

FCC PART 15.247

TEST REPORT

For

Hantat Technology Ltd.

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FCC ID: V3NHB098

Report Type: Original Report	Product Type: Bluetooth Speaker
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hantat Technology Ltd.*'s product, model number: *HB098 (FCC ID: V3NHB098)* (the "EUT") in this report was a *Bluetooth Speaker*, which was measured approximately: 10.2 cm (L) x 9.7 cm (W) x 5.5 cm (H), rated input voltage: DC3.7V from rechargeable Li-ion battery or DC5V from USB port .

All measurement and test data in this report was gathered from production sample serial number: 160829801 (Assigned by BACL, Dongguan). The EUT was received on 2016-08-29.

Objective

This report is prepared on behalf of *Hantat Technology Ltd.* 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 15.247 DSS submissions with FCC ID: V3NHB098.

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.

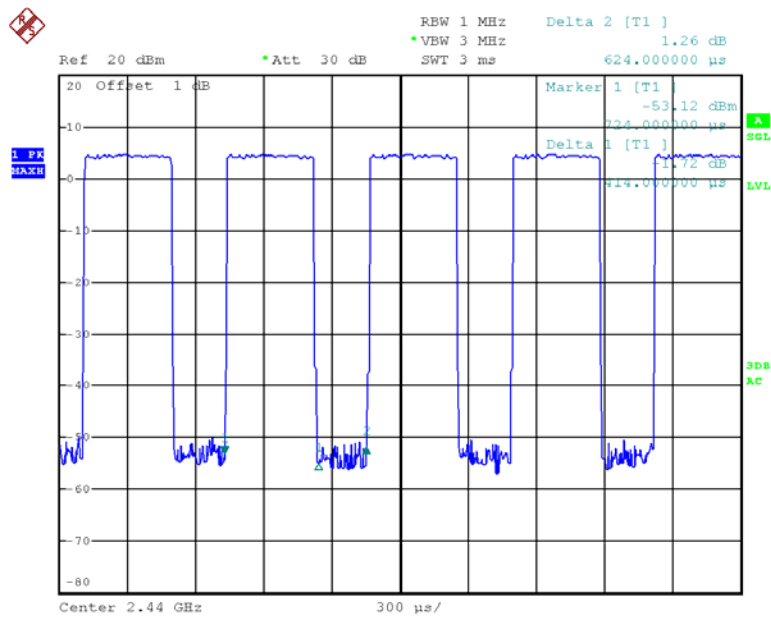
Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The software configured maximum duty cycle as below:

Mode	T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
BLE	0.414	0.624	66.35



Date: 30.SEP.2016 11:26:48

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Adapter	C-P44	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Charge Cable	No	No	0.54	Adapter	EUT

The diagram illustrates the LISN1 setup. A large rectangular area represents the "Non-Conductive Table 80 cm above Ground Plane", with a width of "1.5 Meter" and a height of "1.0 Meter". On the right side of the table, an "EUT" (Equipment Under Test) is placed. To the right of the EUT is an "Adapter", with a "10cm" gap between them. Above the adapter, a "LISN1" (Line Impedance Stabilization Network) is connected to the table via a vertical line.

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

Test Time: 2016-09-05~2016-09-30.

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 ≤ 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 ≤ 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 ≤ 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 tune-up power 5 dBm (3.16 mW) that declared by manufacturer.

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 3.16/5 \cdot (\sqrt{2.480}) = 1.0 < 3.0$

So the 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 internal antenna arrangement for Bluetooth and the antenna gain is 0dBi, 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_{cisp} 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_{cisp} of Table 1, then:

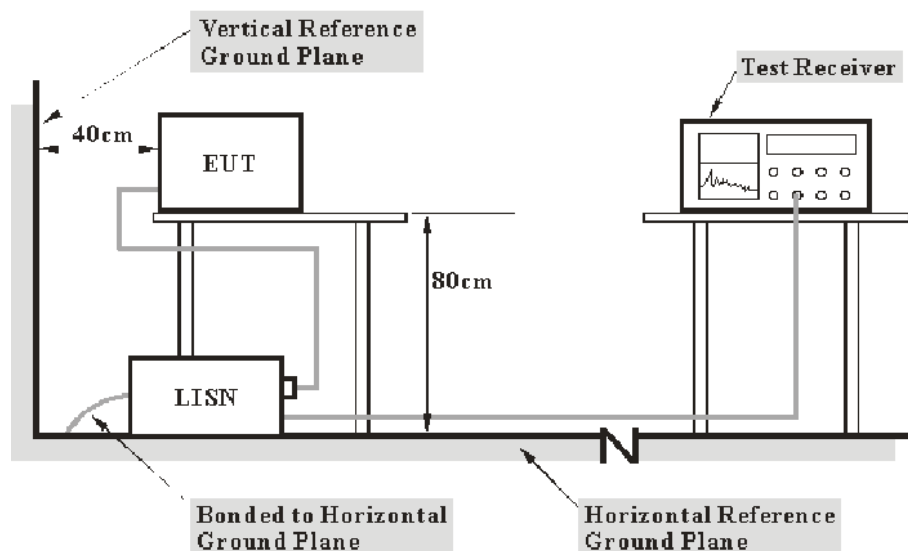
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of 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_{cisp}

Measurement	U_{cisp}
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 adapter 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	2016-07-16	2017-07-15
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	2016-05-06	2017-05-06
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 in accordance to NVLAP requirements, 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.

