

FCC PART 15.247

TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd.

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FCC ID: PP2A650

Report Type: Original Report	Product Type: Bluetooth Outdoor Speaker
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FINAL

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Rapoo Technology Co., Ltd.*'s product, model number: A650 (FCC ID: PP2A650) (the "EUT") in this report was a *Bluetooth Outdoor Speaker*, which was measured approximately: 6.5 cm (L) x 6.5 cm (W) x 17 cm (H), rated input voltage: DC 3.7V rechargeable Li-ion battery or DC5V charging from adapter.

All measurement and test data in this report was gathered from production sample serial number: 150707002 (Assigned by BACL, Dongguan). The EUT was received on 2015-07-07.

Objective

This report is prepared on behalf of *Shenzhen Rapoo Technology Co., 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 15C DSS submissions with FCC ID: PP2A650.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

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.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The software “BlueTest3” was used, which was provided by manufacture, the maximum power (100% duty cycle) was configured as default value by the software.

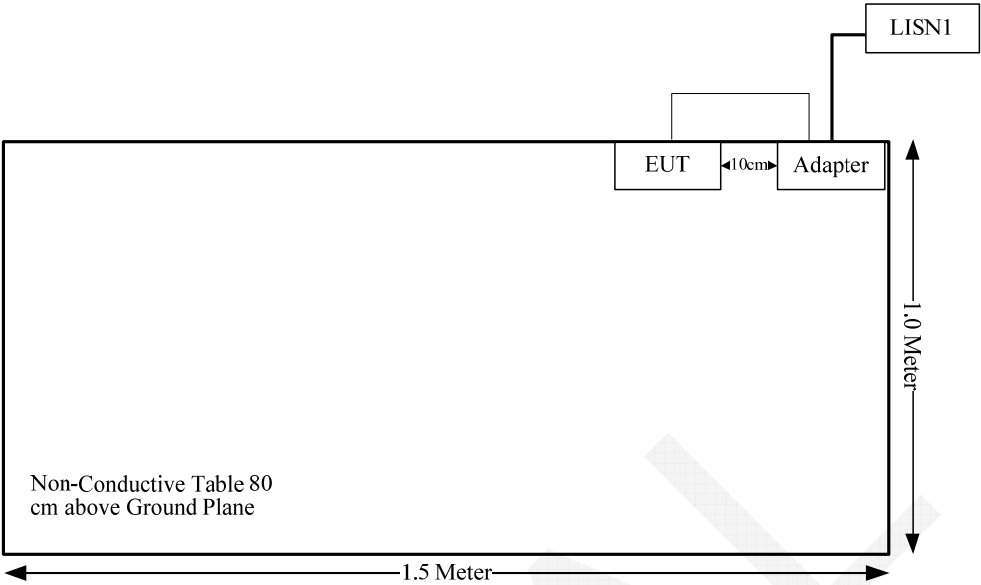
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
DC Cable	no	no	0.6	USB Port of Adapter	EUT

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 v05r02:

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 maximum conducted average output power = 3.23 dBm (2.10mW) at 2402 MHz

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$

$= 2.10/5 \cdot (\sqrt{2.402}) = 0.65 < 3.0$

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one integral antenna arrangement for BT, which was permanently attached and the antenna gain is 2.72 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:

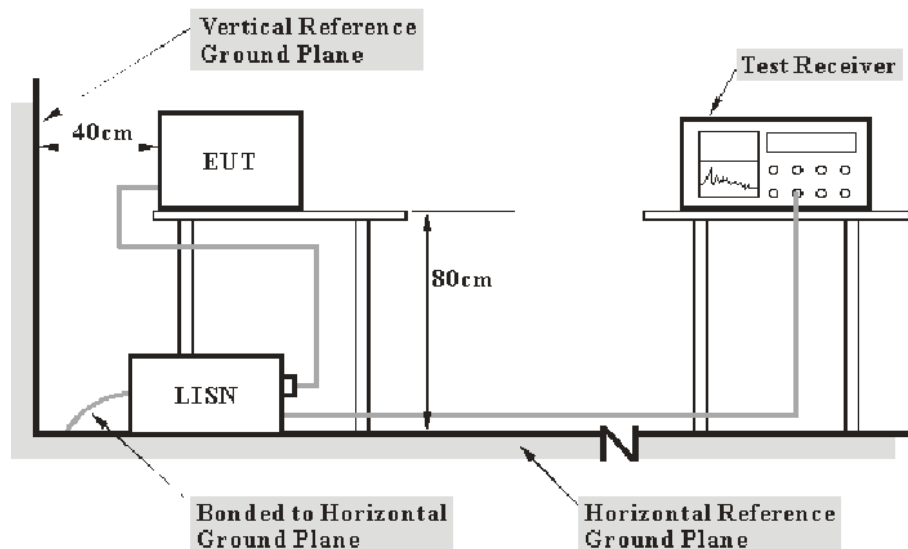
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

