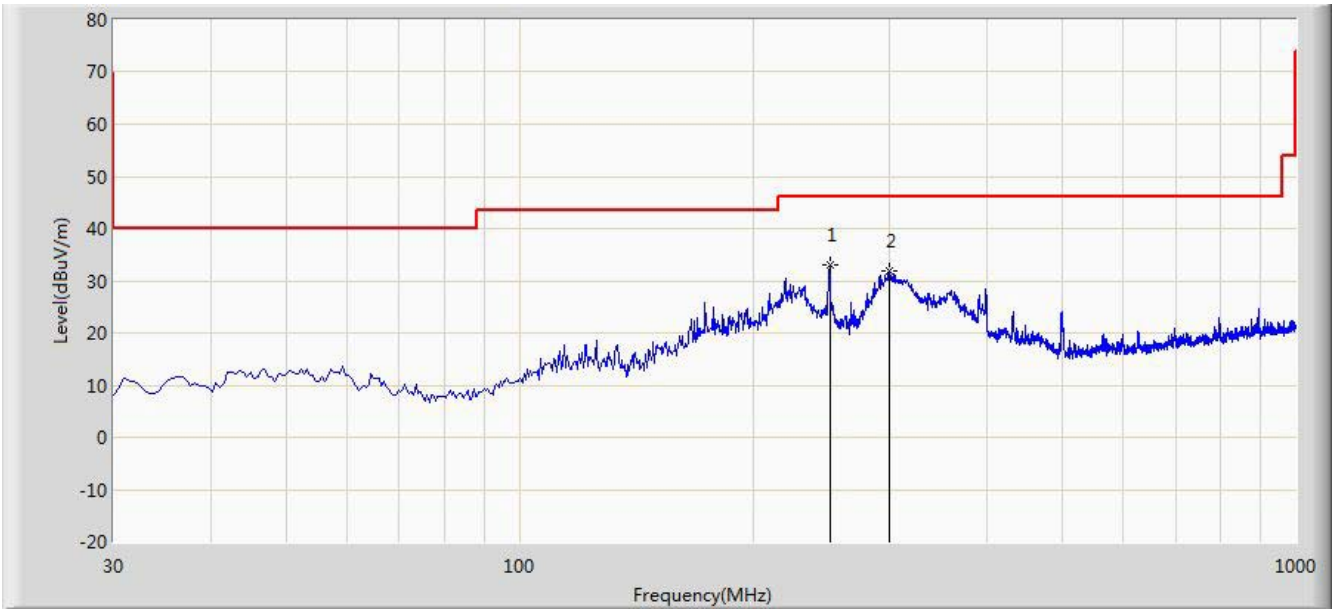
Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (83.2dBμV/m).

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:

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:28
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Mode: Transmit by BLE at channel 2402MHz	

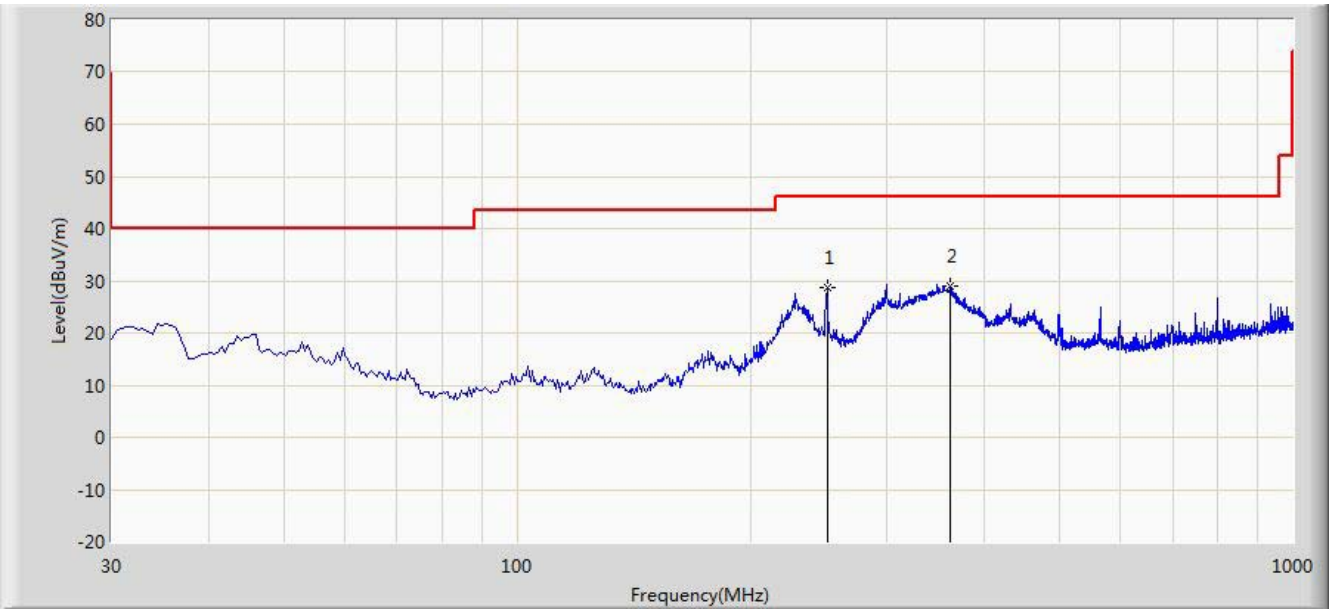


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	251.160	32.985	50.804	-13.015	46.000	-17.819	QP
2			300.145	31.944	48.923	-14.056	46.000	-16.979	QP

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:31
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: LED Lamp	Power: AC 120V/60Hz
Mode: Transmit by BLE at channel 2402MHz	

