

## FCC PART 15.247

## TEST REPORT

For

### Monitorling Limited

RM 509, 5/F, 336 Kwun Tong Road, Kwun Tong, Hong Kong

**FCC ID: 2AGQD-HB45B**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Hibu
<b>Test Engineer:</b> Allen Qiao <i>Allen Qiao</i>	
<b>Report Number:</b> RDG151030005-00	
<b>Report Date:</b> 2016-03-08	
<b>Reviewed By:</b> Sula Huang <i>Sula Huang</i> RF Leader	
<b>Test Laboratory:</b> Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>	

**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY .....	4
TEST FACILITY .....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
DESCRIPTION OF TEST CONFIGURATION .....	5
EQUIPMENT MODIFICATIONS .....	5
EUT EXERCISE SOFTWARE .....	5
SUPPORT EQUIPMENT LIST AND DETAILS .....	5
EXTERNAL CABLE.....	5
BLOCK DIAGRAM OF TEST SETUP .....	6
<b>SUMMARY OF TEST RESULTS .....</b>	<b>7</b>
<b>FCC §15.247 (i) &amp; §1.1310 &amp; §2.1093- RF EXPOSURE .....</b>	<b>8</b>
APPLICABLE STANDARD .....	8
<b>FCC §15.203 - ANTENNA REQUIREMENT.....</b>	<b>9</b>
APPLICABLE STANDARD .....	9
ANTENNA CONNECTOR CONSTRUCTION .....	9
<b>FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS .....</b>	<b>10</b>
APPLICABLE STANDARD .....	10
MEASUREMENT UNCERTAINTY.....	10
EUT SETUP.....	10
EMI TEST RECEIVER SETUP.....	11
TEST PROCEDURE .....	11
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	11
TEST EQUIPMENT LIST AND DETAILS.....	12
TEST RESULTS SUMMARY .....	12
TEST DATA .....	12
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>15</b>
APPLICABLE STANDARD .....	15
MEASUREMENT UNCERTAINTY.....	15
EUT SETUP .....	15
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	16
TEST PROCEDURE .....	16
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	16
TEST EQUIPMENT LIST AND DETAILS.....	17
TEST RESULTS SUMMARY .....	17
TEST DATA .....	17
<b>FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH.....</b>	<b>21</b>
APPLICABLE STANDARD .....	21
TEST PROCEDURE .....	21
TEST EQUIPMENT LIST AND DETAILS.....	21
TEST DATA .....	21
<b>FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....</b>	<b>24</b>

APPLICABLE STANDARD .....	24
TEST PROCEDURE .....	24
TEST EQUIPMENT LIST AND DETAILS.....	24
TEST DATA .....	24
<b>FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....</b>	<b>26</b>
APPLICABLE STANDARD .....	26
TEST PROCEDURE .....	26
TEST EQUIPMENT LIST AND DETAILS.....	26
TEST DATA .....	26
<b>FCC §15.247(e) - POWER SPECTRAL DENSITY .....</b>	<b>28</b>
APPLICABLE STANDARD .....	28
TEST PROCEDURE .....	28
TEST EQUIPMENT LIST AND DETAILS.....	28
TEST DATA .....	28

---

## GENERAL INFORMATION

---

### Product Description for Equipment under Test (EUT)

The *Monitorlinq Limited*'s product, model number: HB45B (*FCC ID: 2AGQD-HB45B*) (the "EUT") in this report was a *Hibu*, which was measured approximately: 4.75cm (L) x 4.75cm (W) x 1.2cm (H), rated input voltage: DC3.7V rechargeable Li-ion battery or DC5V charging from charger.

*All measurement and test data in this report was gathered from production sample serial number: 151030005 (Assigned by BACL, Dongguan). The EUT was received on 2015-11-12.*

### Objective

This report is prepared on behalf of *Monitorlinq Limited* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 18 8CC submissions with FCC ID: 2AGQD-HB45W.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

### Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	...	...
...	...	...	...
...	...	...	...
...	...	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

### Equipment Modifications

No modification was made to the EUT tested.

### EUT Exercise Software

The software “Smart RF Studio 7” was used for testing, which was provided by manufacturer. The maximum power with duty cycle 100% was configured by system default setting.