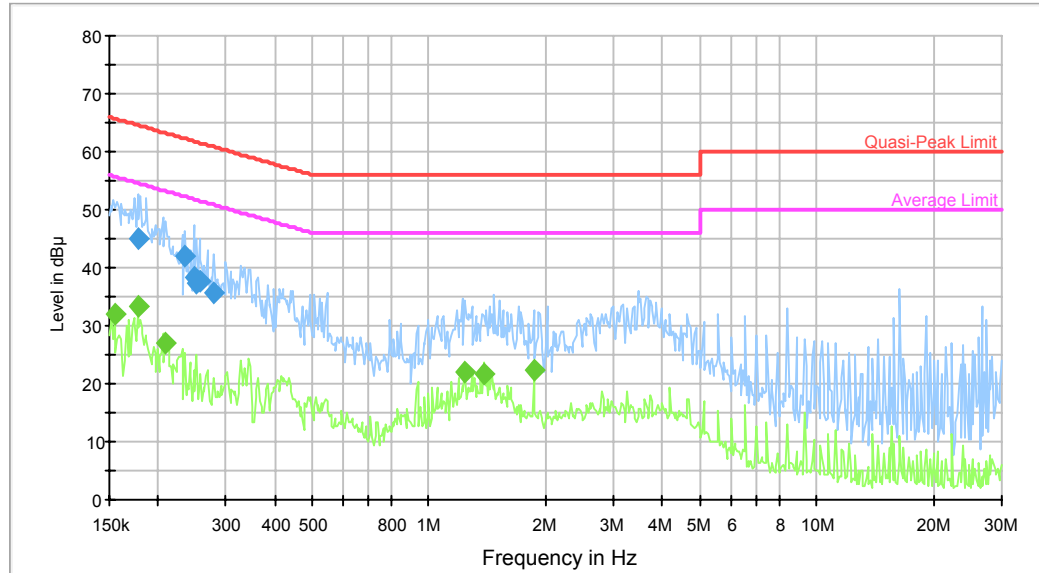
Test Data**Environmental Conditions**

Temperature:	28.4°C
Relative Humidity:	55%
ATM Pressure:	100 kPa

The testing was performed by Gavin Xu on 2016-09-07.

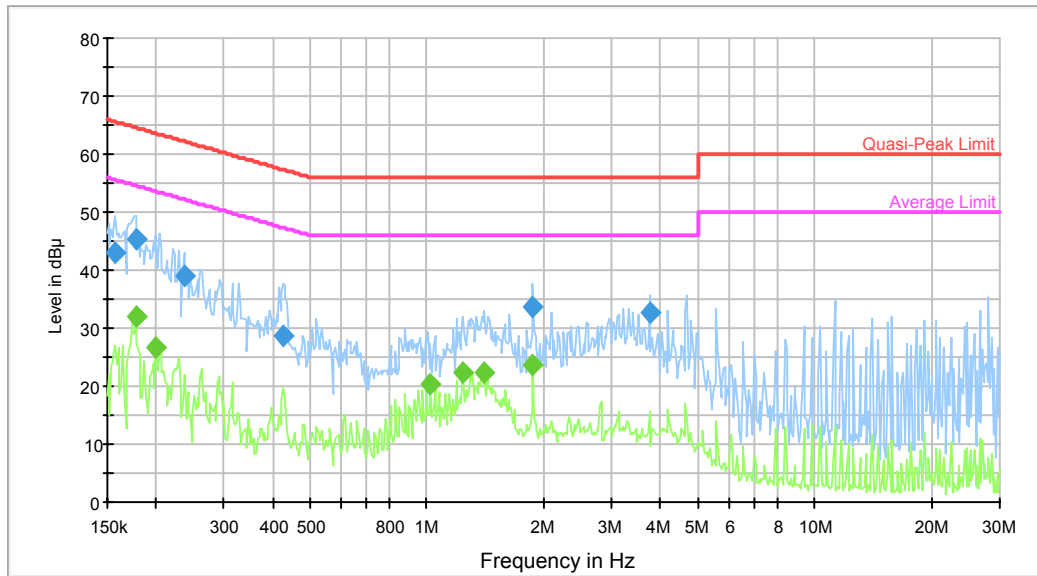
Test Mode: Transmitting

AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.177322	45.0	9.000	L1	9.7	19.6	64.6	Compliance
0.234359	42.1	9.000	L1	9.6	20.2	62.3	Compliance
0.247802	38.4	9.000	L1	9.6	23.4	61.8	Compliance
0.251783	37.3	9.000	L1	9.6	24.4	61.7	Compliance
0.255827	37.8	9.000	L1	9.6	23.8	61.6	Compliance
0.279263	35.7	9.000	L1	9.6	25.1	60.8	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154858	32.0	9.000	L1	9.7	23.7	55.7	Compliance
0.177322	33.3	9.000	L1	9.7	21.3	54.6	Compliance
0.209621	27.1	9.000	L1	9.6	26.1	53.2	Compliance
1.239175	21.9	9.000	L1	9.7	24.1	46.0	Compliance
1.385415	21.8	9.000	L1	9.7	24.2	46.0	Compliance
1.860457	22.3	9.000	L1	9.7	23.7	46.0	Compliance

AC120 V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.157346	43.0	9.000	N	9.6	22.6	65.6	Compliance
0.177322	45.4	9.000	N	9.6	19.2	64.6	Compliance
0.236234	39.1	9.000	N	9.6	23.1	62.2	Compliance
0.426011	28.6	9.000	N	9.6	28.7	57.3	Compliance
1.875341	33.6	9.000	N	9.7	22.4	56.0	Compliance
3.750995	32.8	9.000	N	9.7	23.2	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.177322	31.9	9.000	N	9.6	22.7	54.6	Compliance
0.199835	26.8	9.000	N	9.6	26.8	53.6	Compliance
1.023481	20.5	9.000	N	9.7	25.5	46.0	Compliance
1.239175	22.2	9.000	N	9.7	23.8	46.0	Compliance
1.407671	22.5	9.000	N	9.7	23.5	46.0	Compliance
1.875341	23.6	9.000	N	9.7	22.4	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.