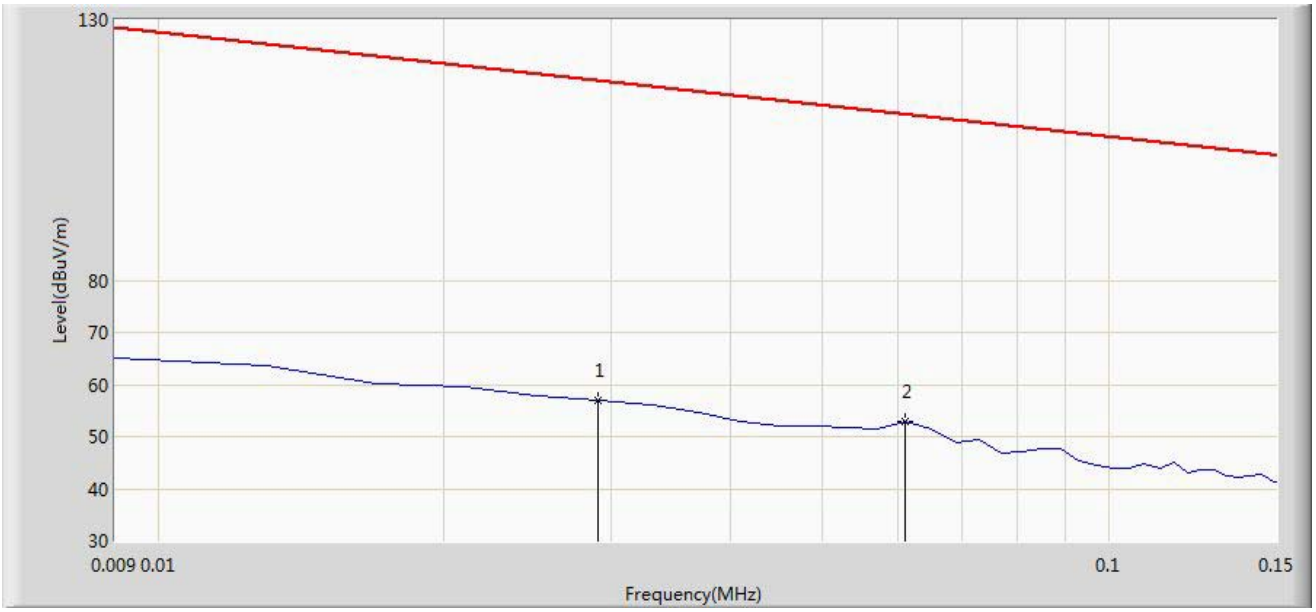


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			251.160	28.827	46.646	-17.173	46.000	-17.819	QP
2		*	362.225	28.900	44.507	-17.100	46.000	-15.607	QP

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 17:32
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: LED Lamp	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 9kHz~30MHz.	

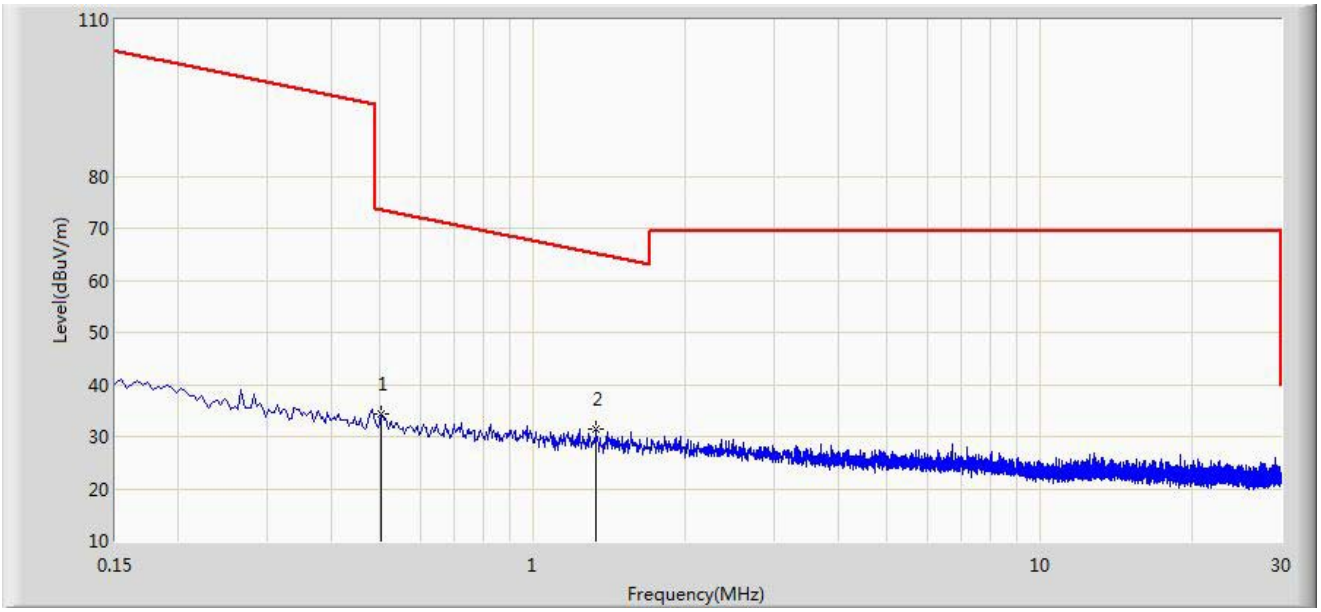


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			0.029	56.898	35.849	-61.444	118.342	21.049	QP
2		*	0.061	52.856	32.545	-59.031	111.887	20.311	QP

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 17:46
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: FMZB1519_0.009-30MHz	Polarity: Face on
EUT: LED Lamp	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 9kHz~30MHz.	