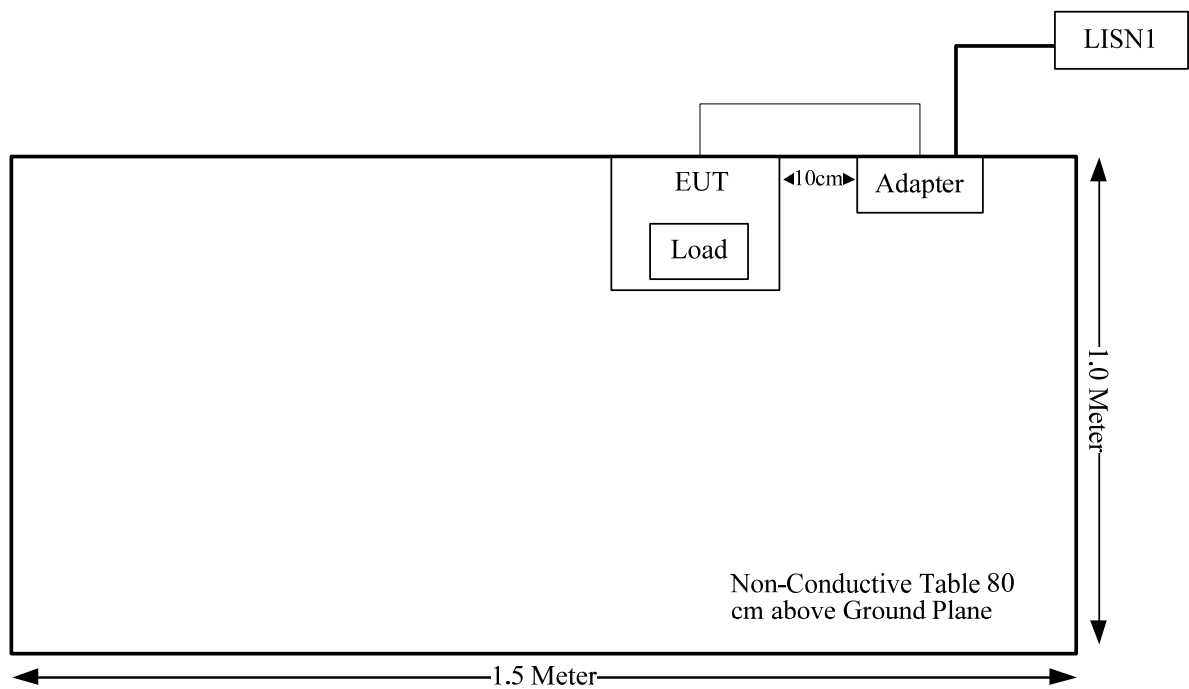
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Monitorlinq	Hibu Wireless Charging Base	HB45W	N/A
N/A	Adapter	HNBC050100	N/A

### External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum conducted output power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

---

**FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE**

---

**Applicable Standard**

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

**Measurement Result**

The max tune-up power is -5 dBm (0.32mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 0.32/5 \cdot (\sqrt{2.48}) = 0.1 < 3.0$

**So the stand-alone SAR evaluation is not necessary.**



---

## **FCC §15.203 - ANTENNA REQUIREMENT**

---

### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

### **Antenna Connector Construction**

The EUT has one integral antenna arrangement for LE and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cispr}$  of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cispr}$  of Table 1, then:

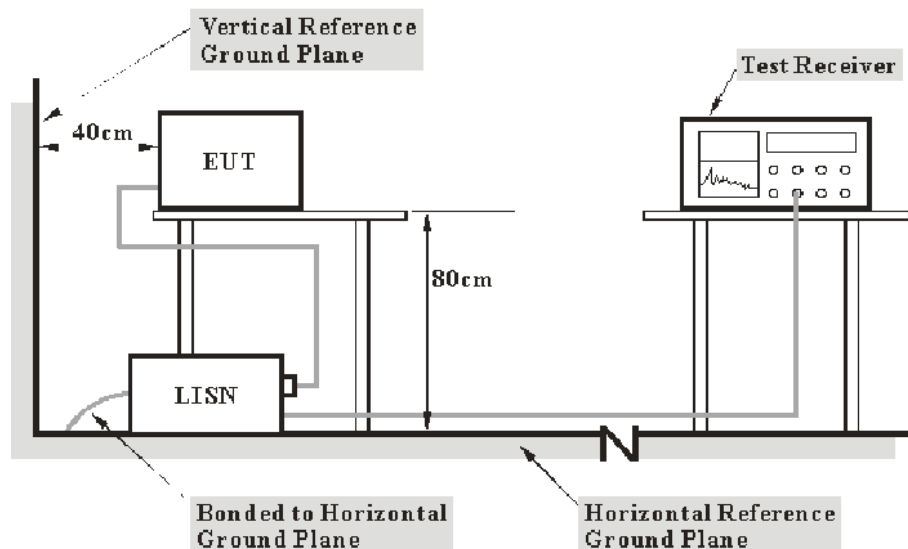
- compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.12 dB (150 kHz to 30 MHz).

Table 1 – Values of  $U_{cispr}$

Measurement	$U_{cispr}$
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

### EUT Setup



- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The EUT was connected to a 120 VAC/60 Hz power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

### Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

### Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2015-12-10	2016-12-09
R&S	L.I.S.N	ESH2-Z5	892107/021	2015-07-16	2016-07-15
R&S	Two-line V-network	ENV 216	3560.6550.12	2015-11-26	2016-11-25
N/A	Coaxial Cable	1.8m	N/A	2015-05-06	2016-05-06
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Results Summary**

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

**18.6 dB at 0.426011 MHz in the Line conducted mode**

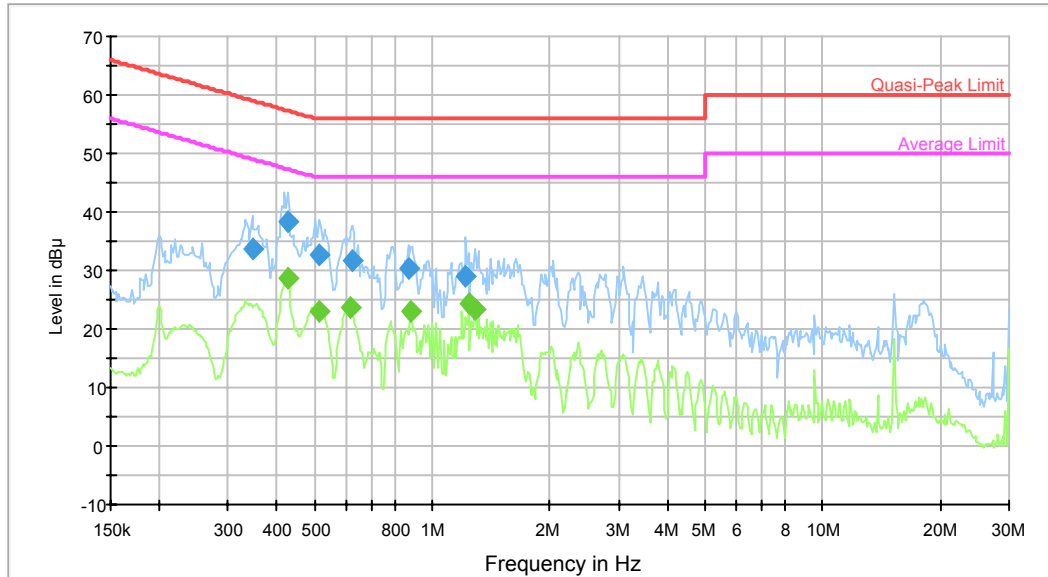
**Test Data****Environmental Conditions**