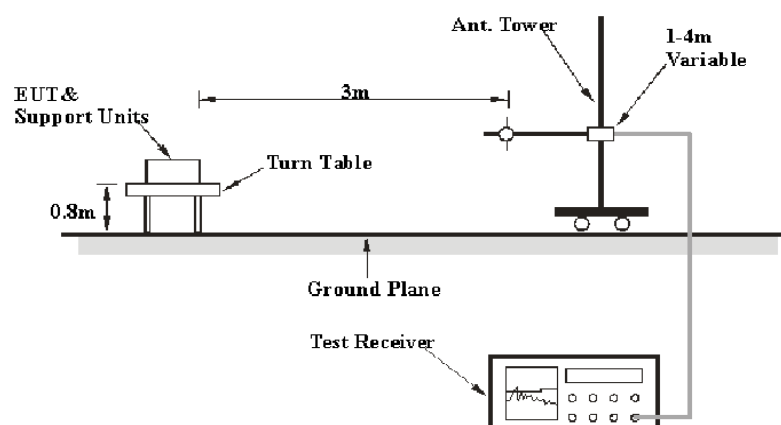
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB

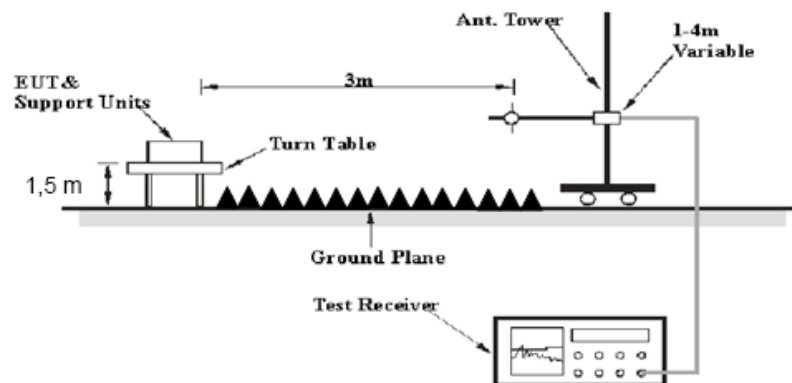
Table 2 – Values of U_{cisp}

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:

30MHz-1000MHz:

Detector	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Detector	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

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	2016-08-03	2017-08-02
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
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	2016-02-19	2017-02-19
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	2016-09-06	2017-09-06
N/A	Coaxial Cable	14m	N/A	2016-05-06	2017-05-06
N/A	Coaxial Cable	8m	N/A	2016-05-06	2017-05-06

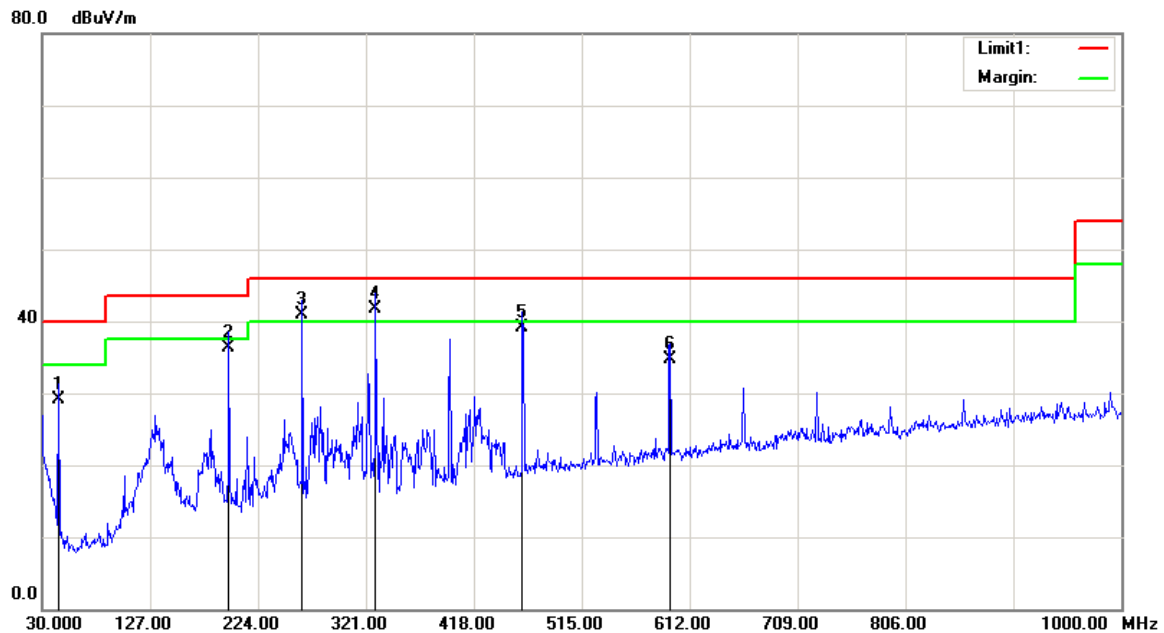
* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