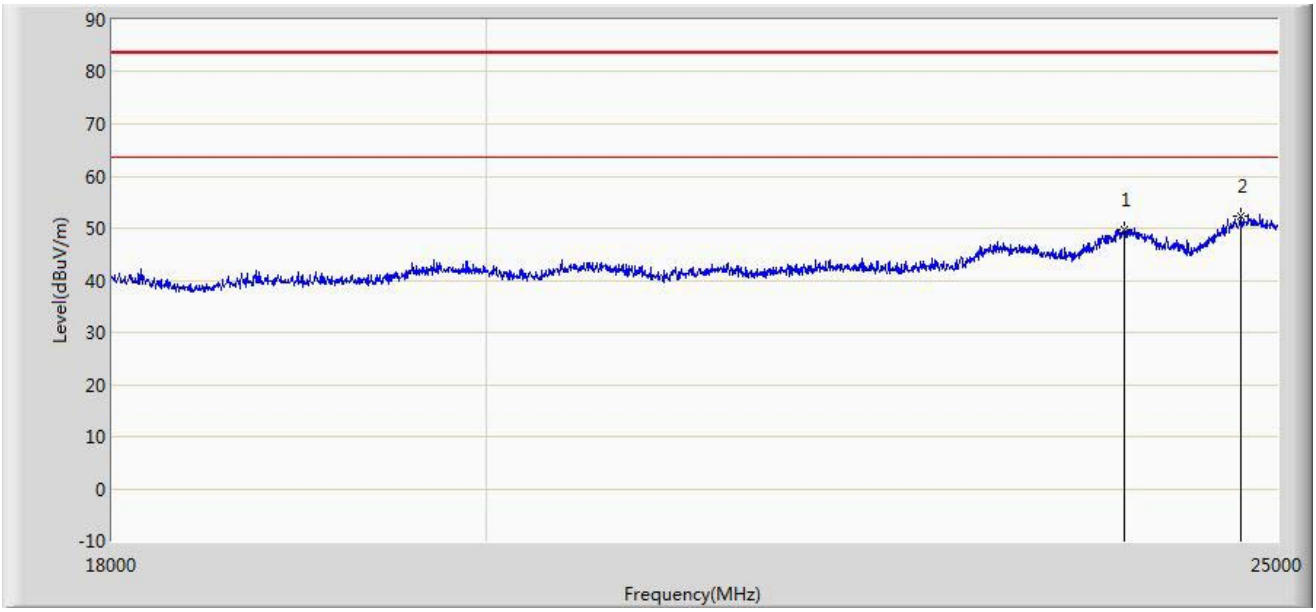


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			0.502	34.381	13.958	-39.209	73.590	20.423	QP
2		*	1.334	31.591	11.100	-33.534	65.125	20.491	QP

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 21:11
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9170_18-40GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Note: There is the ambient noise within frequency range 18GHz~25GHz.	

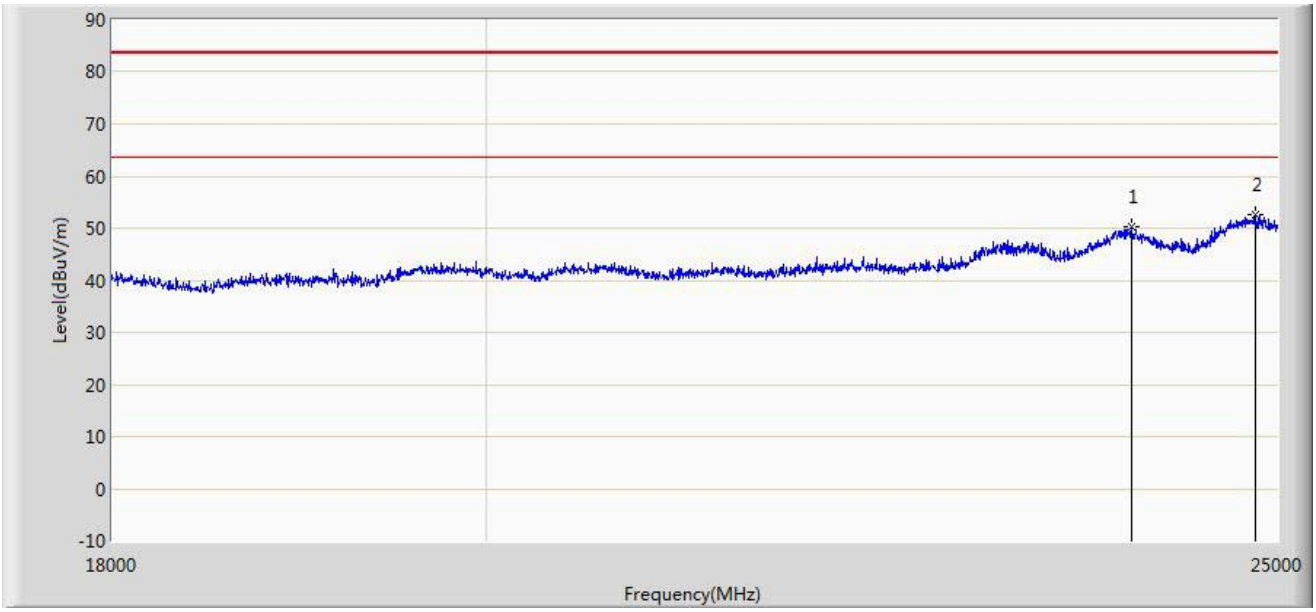


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			23943.000	49.787	35.877	-33.713	83.500	13.910	PK
2		*	24741.000	52.380	37.686	-31.120	83.500	14.694	PK

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

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre_Amplifier Gain (dB)

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 21:12
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9170_18-40GHz	Polarity: Vertical
EUT: LED Lamp	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	50.381	36.437	-33.119	83.500	13.944	PK
2		*	24846.000	52.507	37.739	-30.993	83.500	14.768	PK

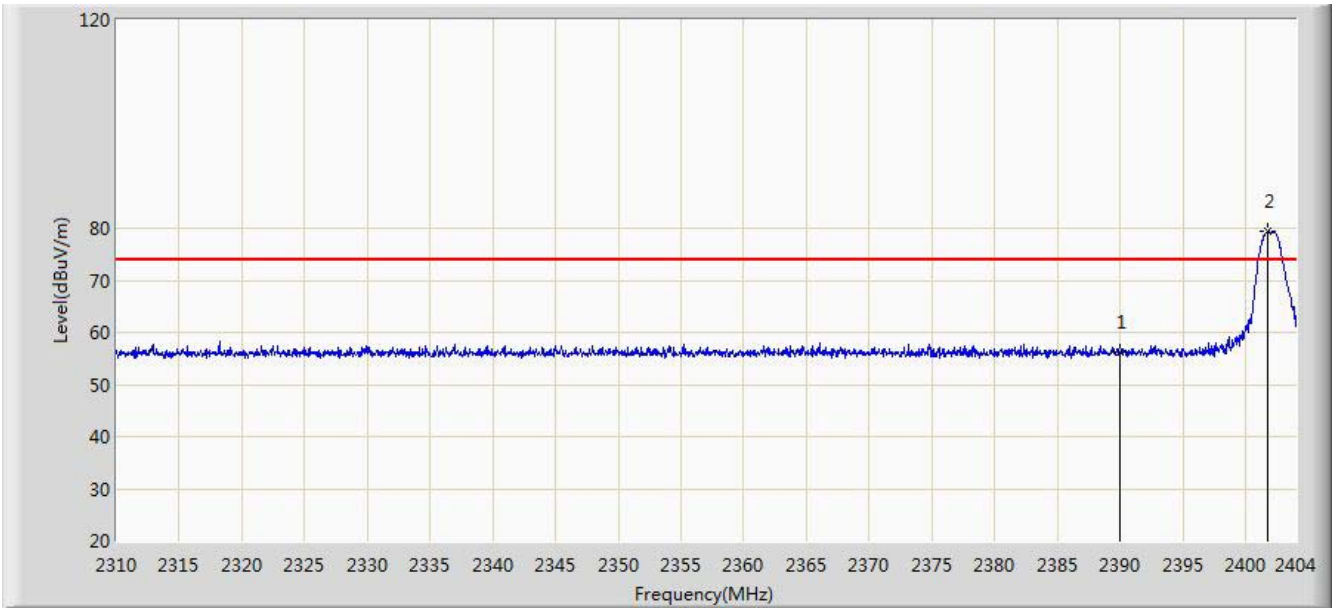
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre_Amplifier Gain (dB)