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 3.46 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 C63.4-2009 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	2014-10-20	2015-10-20
R&S	L.I.S.N	ESH2-Z5	892107/021	2015-06-09	2016-06-09
R&S	Two-line V-network	ENV 216	3560.6550.12	2014-12-11	2015-12-11
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:

16.8 dB at 0.609741 MHz in the **Neutral** conducted mode

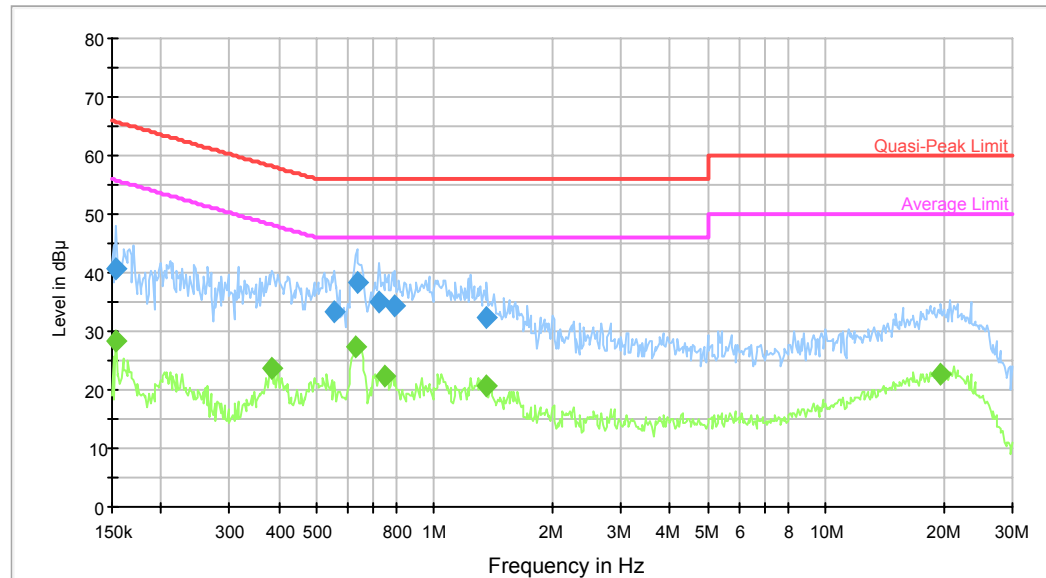
Test Data**Environmental Conditions**

Temperature:	27.6 °C
Relative Humidity:	56 %
ATM Pressure:	99.6 kPa

The testing was performed by Allen Qiao on 2015-07-07.

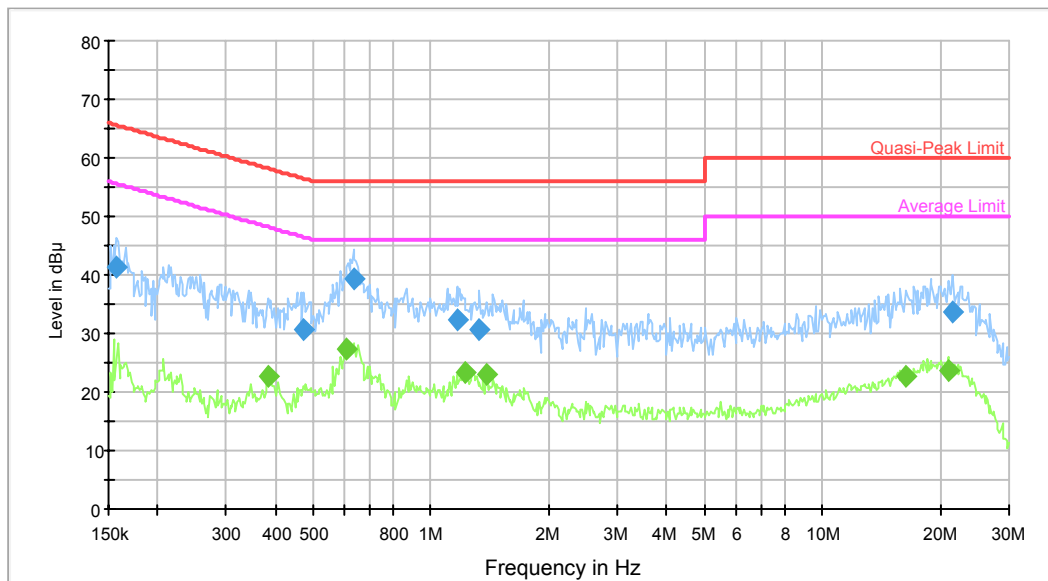
Test Mode: Transmitting (BLE)

AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.153629	40.7	9.000	L1	10.2	25.1	65.8	Compliance
0.554139	33.4	9.000	L1	10.1	22.6	56.0	Compliance
0.634524	38.5	9.000	L1	10.3	17.5	56.0	Compliance
0.720803	35.0	9.000	L1	10.4	21.0	56.0	Compliance
0.793127	34.4	9.000	L1	10.4	21.6	56.0	Compliance
1.363512	32.2	9.000	L1	10.4	23.8	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.153629	28.3	9.000	L1	10.2	27.5	55.8	Compliance
0.384091	23.6	9.000	L1	10.3	24.6	48.2	Compliance
0.629488	27.3	9.000	L1	10.3	18.7	46.0	Compliance
0.744147	22.4	9.000	L1	10.4	23.6	46.0	Compliance
1.363512	20.7	9.000	L1	10.4	25.3	46.0	Compliance
19.676017	22.7	9.000	L1	10.8	27.3	50.0	Compliance

AC120 V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.157346	41.3	9.000	N	10.2	24.3	65.6	Compliance
0.472507	30.8	9.000	N	10.1	25.7	56.5	Compliance
0.634524	39.2	9.000	N	10.3	16.8	56.0	Compliance
1.162648	32.4	9.000	N	10.4	23.6	56.0	Compliance
1.331304	30.7	9.000	N	10.4	25.3	56.0	Compliance
21.478456	33.7	9.000	N	11.0	26.3	60.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.384091	22.8	9.000	N	10.2	25.4	48.2	Compliance
0.609741	27.4	9.000	N	10.3	18.6	46.0	Compliance
1.219583	23.4	9.000	N	10.4	22.6	46.0	Compliance
1.385415	23.1	9.000	N	10.4	22.9	46.0	Compliance
16.251162	22.8	9.000	N	10.7	27.2	50.0	Compliance
20.971112	23.8	9.000	N	11.0	26.2	50.0	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: 5.0 dB

200M~1GHz: 6.2 dB

1G~6GHz: 4.45 dB

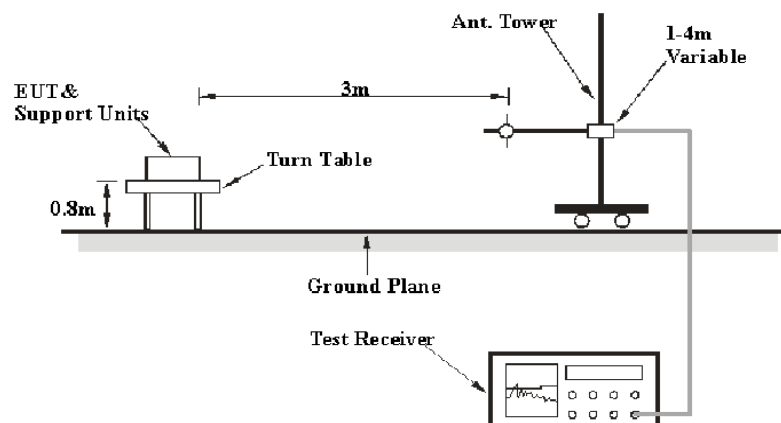
6G~18GHz: 5.23 dB

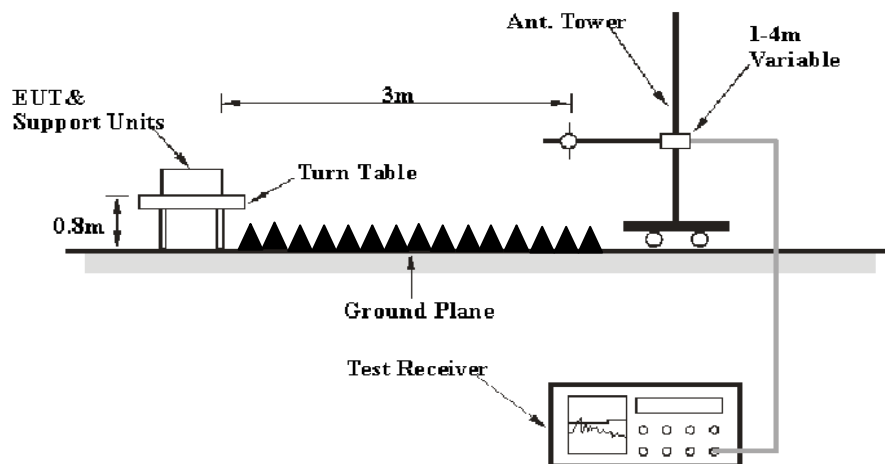
Table 2 – Values of U_{cisp}

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 C63.4-2009. 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.