<b>Temperature:</b>	18.4°C
<b>Relative Humidity:</b>	27 %
<b>ATM Pressure:</b>	102.2kPa

*The testing was performed by Allen Qiao on 2016-01-26.*

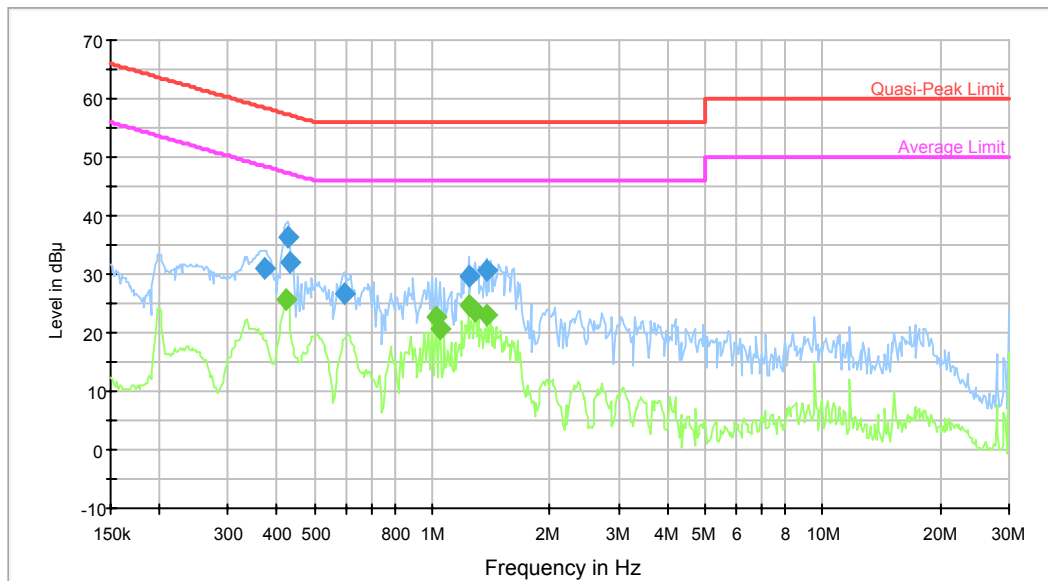
Test Mode: Transmitting

AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.346296	33.9	9.000	L1	9.7	25.2	59.1	Compliance
0.426011	38.3	9.000	L1	9.8	19.0	57.3	Compliance
0.515791	32.7	9.000	L1	9.8	23.3	56.0	Compliance
0.624492	31.6	9.000	L1	9.8	24.4	56.0	Compliance
0.865782	30.2	9.000	L1	9.8	25.8	56.0	Compliance
1.219583	29.1	9.000	L1	9.8	26.9	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.426011	28.7	9.000	L1	9.8	18.6	47.3	Compliance
0.511698	23.1	9.000	L1	9.8	22.9	46.0	Compliance
0.614619	23.7	9.000	L1	9.8	22.3	46.0	Compliance
0.879690	23.1	9.000	L1	9.8	22.9	46.0	Compliance
1.239175	24.4	9.000	L1	9.8	21.6	46.0	Compliance
1.289541	23.4	9.000	L1	9.8	22.6	46.0	Compliance

**AC120 V, 60 Hz, Neutral:**

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.372042	31.2	9.000	N	9.7	27.3	58.5	Compliance
0.426011	36.2	9.000	N	9.7	21.1	57.3	Compliance
0.432855	31.9	9.000	N	9.7	25.3	57.2	Compliance
0.595338	26.7	9.000	N	9.7	29.3	56.0	Compliance
1.239175	29.7	9.000	N	9.8	26.3	56.0	Compliance
1.385415	30.8	9.000	N	9.8	25.2	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.422630	25.8	9.000	N	9.7	21.6	47.4	Compliance
1.023481	22.7	9.000	N	9.8	23.3	46.0	Compliance
1.048242	20.7	9.000	N	9.8	25.3	46.0	Compliance
1.239175	24.8	9.000	N	9.8	21.2	46.0	Compliance
1.289541	23.6	9.000	N	9.8	22.4	46.0	Compliance
1.385415	23.0	9.000	N	9.8	23.0	46.0	Compliance

## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  of Table 2, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  of Table 2, then:

- compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

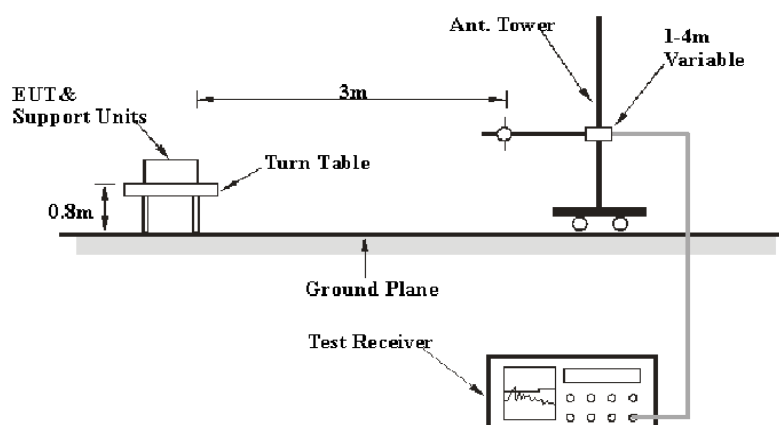
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB

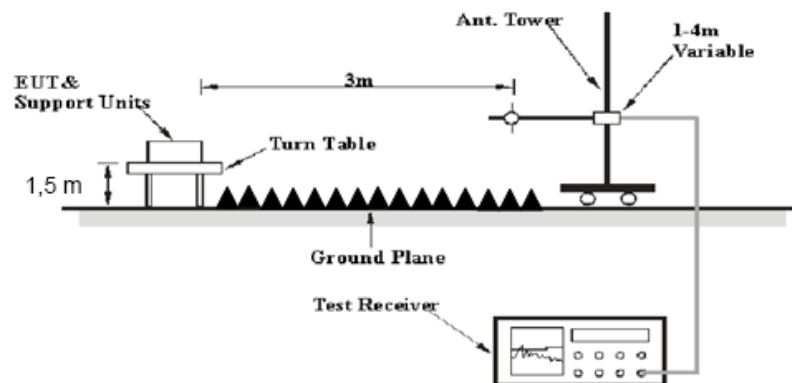
Table 2 – Values of  $U_{cisp}$

Measurement	$U_{cisp}$
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

### EUT Setup

Below 1GHz:



**Above 1GHz:**

The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits. The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

**EMI Test Receiver & Spectrum Analyzer Setup**

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

**Test Procedure**

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

**Corrected Amplitude & Margin Calculation**

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$



The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2015-08-03	2016-08-02
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2015-09-01	2016-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2015-11-23	2016-11-22
ETS-Lindgren	Horn Antenna	3115	9808-5557	2015-09-06	2018-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2015-09-06	2016-09-06
N/A	Coaxial Cable	14m	N/A	2015-05-06	2016-05-06
N/A	Coaxial Cable	8m	N/A	2015-05-06	2016-05-06
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.247, with the worst margin reading of:

**2.92 dB at 4960 MHz in the Horizontal polarization for BLE Model**

### Test Data

#### Environmental Conditions

Temperature:	22.4 °C
Relative Humidity:	61 %
ATM Pressure:	101.5kPa

\* The testing was performed by Allen Qiao on 2016-01-29.

Test Mode: Transmitting

## BLE Mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2402 MHz									
2402	53.44	PK	H	25.65	3.66	0.00	82.75	N/A	N/A
2402	51.97	AV	H	25.65	3.66	0.00	81.28	N/A	N/A
2402	49.52	PK	V	25.65	3.66	0.00	78.83	N/A	N/A
2402	48.18	AV	V	25.65	3.66	0.00	77.49	N/A	N/A
2390	30.62	PK	H	25.61	3.63	0.00	59.86	74.00	14.14
2390	18.18	AV	H	25.61	3.63	0.00	47.42	54.00	6.58
4804	44.47	PK	H	30.59	5.06	27.41	52.71	74.00	21.29
4804	40.18	AV	H	30.59	5.06	27.41	48.42	54.00	5.58
7206	31.69	PK	H	34.09	6.61	25.91	46.48	74.00	27.52
7206	18.42	AV	H	34.09	6.61	25.91	33.21	54.00	20.79
9608	29.48	PK	H	35.96	8.53	27.55	46.42	74.00	27.58
9608	16.33	AV	H	35.96	8.53	27.55	33.27	54.00	20.73
3640	32.6	PK	H	29.11	4.55	27.29	38.97	74.00	35.03
3640	20.13	AV	H	29.11	4.55	27.29	26.50	54.00	27.50
251.5	29.4	QP	H	12.14	1.91	21.49	21.96	46.00	24.04
Middle Channel: 2440 MHz									
2440	51.36	PK	H	25.74	3.76	0.00	80.86	N/A	N/A
2440	50.16	AV	H	25.74	3.76	0.00	79.66	N/A	N/A
2440	47.79	PK	V	25.74	3.76	0.00	77.29	N/A	N/A
2440	46.12	AV	V	25.74	3.76	0.00	75.62	N/A	N/A
4880	46.01	PK	H	30.79	5.18	27.42	54.56	74.00	19.44
4880	42.4	AV	H	30.79	5.18	27.42	50.95	54.00	3.05
7320	32.09	PK	H	34.37	6.75	25.88	47.33	74.00	26.67
7320	18.77	AV	H	34.37	6.75	25.88	34.01	54.00	19.99
9760	29.62	PK	H	36.32	8.62	27.21	47.35	74.00	26.65
9760	16.49	AV	H	36.32	8.62	27.21	34.22	54.00	19.78
3640	32.71	PK	H	29.11	4.55	27.29	39.08	74.00	34.92
3640	20.21	AV	H	29.11	4.55	27.29	26.58	54.00	27.42
3820	32.41	PK	H	29.50	4.64	27.36	39.19	74.00	34.81
3820	19.86	AV	H	29.50	4.64	27.36	26.64	54.00	27.36
251.5	29.6	QP	H	12.14	1.91	21.49	22.16	46.00	23.84
High Channel: 2480 MHz									
2480	49.51	PK	H	25.85	3.68	0.00	79.04	N/A	N/A
2480	47.85	AV	H	25.85	3.68	0.00	77.38	N/A	N/A
2480	45.24	PK	V	25.85	3.68	0.00	74.77	N/A	N/A
2480	43.56	AV	V	25.85	3.68	0.00	73.09	N/A	N/A
2483.5	31.08	PK	H	25.86	3.67	0.00	60.61	74.00	13.39
2483.5	18.83	AV	H	25.86	3.67	0.00	48.36	54.00	5.64
4960	45.59	PK	H	31.00	5.34	27.43	54.50	74.00	19.50
4960	42.17	AV	H	31.00	5.34	27.43	51.08	54.00	2.92
7440	31.82	PK	H	34.66	6.89	25.97	47.40	74.00	26.60
7440	18.87	AV	H	34.66	6.89	25.97	34.45	54.00	19.55
9920	29.84	PK	H	36.71	8.71	26.66	48.60	74.00	25.40
9920	16.45	AV	H	36.71	8.71	26.66	35.21	54.00	18.79
3805	32.56	PK	H	29.47	4.66	27.38	39.31	74.00	34.69
3805	19.92	AV	H	29.47	4.66	27.38	26.67	54.00	27.33
251.5	29.1	QP	H	12.14	1.91	21.49	21.66	46.00	24.34