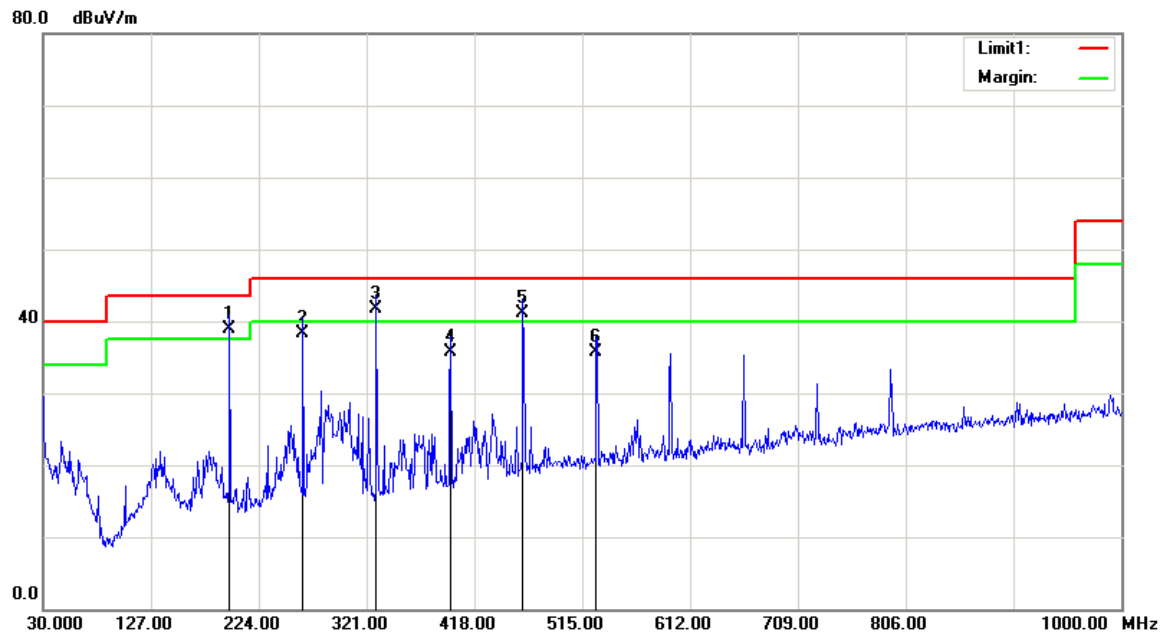
Temperature:	27.1 °C
Relative Humidity:	53%
ATM Pressure:	100.3 kPa

* The testing was performed by Gavin Xu on 2016-09-29

Test Mode: Transmitting

Below 1GHz:**Horizontal:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
44.5500	38.89	QP	-9.79	29.10	40.00	10.90
197.8100	44.16	QP	-7.76	36.40	43.50	7.10
263.7700	47.47	QP	-6.57	40.90	46.00	5.10
329.7300	47.27	QP	-5.47	41.80	46.00	4.20
461.6500	41.27	QP	-2.07	39.20	46.00	6.80
594.5400	35.05	QP	-0.25	34.80	46.00	11.20

Vertical:

Frequency (MHz)	Receiver Reading (dBuV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
197.8100	46.66	QP	-7.76	38.90	43.50	4.60
263.7700	44.97	QP	-6.57	38.40	46.00	7.60
329.7300	47.17	QP	-5.47	41.70	46.00	4.30
396.6600	39.57	QP	-3.87	35.70	46.00	10.30
461.6500	43.17	QP	-2.07	41.10	46.00	4.90
527.6100	36.88	QP	-1.08	35.80	46.00	10.20

Above 1GHz:

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	65.21	PK	H	25.65	3.66	0.00	94.52	N/A	N/A
2402	48.88	AV	H	25.65	3.66	0.00	78.19	N/A	N/A
2402	67.03	PK	V	25.65	3.66	0.00	96.34	N/A	N/A
2402	50.81	AV	V	25.65	3.66	0.00	80.12	N/A	N/A
2390	24.89	PK	V	25.61	3.63	0.00	54.13	74.00	19.87
2390	13.97	AV	V	25.61	3.63	0.00	43.21	54.00	10.79
4804	40.65	PK	V	30.59	5.06	27.41	48.89	74.00	25.11
4804	30.57	AV	V	30.59	5.06	27.41	38.81	54.00	15.19
7206	38.63	PK	V	34.09	6.61	25.91	53.42	74.00	20.58
7206	28.16	AV	V	34.09	6.61	25.91	42.95	54.00	11.05
2950	33.48	PK	V	27.07	6.61	27.54	39.62	74.00	34.38
2950	20.34	AV	V	27.07	6.61	27.54	26.48	54.00	27.52
Middle Channel: 2440 MHz									
2440	67.54	PK	H	25.74	3.76	0.00	97.04	N/A	N/A
2440	50.19	AV	H	25.74	3.76	0.00	79.69	N/A	N/A
2440	69.05	PK	V	25.74	3.76	0.00	98.55	N/A	N/A
2440	52.64	AV	V	25.74	3.76	0.00	82.14	N/A	N/A
4880	43.05	PK	V	30.79	5.18	27.42	51.60	74.00	22.40
4880	30.67	AV	V	30.79	5.18	27.42	39.22	54.00	14.78
7320	42.35	PK	V	34.37	6.75	25.88	57.59	74.00	16.41
7320	30.49	AV	V	34.37	6.75	25.88	45.73	54.00	8.27
2975	33.71	PK	V	27.14	6.70	27.53	40.02	74.00	33.98
2975	20.74	AV	V	27.14	6.70	27.53	27.05	54.00	26.95
3580	34.69	PK	V	28.98	4.58	27.26	40.99	74.00	33.01
3580	21.63	AV	V	28.98	4.58	27.26	27.93	54.00	26.07
High Channel: 2480 MHz									
2480	70.78	PK	H	25.85	3.68	0.00	100.31	N/A	N/A
2480	54.69	AV	H	25.85	3.68	0.00	84.22	N/A	N/A
2480	71.45	PK	V	25.85	3.68	0.00	100.98	N/A	N/A
2480	54.94	AV	V	25.85	3.68	0.00	84.47	N/A	N/A
2483.5	28.42	PK	V	25.86	3.67	0.00	57.95	74.00	16.05
2483.5	14.15	AV	V	25.86	3.67	0.00	43.68	54.00	10.32
4960	42.63	PK	V	31.00	5.34	27.43	51.54	74.00	22.46
4960	32.49	AV	V	31.00	5.34	27.43	41.40	54.00	12.60
7440	43.6	PK	V	34.66	6.89	25.97	59.18	74.00	14.82
7440	31.98	AV	V	34.66	6.89	25.97	47.56	54.00	6.44
2975	33.47	PK	V	27.14	6.70	27.53	39.78	74.00	34.22
2975	20.94	AV	V	27.14	6.70	27.53	27.25	54.00	26.75