7.7. Radiated Restricted Band Edge Measurement

7.7.1. Test Result

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:02
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2402MHz	

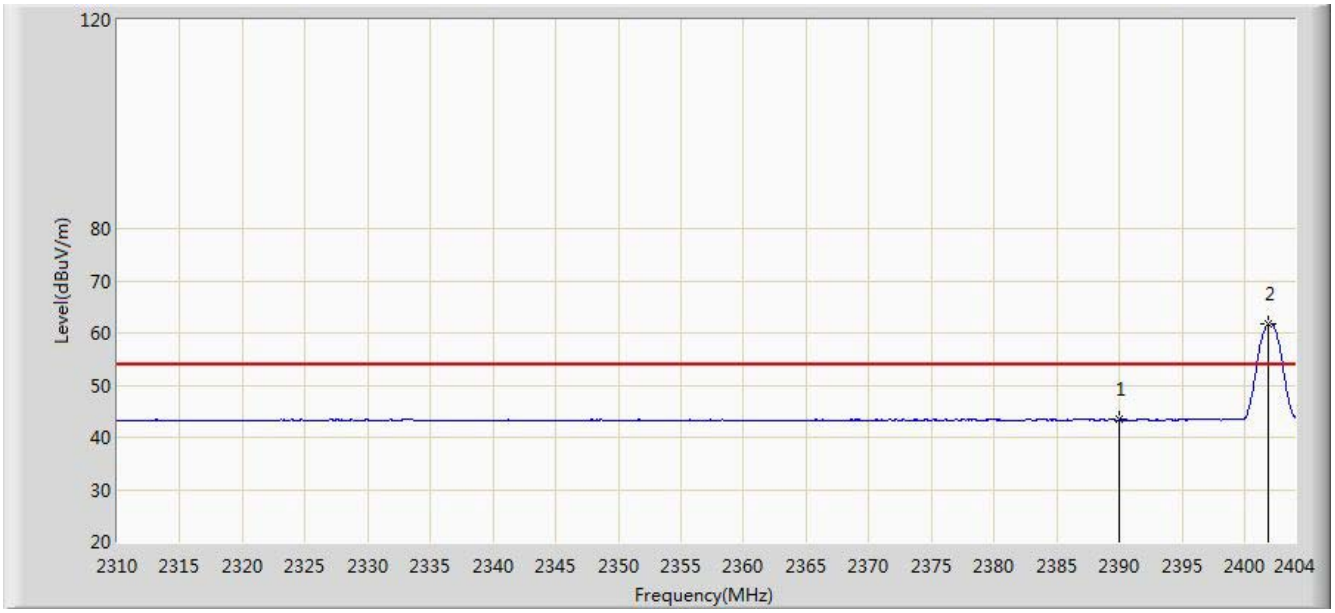


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	56.091	25.407	-17.909	74.000	30.684	PK
2		*	2401.744	79.345	48.683	N/A	N/A	30.661	PK

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:03
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2402MHz	

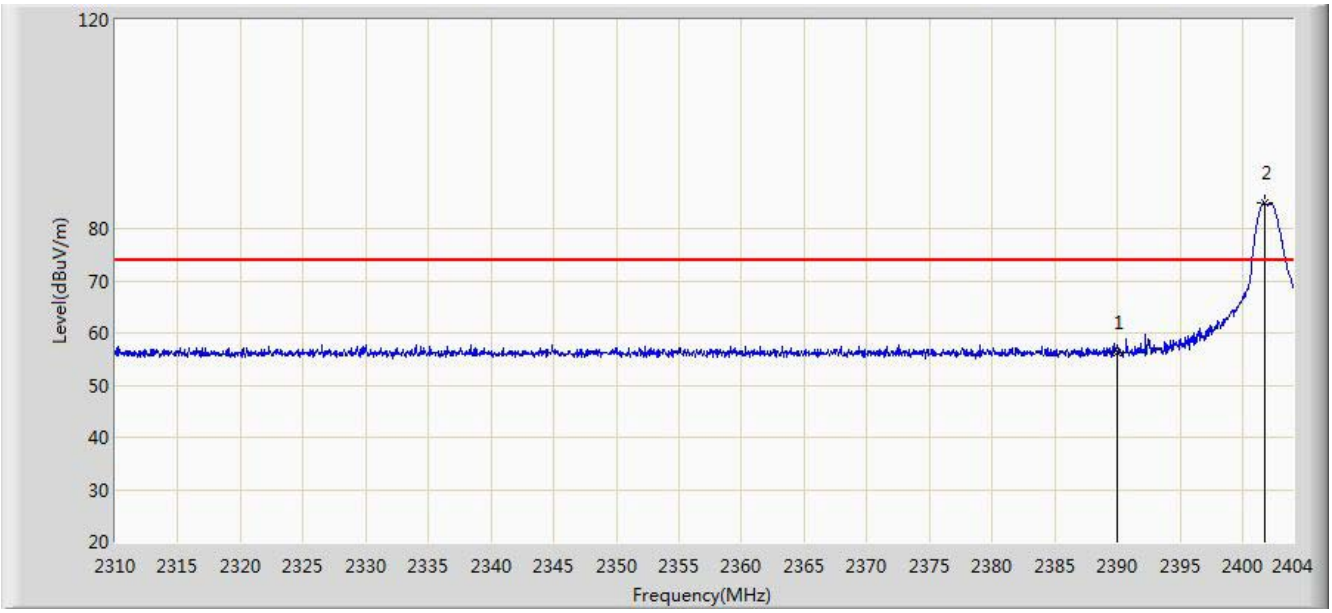


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	43.346	12.662	-10.654	54.000	30.684	AV
2		*	2401.885	61.806	31.145	N/A	N/A	30.661	AV