## BLE Low Channel

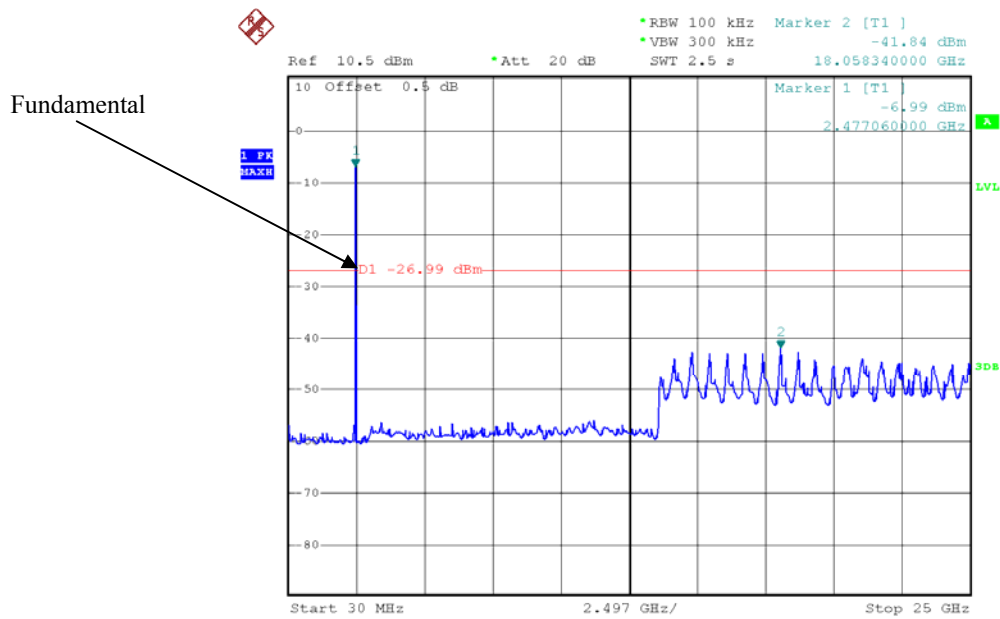


### BLE Middle Channel



Page 19 of 30

### BLE High Channel



Date: 29.JAN.2016 09:26:41

## FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

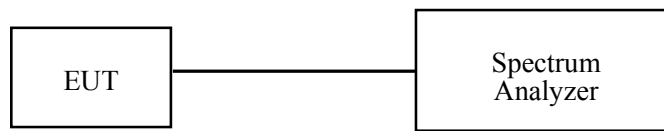
### Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r04

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2015-07-28	2016-07-27
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	21.5°C
Relative Humidity:	50 %
ATM Pressure:	101.4 kPa

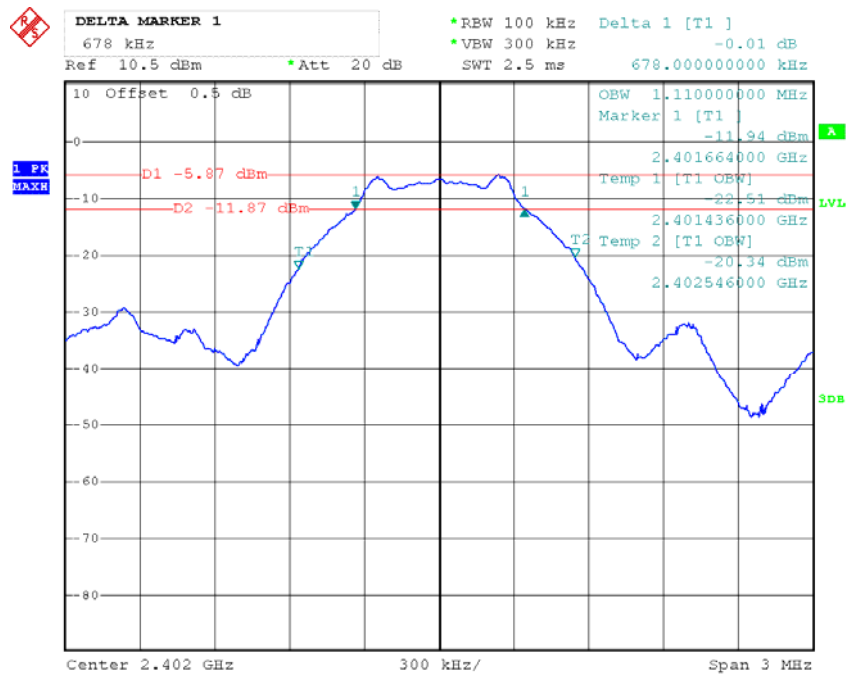
\* The testing was performed by Allen Qiao on 2016-01-28.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots.