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

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	/	Ave.

Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

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	2015-05-09	2016-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-07-28	2017-07-27
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2014-12-04	2015-12-04
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2014-09-06	2015-09-06
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

* **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:

3.57 dB at 7440 MHz in the Horizontal polarization

Test Data

Environmental Conditions

Temperature:	26.4 °C
Relative Humidity:	55 %
ATM Pressure:	99.7 kPa

* The testing was performed by Allen Qiao on 2015-07-13.

Test Mode: Transmitting

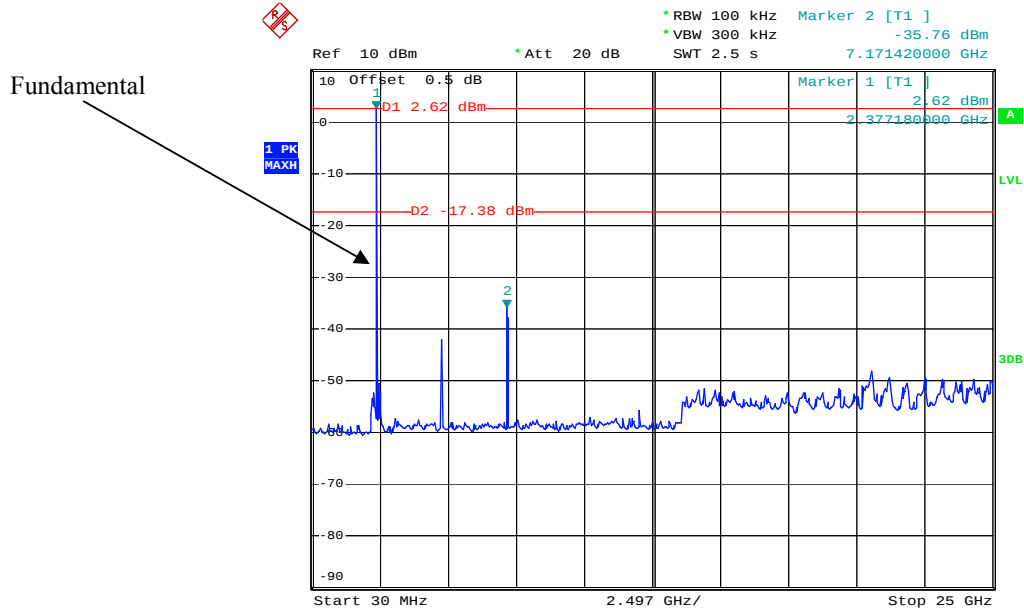
BLE Mode

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	63.95	PK	H	25.65	3.66	0.00	93.26	N/A	N/A
2402	52.24	AV	H	25.65	3.66	0.00	81.55	N/A	N/A
2402	61.38	PK	V	25.65	3.66	0.00	90.69	N/A	N/A
2402	49.69	AV	V	25.65	3.66	0.00	79.00	N/A	N/A
2390	26.25	PK	H	25.61	3.63	0.00	55.49	74.00	18.51
2390	13.41	AV	H	25.61	3.63	0.00	42.65	54.00	11.35
4804	47.31	PK	H	30.59	5.06	27.41	55.55	74.00	18.45
4804	34.7	AV	H	30.59	5.06	27.41	42.94	54.00	11.06
7206	47.17	PK	H	34.09	6.61	25.91	61.96	74.00	12.04
7206	34.59	AV	H	34.09	6.61	25.91	49.38	54.00	4.62*
9608	29.93	PK	H	35.96	8.53	27.55	46.87	74.00	27.13
9608	16.65	AV	H	35.96	8.53	27.55	33.59	54.00	20.41
3505	34.2	PK	H	28.81	4.52	27.24	40.29	74.00	33.71
3505	21.01	AV	H	28.81	4.52	27.24	27.10	54.00	26.90
232	44.1	QP	V	11.99	1.83	21.48	36.44	46.00	9.56