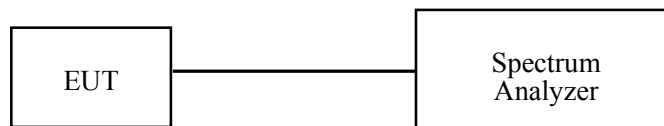
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$
- 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	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	41%
ATM Pressure:	99.9 kPa

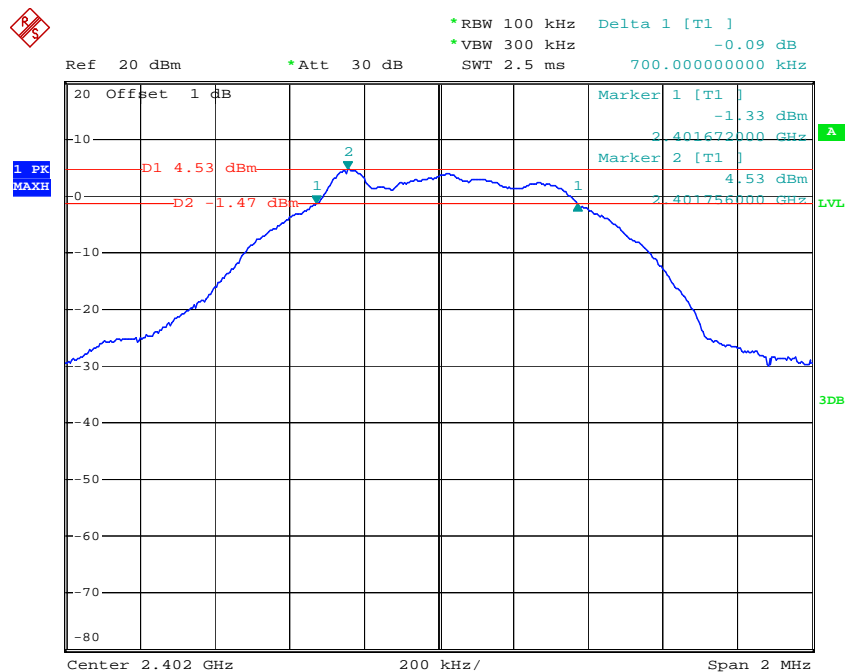
** The testing was performed by Gavin Xu on 2016-09-05.*

Test Mode: Transmitting

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

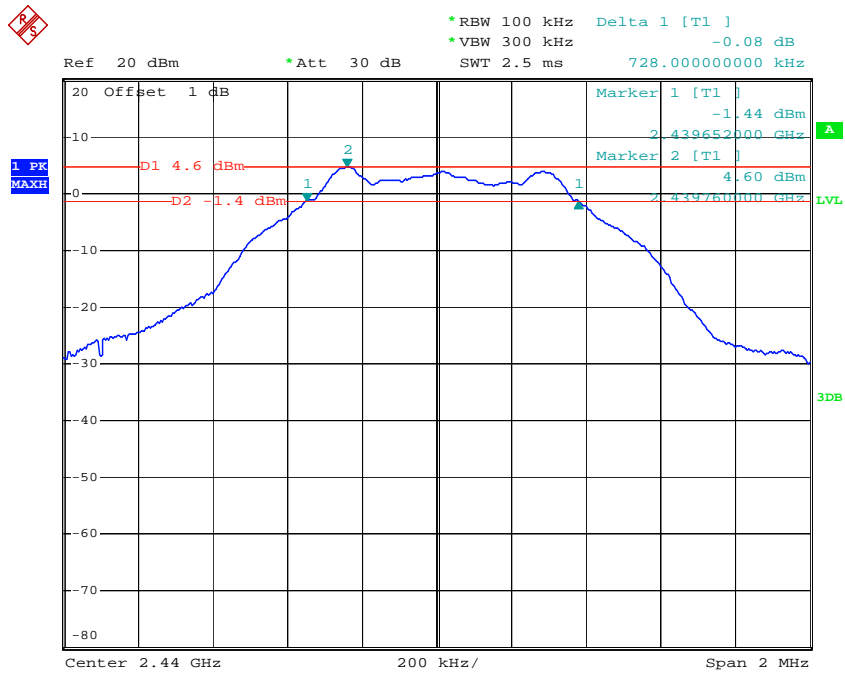
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	0.7	≥ 0.5
	Middle	2440	0.728	≥ 0.5
	High	2480	0.728	≥ 0.5

BLE Low Channel



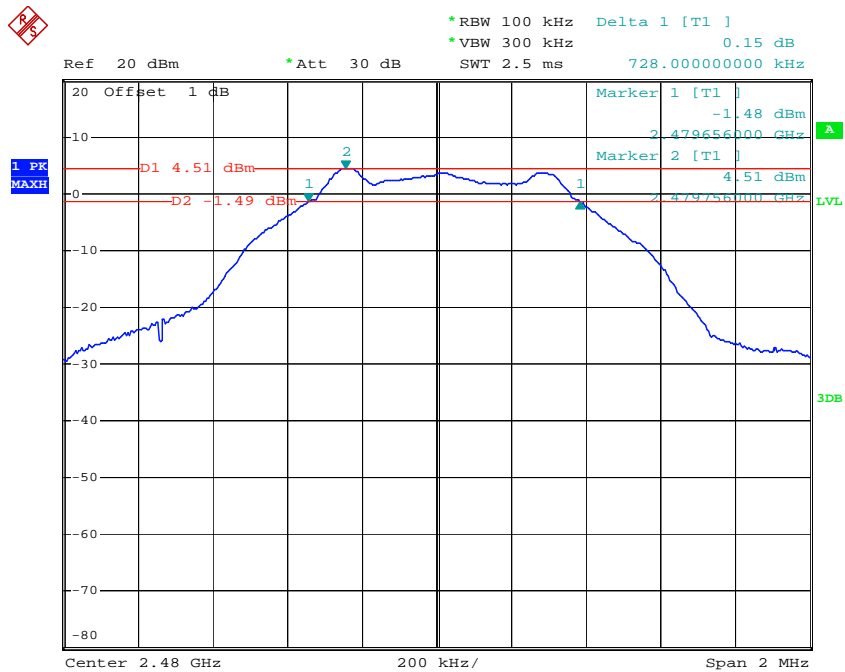
Date: 5.SEP.2016 18:47:12

BLE Middle Channel



Date: 5.SEP.2016 18:49:10

BLE High Channel



Date: 5.SEP.2016 18:45:21

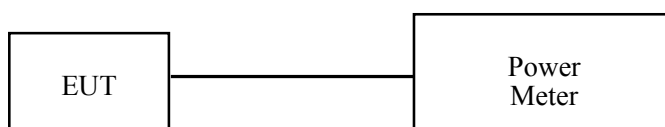
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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