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:04
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2402MHz	

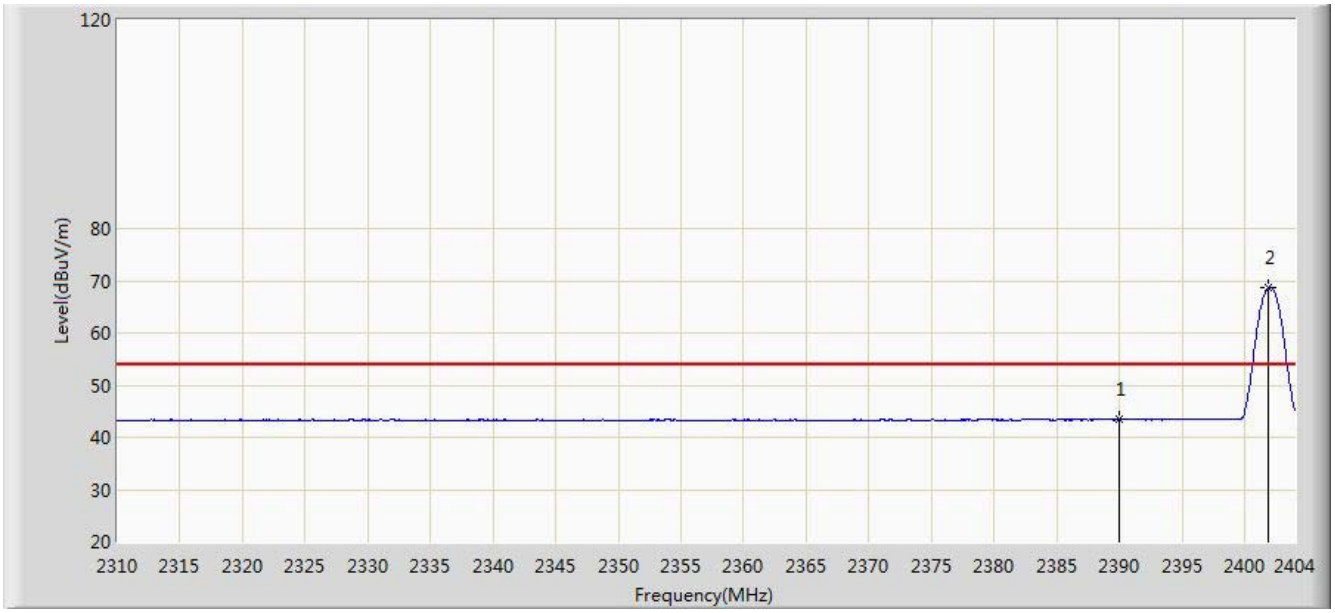


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	56.270	25.586	-17.730	74.000	30.684	PK
2		*	2401.744	84.850	54.188	N/A	N/A	30.661	PK

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:05
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2402MHz	

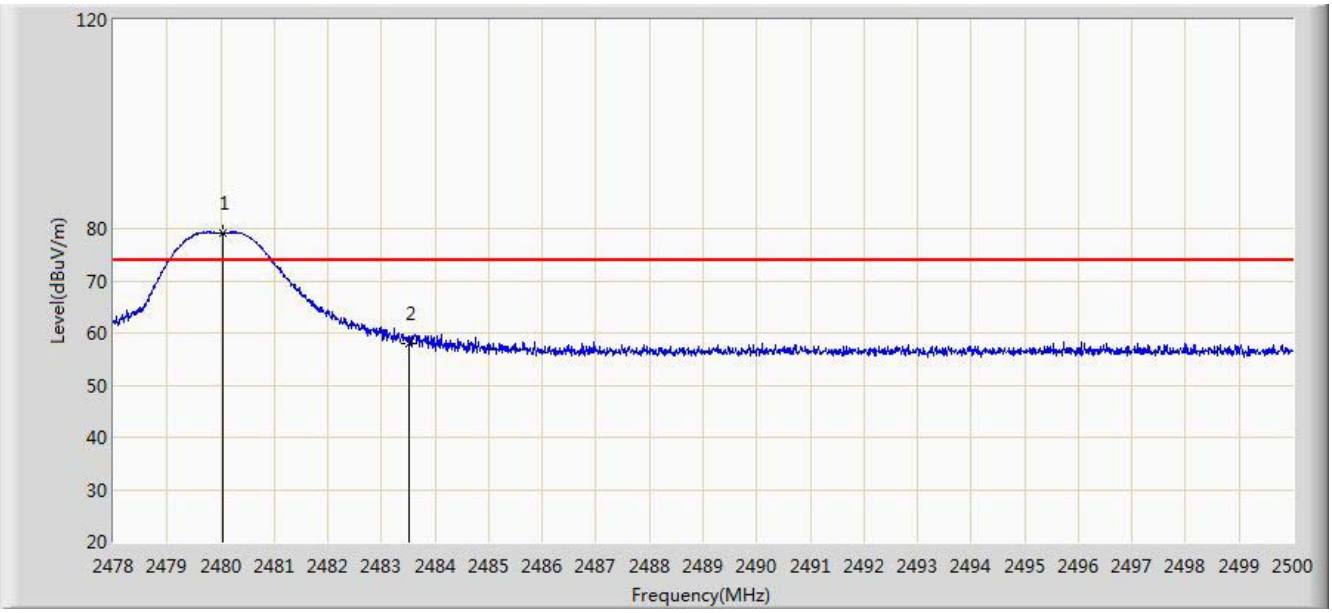


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	43.396	12.712	-10.604	54.000	30.684	AV
2		*	2401.885	68.608	37.947	N/A	N/A	30.661	AV