Middle Channel: 2440 MHz									
2440	64.07	PK	H	25.74	3.76	0.00	93.57	N/A	N/A
2440	52.44	AV	H	25.74	3.76	0.00	81.94	N/A	N/A
2440	61.53	PK	V	25.74	3.76	0.00	91.03	N/A	N/A
2440	49.71	AV	V	25.74	3.76	0.00	79.21	N/A	N/A
4880	47.26	PK	H	30.79	5.18	27.42	55.81	74.00	18.19
4880	34.87	AV	H	30.79	5.18	27.42	43.42	54.00	10.58
7320	47.34	PK	H	34.37	6.75	25.88	62.58	74.00	11.42
7320	34.61	AV	H	34.37	6.75	25.88	49.85	54.00	4.15*
9760	29.97	PK	H	36.32	8.62	27.21	47.70	74.00	26.30
9760	16.79	AV	H	36.32	8.62	27.21	34.52	54.00	19.48
3050	34.2	PK	H	27.36	6.64	27.49	40.71	74.00	33.29
3050	21.09	AV	H	27.36	6.64	27.49	27.60	54.00	26.40
1890	35.03	PK	H	24.38	3.05	27.51	34.95	74.00	39.05
1890	22.15	AV	H	24.38	3.05	27.51	22.07	54.00	31.93
232	43.7	QP	V	11.99	1.83	21.48	36.04	46.00	9.96
High Channel: 2480 MHz									
2480	64.98	PK	H	25.85	3.68	0.00	94.51	N/A	N/A
2480	52.89	AV	H	25.85	3.68	0.00	82.42	N/A	N/A
2480	62.16	PK	V	25.85	3.68	0.00	91.69	N/A	N/A
2480	50.72	AV	V	25.85	3.68	0.00	80.25	N/A	N/A
2483.5	28.19	PK	H	25.86	3.67	0.00	57.72	74.00	16.28
2483.5	15.44	AV	H	25.86	3.67	0.00	44.97	54.00	9.03
4960	47.54	PK	H	31.00	5.34	27.43	56.45	74.00	17.55
4960	35.01	AV	H	31.00	5.34	27.43	43.92	54.00	10.08
7440	47.47	PK	H	34.66	6.89	25.97	63.05	74.00	10.95
7440	34.85	AV	H	34.66	6.89	25.97	50.43	54.00	3.57*
9920	30.21	PK	H	36.71	8.71	26.66	48.97	74.00	25.03
9920	17.02	AV	H	36.71	8.71	26.66	35.78	54.00	18.22
3505	34.39	PK	H	28.81	4.52	27.24	40.48	74.00	33.52
3505	21.28	AV	H	28.81	4.52	27.24	27.37	54.00	26.63
232	43.6	QP	V	11.99	1.83	21.48	35.94	46.00	10.06

*within measurement uncertainty!

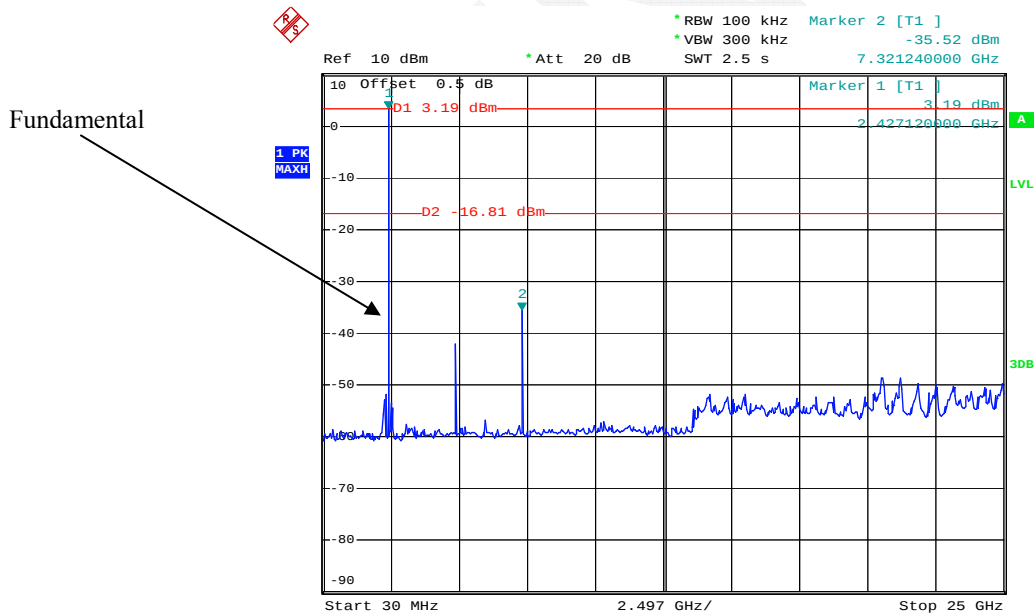
Conducted Spurious Emissions at Antenna Port