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
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	41%
ATM Pressure:	99.9 kPa

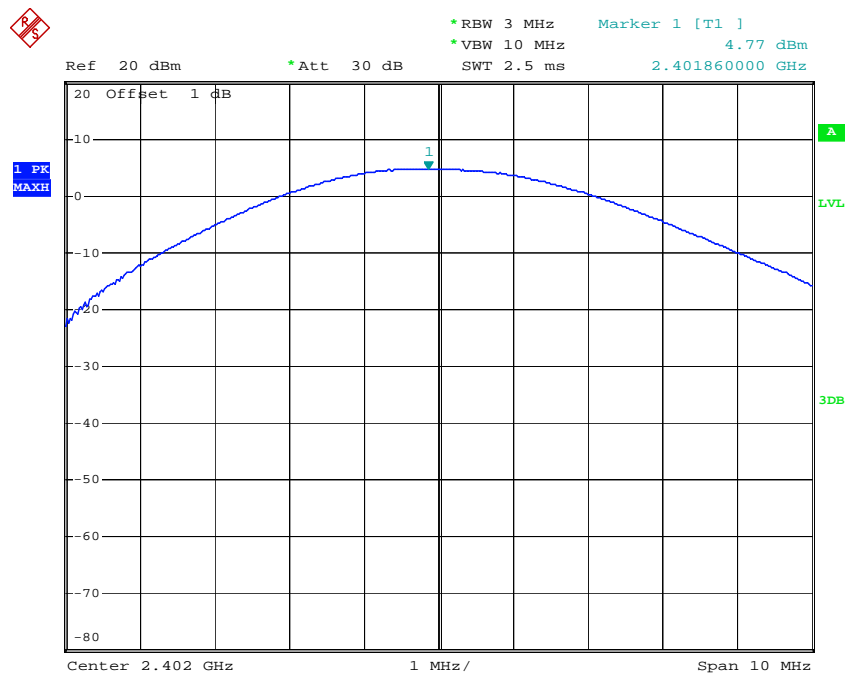
* The testing was performed by Gavin Xu on 2016-09-05.

Test Mode: Transmitting

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

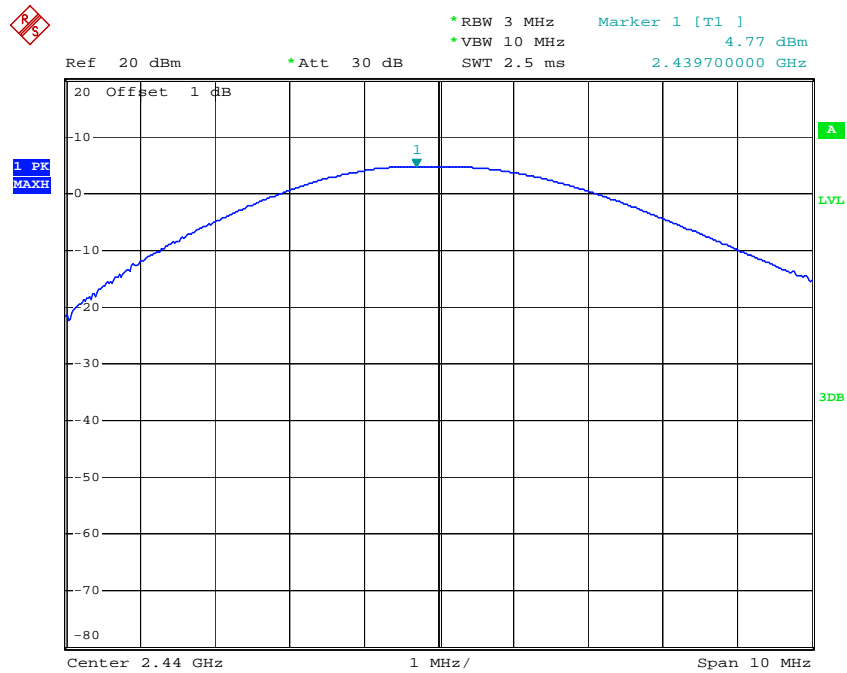
Test mode	Channel	Frequency	Max Peak Conducted Output Power	Limit
		(MHz)	(dBm)	(dBm)
BLE	Low	2402	4.77	30
	Middle	2440	4.77	30
	High	2480	4.80	30