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2480MHz	

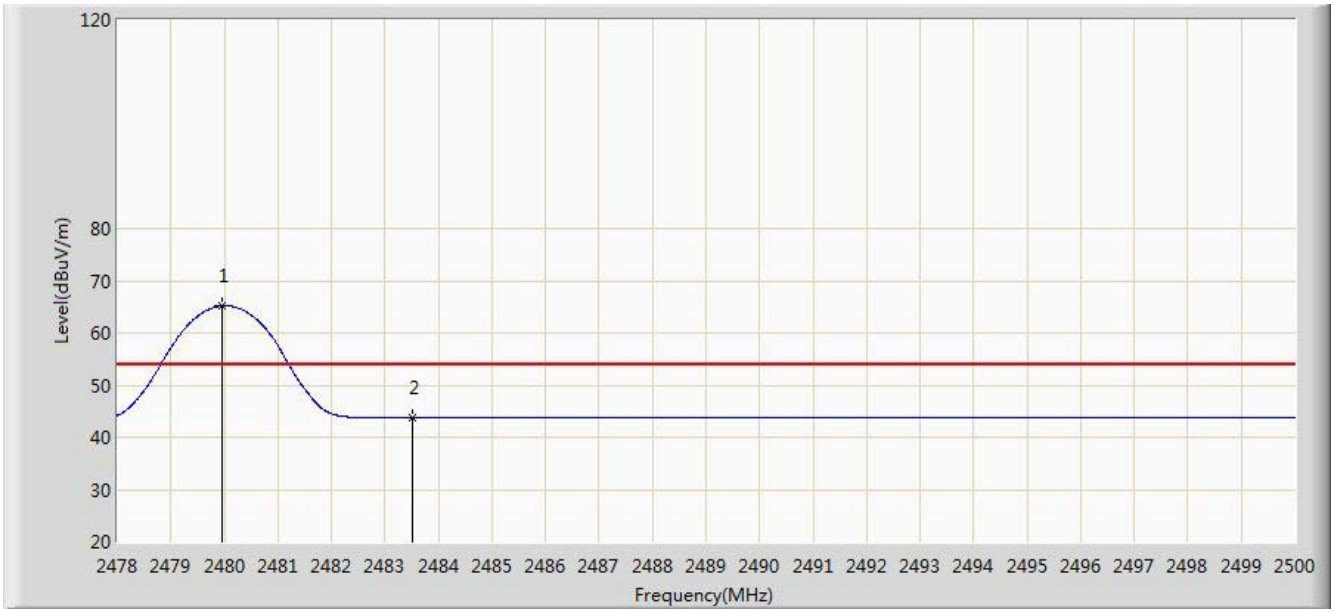


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.046	79.238	48.575	N/A	N/A	30.662	PK
2			2483.500	57.957	27.284	-16.043	74.000	30.673	PK

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:09
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2480MHz	

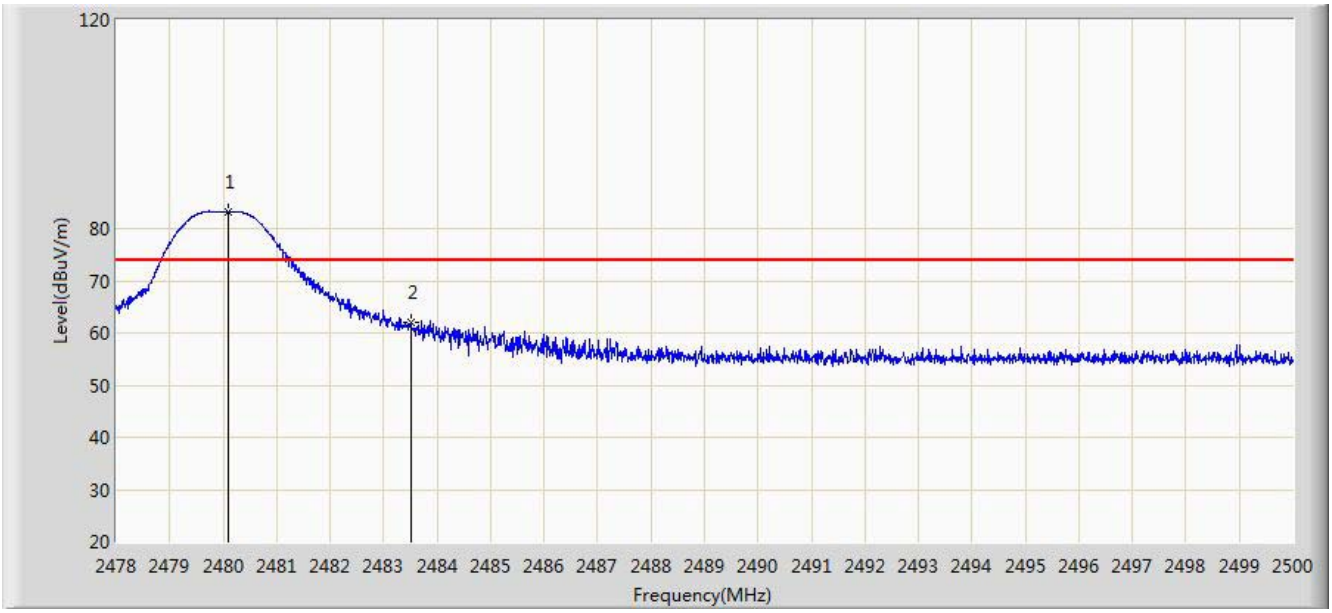


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.969	65.189	34.527	N/A	N/A	30.662	AV
2			2483.500	43.701	13.028	-10.299	54.000	30.673	AV

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:12
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE at channel 2480MHz	