BLE Low Channel



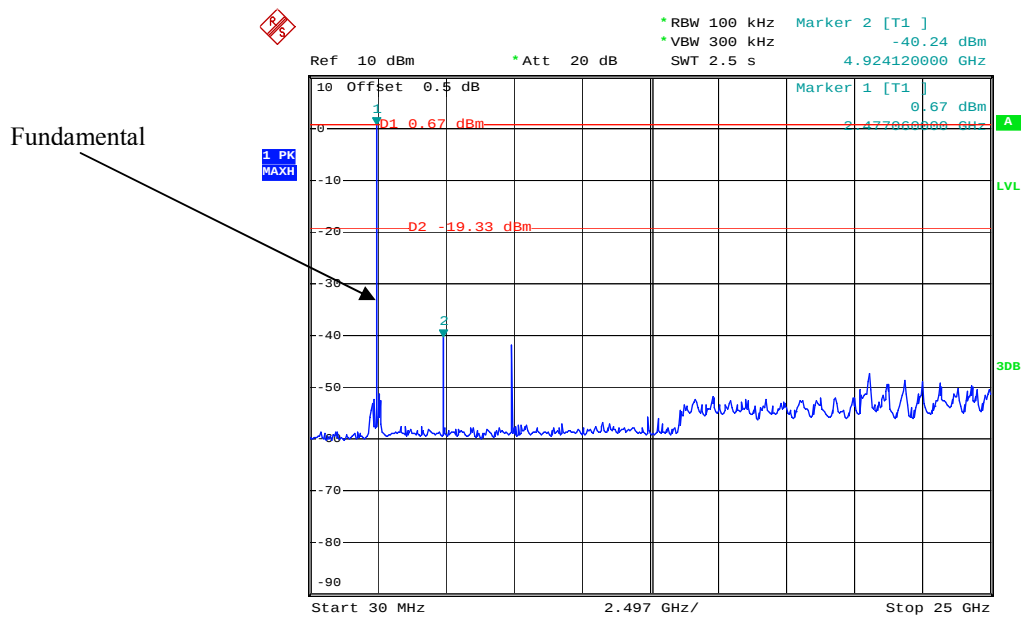
Date: 13.JUL.2015 10:55:24

BLE Middle Channel



Date: 13.JUL.2015 10:57:07

BLE High Channel



Date: 13.JUL.2015 10:58:56

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 v03r03

- 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	FSP 38	100478	2015-05-09	2016-05-09

* **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:	26.4°C
Relative Humidity:	53 %
ATM Pressure:	99.7 kPa

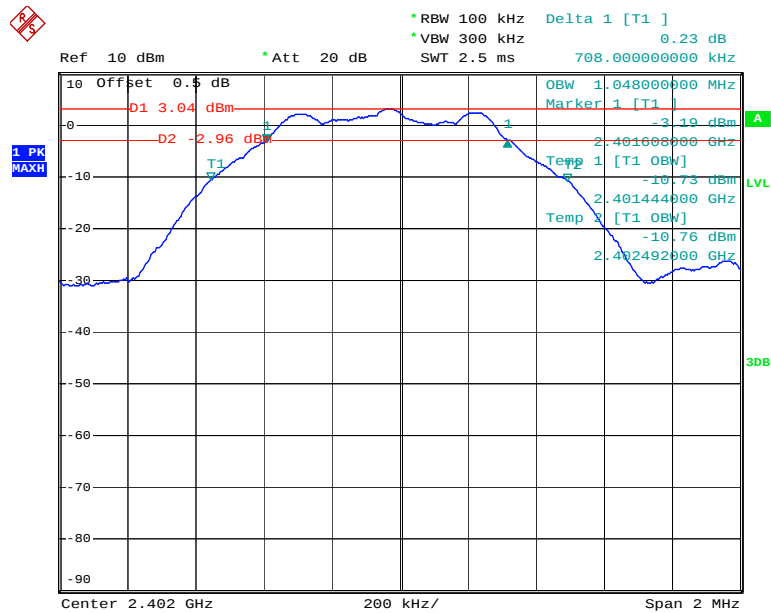
* The testing was performed by Allen Qiao on 2015-07-13.