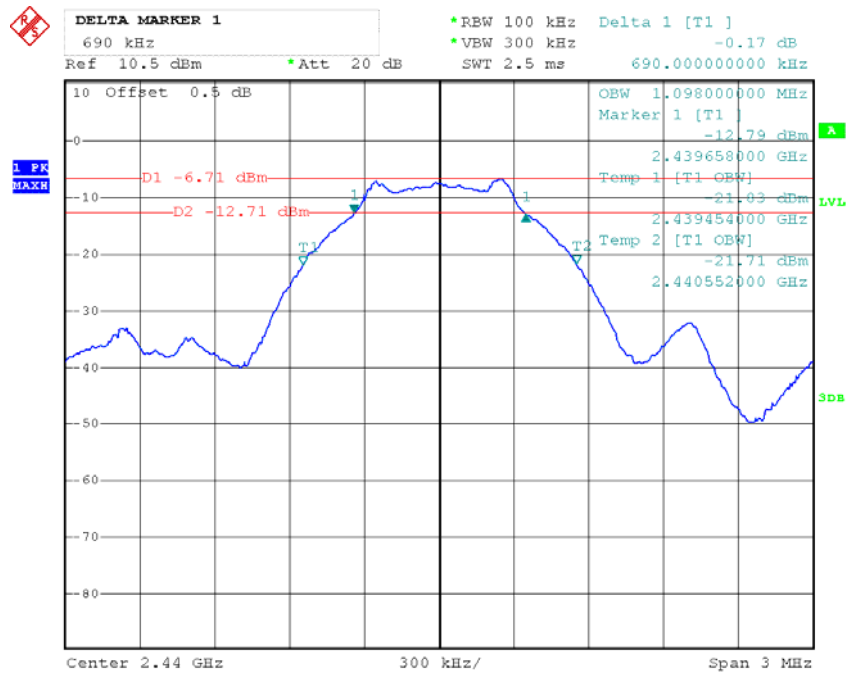
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	0.678	$\geq 0.5$
	Middle	2440	0.69	$\geq 0.5$
	High	2480	0.678	$\geq 0.5$

### BLE Low Channel



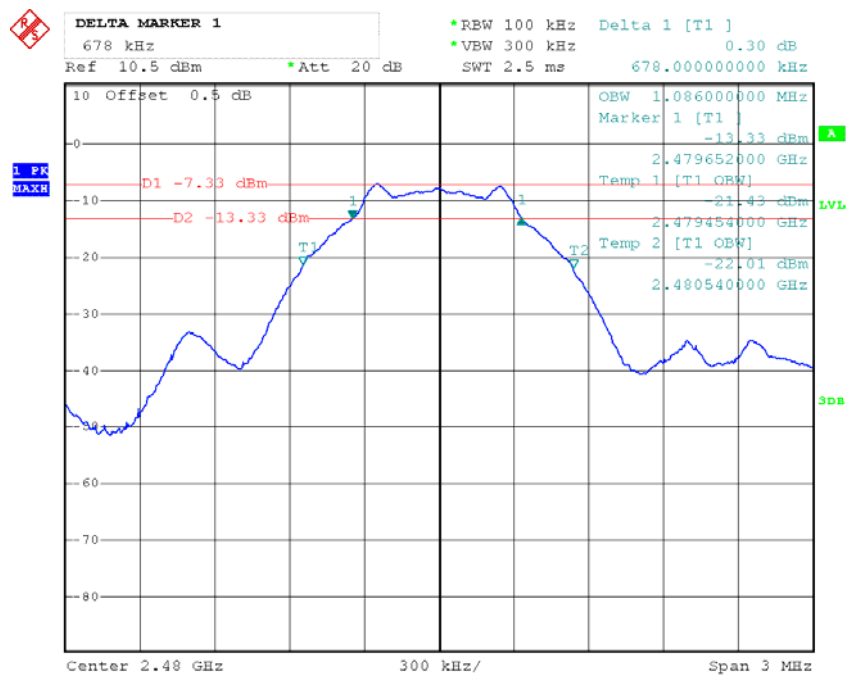
Date: 28.JAN.2016 17:12:32

### BLE Middle Channel



Date: 28.JAN.2016 17:11:33

### BLE High Channel



Date: 28.JAN.2016 17:10:42

## FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

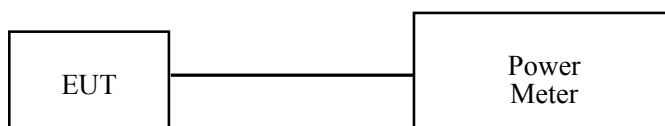
### Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

### Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r04

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2015-11-03	2016-11-03
Agilent	Wideband Power Sensor	N1921A	MY54170013	2015-11-03	2016-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2015-11-03	2016-11-03
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	21.5°C
Relative Humidity:	50 %
ATM Pressure:	101.4 kPa

\* The testing was performed by Allen Qiao on 2016-01-28.