BLE Low Channel



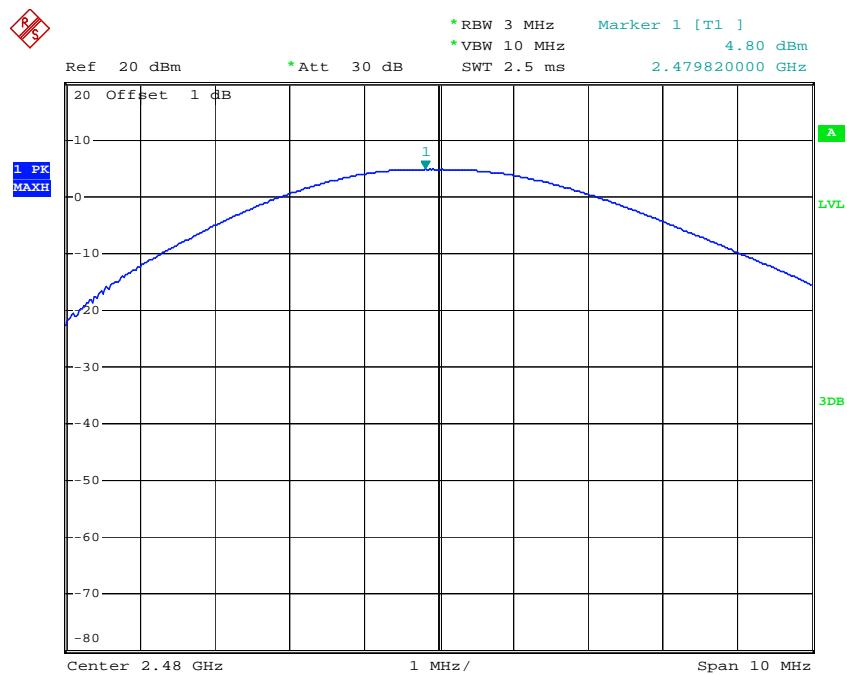
Date: 5.SEP.2016 19:35:43

BLE Middle Channel



Date: 5.SEP.2016 19:35:04

BLE High Channel



Date: 5.SEP.2016 19:36:30

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	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

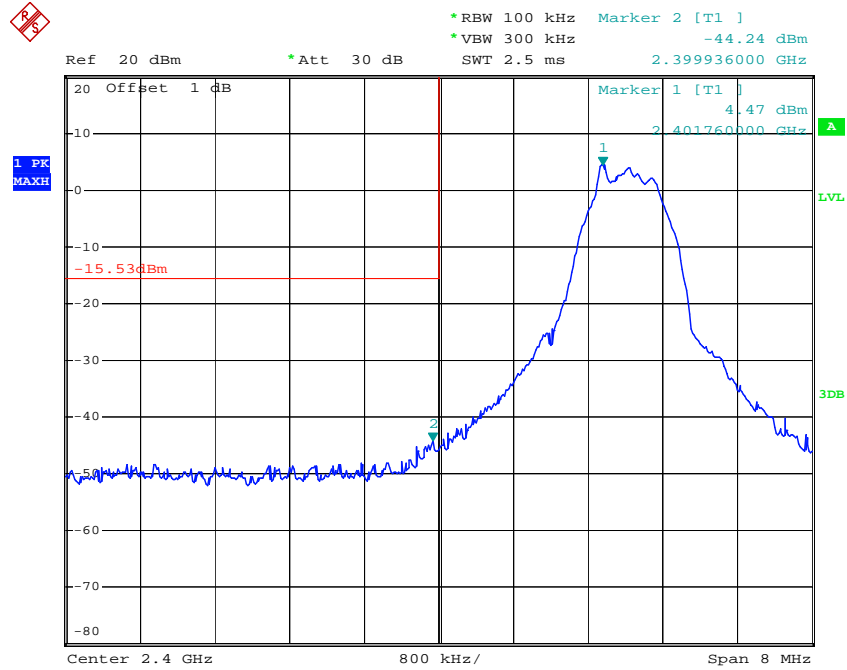
Temperature:	28.7 °C
Relative Humidity:	41%
ATM Pressure:	99.9 kPa

** The testing was performed by Gavin Xu on 2016-09-05.*

Test mode: Transmitting

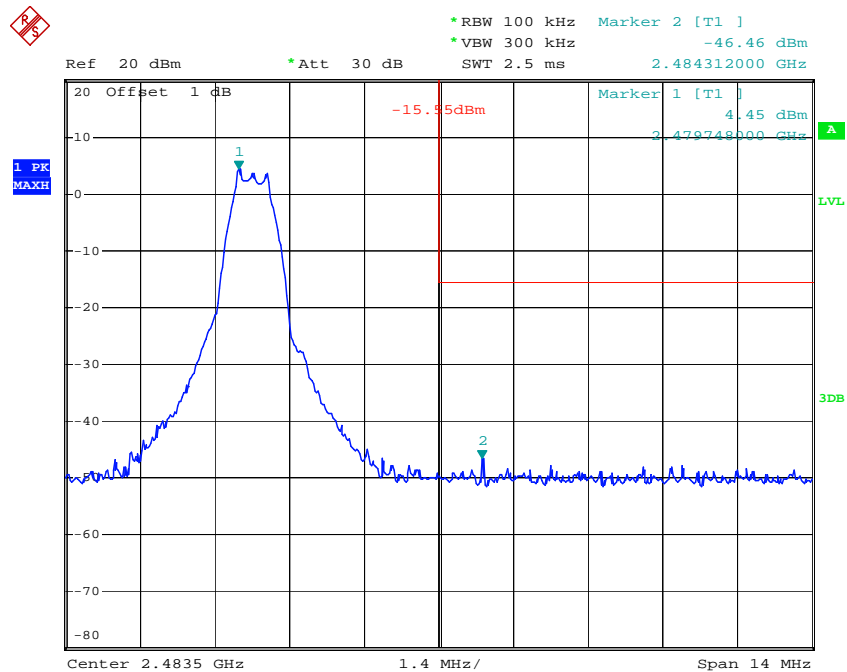
Test Result: Compliant. Please refer to following plots.