Test Mode: Transmitting

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

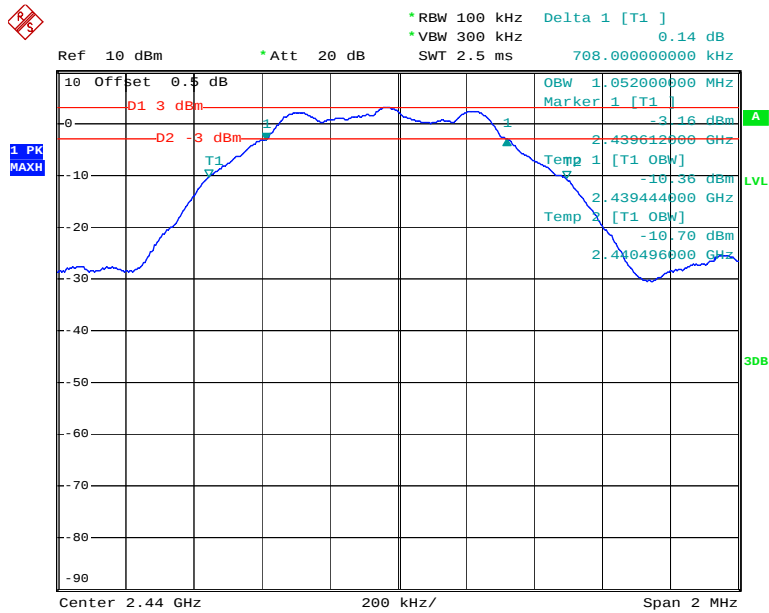
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	0.708	≥ 0.5
	Middle	2440	0.708	≥ 0.5
	High	2480	0.72	≥ 0.5

BLE Low Channel



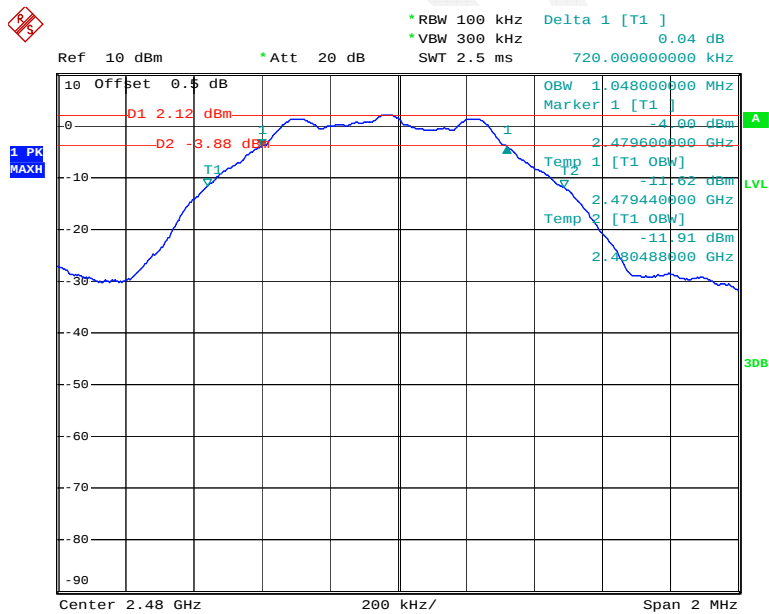
Date: 13.JUL.2015 10:42:35

BLE Middle Channel



Date: 13.JUL.2015 10:41:33

BLE High Channel



Date: 13.JUL.2015 10:40:40

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 v03r03

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	2015-05-09	2016-05-09

* **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:	25.8 °C
Relative Humidity:	53 %
ATM Pressure:	99.7 kPa

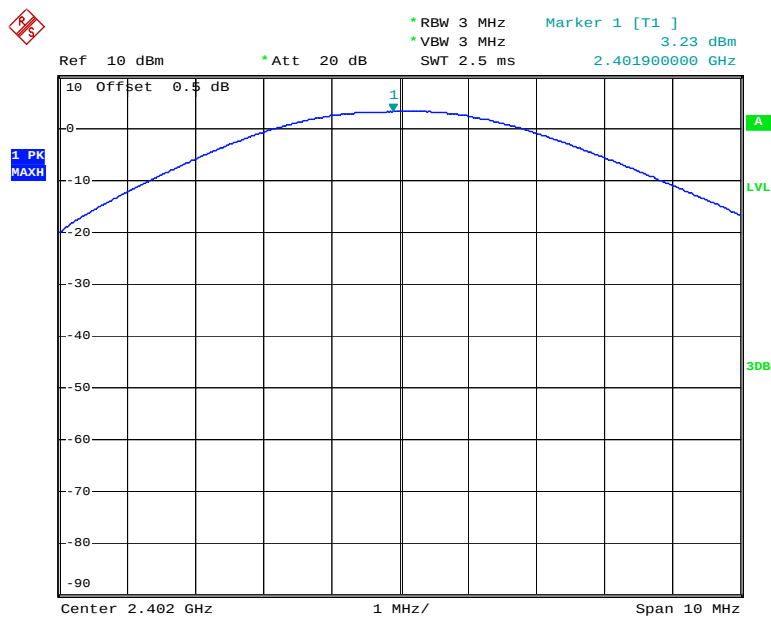
* The testing was performed by Allen Qiao on 2015-07-13.