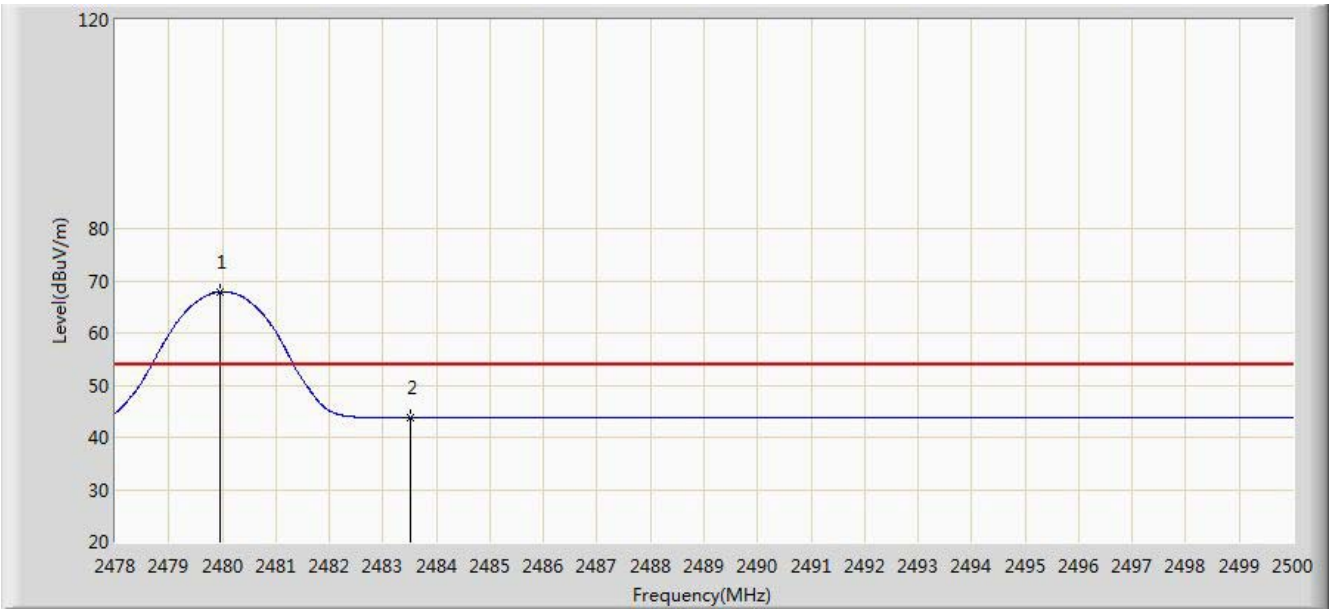


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.101	83.203	52.540	N/A	N/A	30.662	PK
2			2483.500	62.136	31.463	-11.864	74.000	30.673	PK

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

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

Engineer: Andy Zhu	
Site: AC1	Time: 2014/10/21 - 15:17
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode 1: Transmit by BLE 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		*	2479.969	67.848	37.186	N/A	N/A	30.662	AV
2			2483.500	43.795	13.122	-10.205	54.000	30.673	AV

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

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

7.8. AC Conducted Emissions Measurement

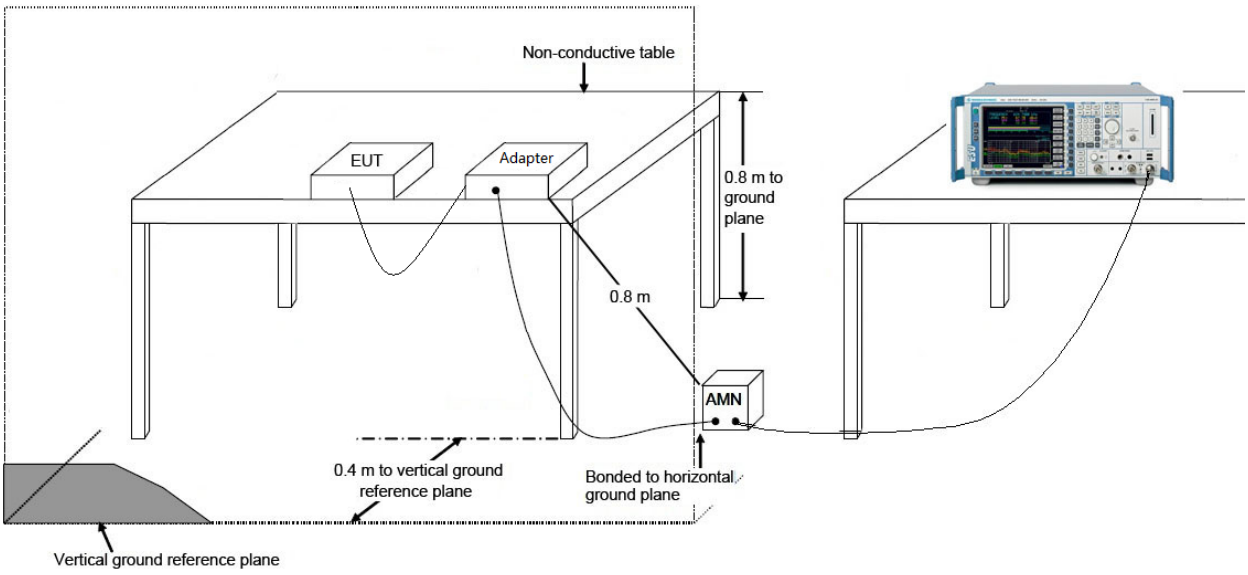
7.8.1. Test Limit

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.