BLE Band Edge , Left Side



Date: 5.SEP.2016 18:48:24

BLE Band Edge, Right Side



Date: 5.SEP.2016 18:46:34

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

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) 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	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	41%
ATM Pressure:	99.9 kPa

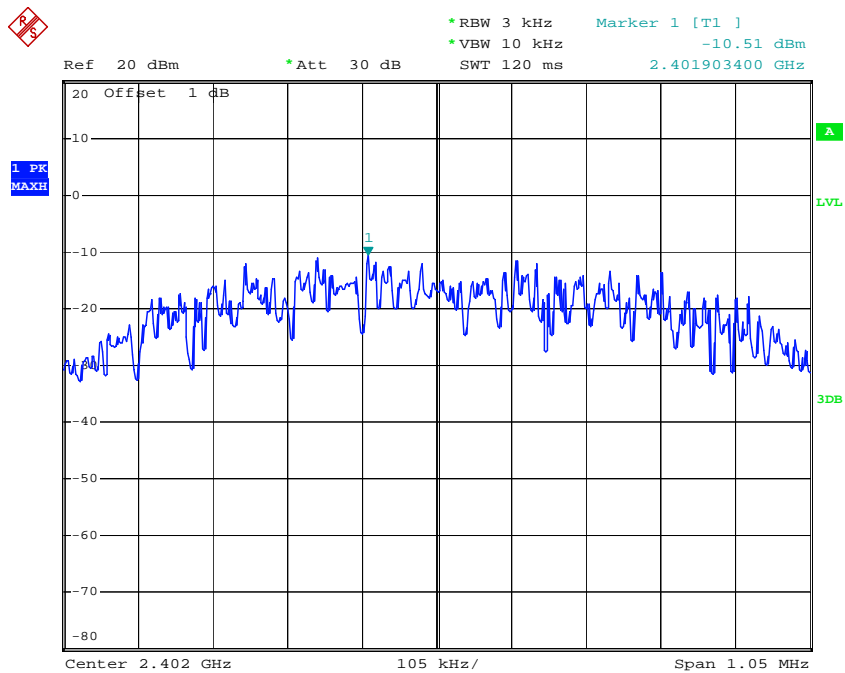
* The testing was performed by Gavin Xu on 2016-09-05.

Test Mode: Transmitting

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

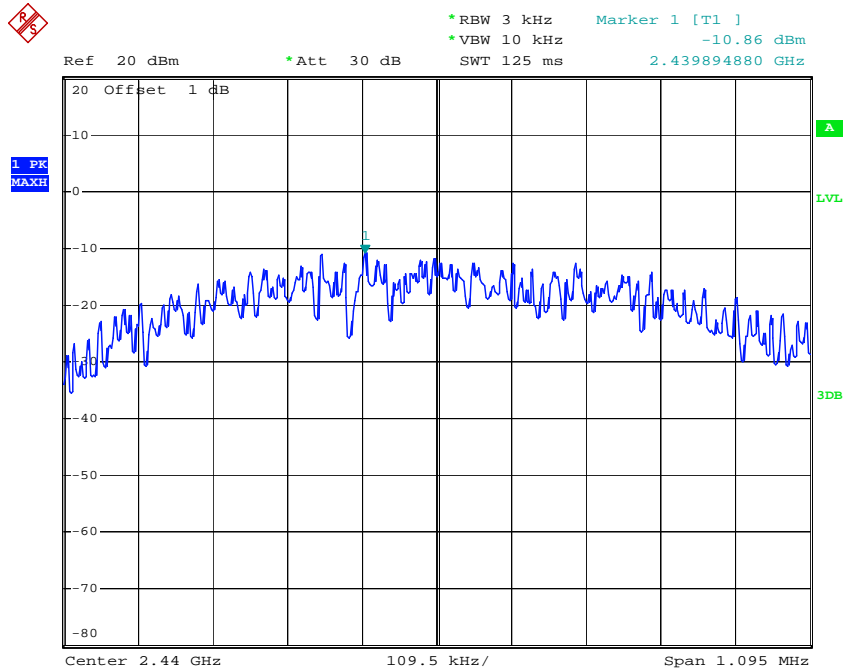
Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402	-10.51	≤ 8
	Middle	2440	-10.86	≤ 8
	High	2480	-10.88	≤ 8

Power Spectral Density, BLE Low Channel



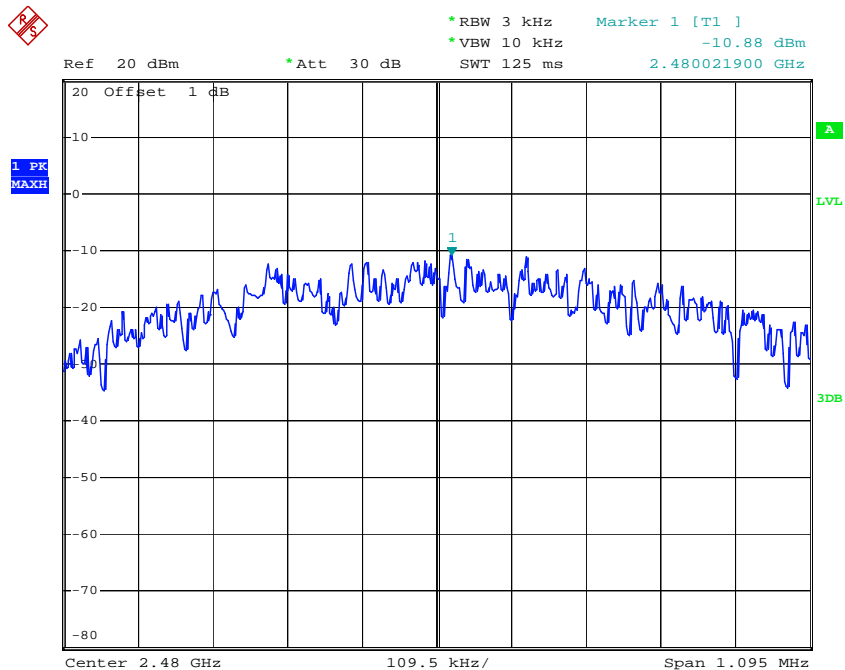
Date: 5.SEP.2016 19:46:41

Power Spectral Density, BLE Middle Channel



Date: 5.SEP.2016 19:35:15

Power Spectral Density, BLE High Channel



Date: 5.SEP.2016 19:38:58

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