*Test Mode: Transmitting*

*Test Result: Compliant. Please refer to the following table.*

Test mode	Channel	Frequency	Max Peak Conducted Output Power	Limit	Result
		(MHz)	(dBm)	(dBm)	
BLE	Low	2402	-5.54	30	Compliance
	Middle	2440	-6.37	30	Compliance
	High	2480	-6.86	30	Compliance

## **FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE**

### **Applicable Standard**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### **Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2015-07-28	2016-07-27
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Data**

#### **Environmental Conditions**

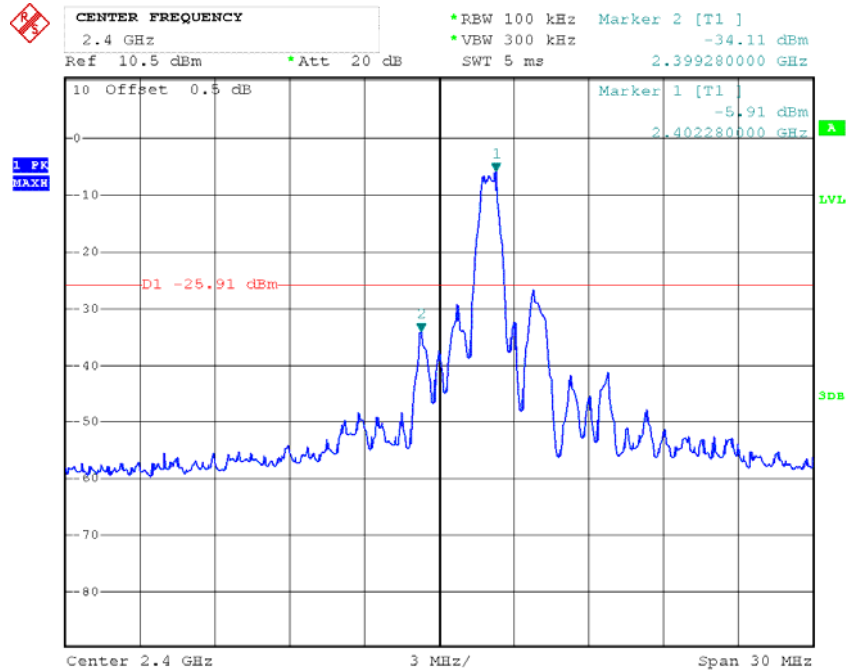
<b>Temperature:</b>	21.5°C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.4 kPa

\* The testing was performed by Allen Qiao on 2016-01-28.

Test mode: Transmitting

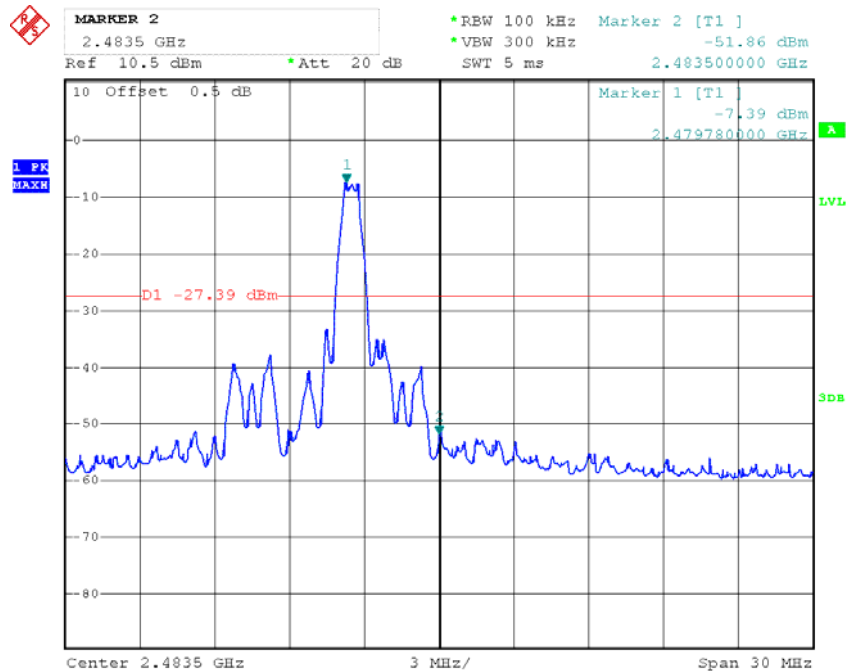
Test Result: Compliant. Please refer to following plots.

### BLE Band Edge, Left Side



Date: 28.JAN.2016 17:13:45

### BLE Band Edge, Right Side



Date: 28.JAN.2016 17:14:48

## FCC §15.247(e) - POWER SPECTRAL DENSITY

### Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r04

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \times \text{RBW}$ .
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	831259/019	2015-07-28	2016-07-27
N/A	Coaxial Cable	0.1m	N/A	2015-05-06	2016-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2015-05-06	2016-05-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	21.5°C
Relative Humidity:	50 %
ATM Pressure:	101.4 kPa