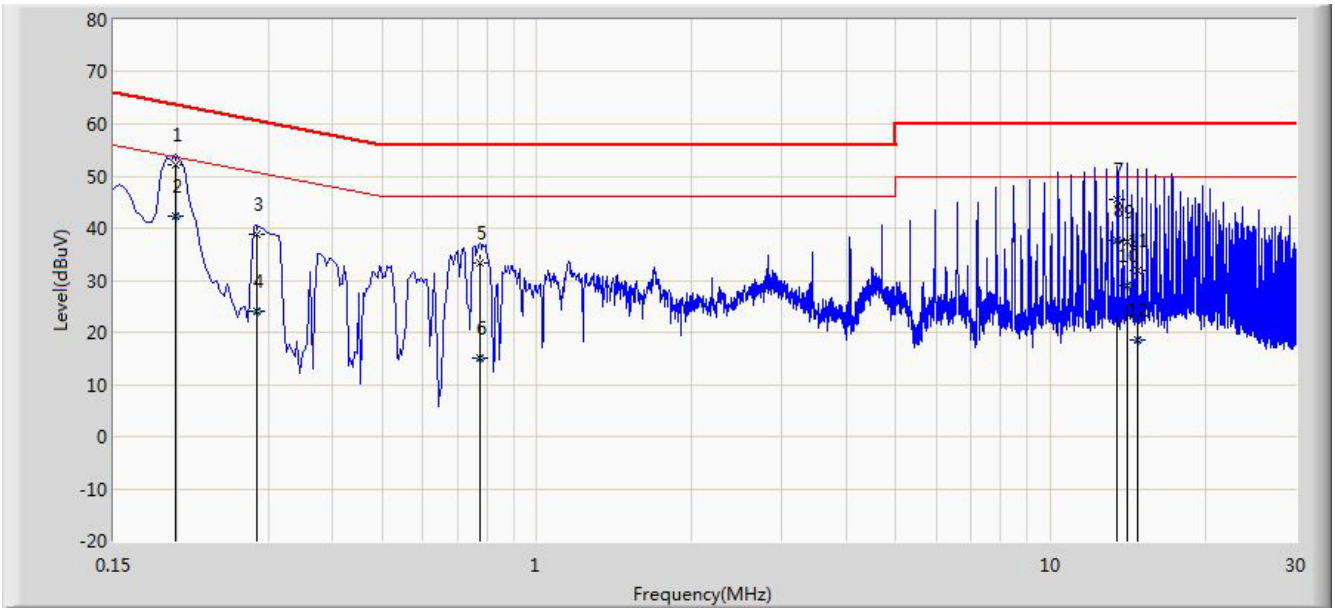
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.8.2. Test Setup



7.8.3. Test Result

Engineer: Andy Zhu	
Site: SR2	Time: 2014/10/24 - 19:55
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode1	

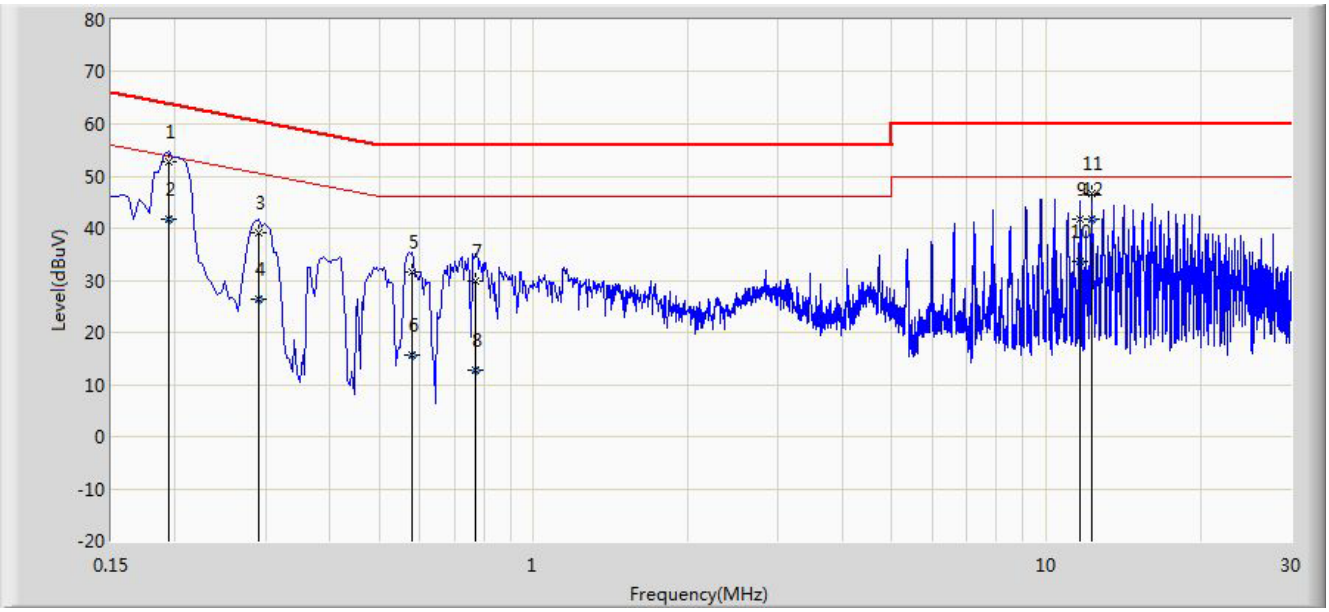


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.198	52.243	42.238	-11.451	63.694	10.005	QP
2		*	0.198	42.292	32.287	-11.402	53.694	10.005	AV
3			0.286	38.744	28.751	-21.896	60.640	9.993	QP
4			0.286	23.939	13.946	-26.701	50.640	9.993	AV
5			0.774	33.384	23.360	-22.616	56.000	10.024	QP
6			0.774	15.028	5.004	-30.972	46.000	10.024	AV
7			13.506	45.434	35.380	-14.566	60.000	10.054	QP
8			13.506	37.825	27.771	-12.175	50.000	10.054	AV
9			14.102	37.473	27.412	-22.527	60.000	10.061	QP
10			14.102	28.863	18.802	-21.137	50.000	10.061	AV
11			14.734	31.800	21.741	-28.200	60.000	10.059	QP
12			14.734	18.669	8.610	-31.331	50.000	10.059	AV

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

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

Engineer: Andy Zhu	
Site: SR2	Time: 2014/10/24 - 20:05
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: LED Lamp	Power: AC 120V/60Hz
Note: Mode1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.194	52.692	42.671	-11.172	63.864	10.021	QP
2			0.194	41.835	31.814	-12.029	53.864	10.021	AV
3			0.290	39.061	29.031	-21.463	60.524	10.030	QP
4			0.290	26.407	16.377	-24.117	50.524	10.030	AV
5			0.578	31.543	21.400	-24.457	56.000	10.143	QP
6			0.578	15.531	5.388	-30.469	46.000	10.143	AV
7			0.770	29.949	19.913	-26.051	56.000	10.036	QP
8			0.770	12.715	2.679	-33.285	46.000	10.036	AV
9			11.666	41.653	31.538	-18.347	60.000	10.115	QP
10			11.666	33.669	23.554	-16.331	50.000	10.115	AV
11			12.282	46.595	36.478	-13.405	60.000	10.117	QP
12		*	12.282	41.678	31.561	-8.322	50.000	10.117	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 **LED Lamp FCC ID:**

2ABX8SH-000000005 is in compliance with Part 15C of the FCC Rules.

The End