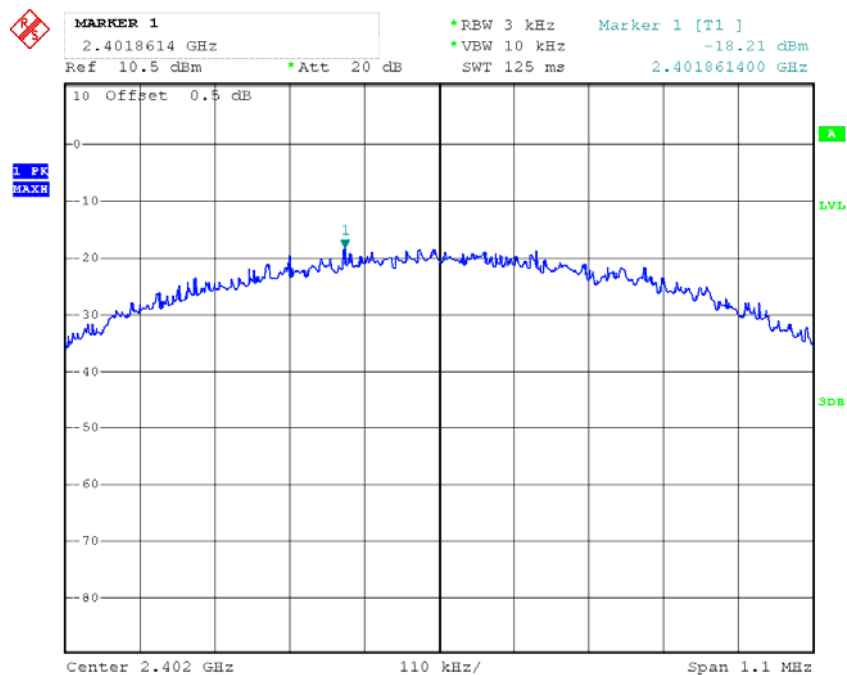
\* The testing was performed by Allen Qiao on 2016-01-28.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots

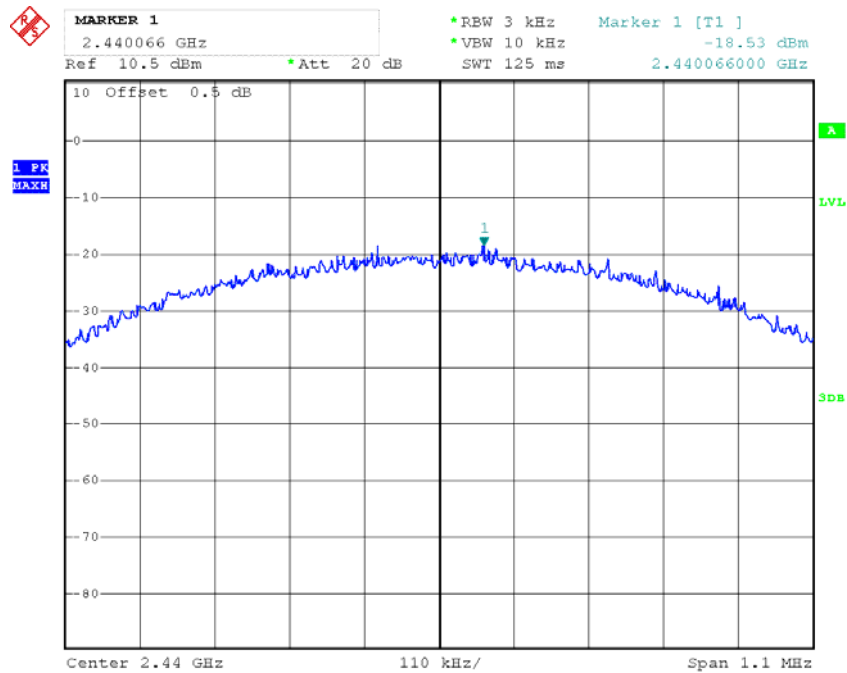
Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402	-18.21	$\leq 8$
	Middle	2440	-18.53	$\leq 8$
	High	2480	-18.89	$\leq 8$

### Power Spectral Density, BLE Low Channel



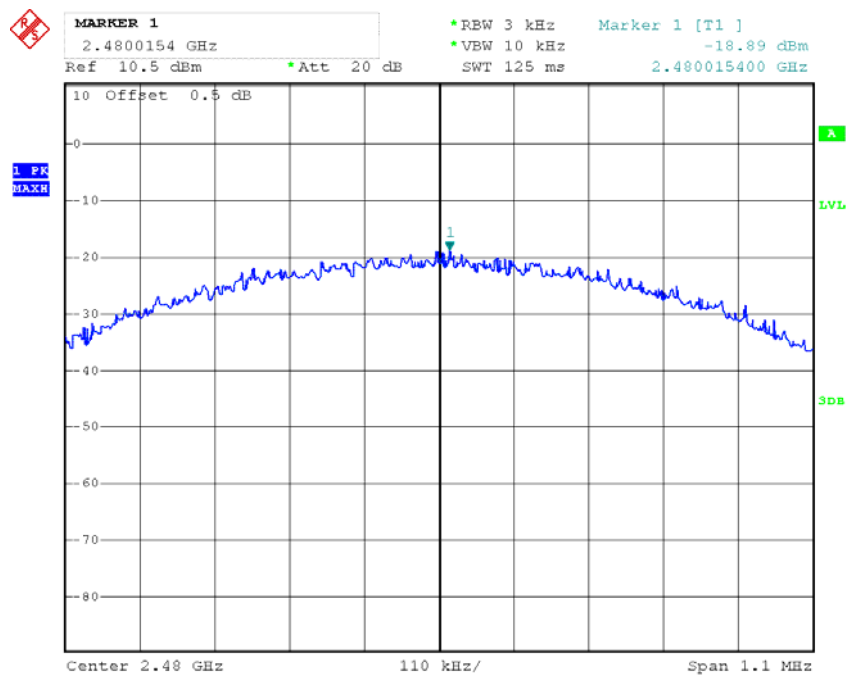
Date: 28.JAN.2016 17:17:50

### Power Spectral Density, BLE Middle Channel



Date: 28.JAN.2016 17:16:57

### Power Spectral Density, BLE High Channel



Date: 28.JAN.2016 17:16:19

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