Test Mode: Transmitting (BLE)

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

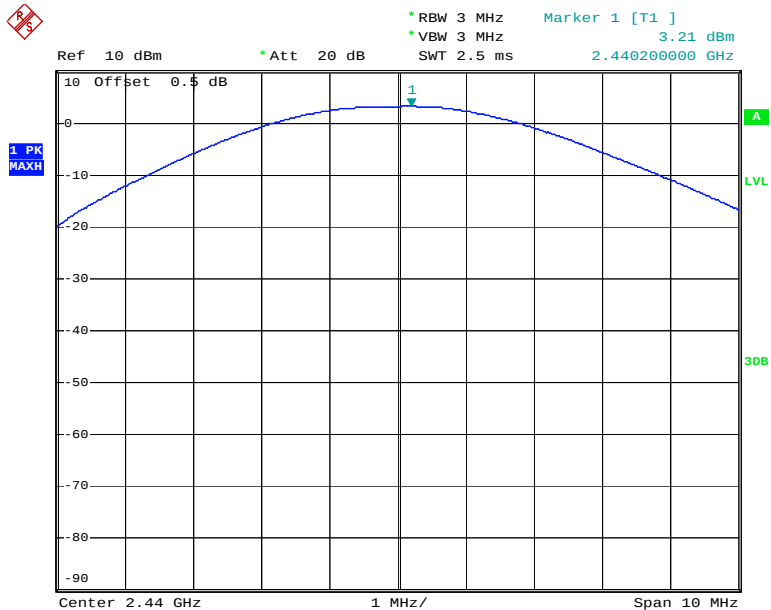
Test mode	Channel	Frequency	Max Peak Conducted Output Power	Limit	Result
		(MHz)	(dBm)	(dBm)	
BLE	Low	2402	3.23	30	PASS
	Middle	2440	3.21	30	PASS
	High	2480	2.27	30	PASS

BLE Low Channel



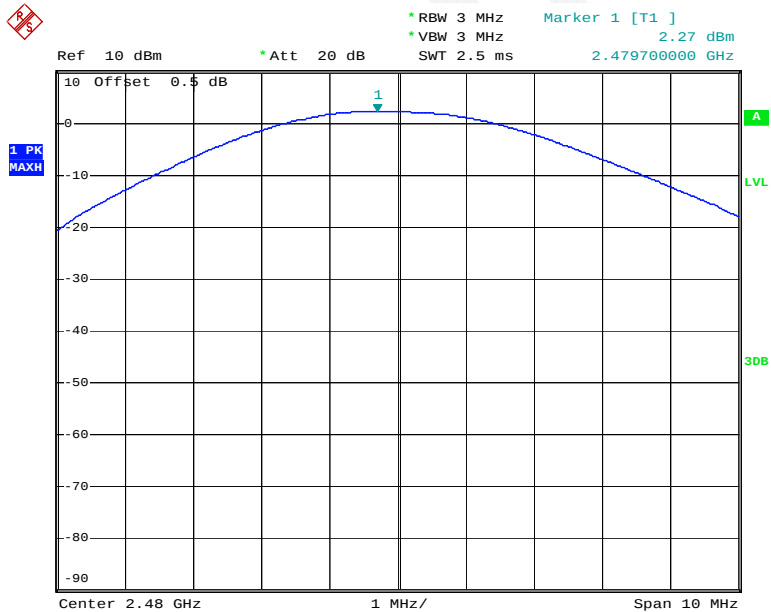
Date: 13.JUL.2015 10:38:11

BLE Middle Channel



Date: 13.JUL.2015 10:38:39

BLE High Channel



Date: 13.JUL.2015 10:39:08

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	2015-05-09	2016-05-09

* **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

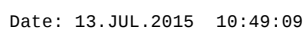
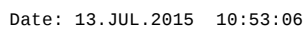
Environmental Conditions

Temperature:	25.8 °C
Relative Humidity:	51 %
ATM Pressure:	99.7 kPa

* The testing was performed by Allen Qiao on 2015-07-13.

Test mode: Transmitting

BLE Band Edge , Left Side



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 v03r03

- 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	2015-05-09	2016-05-09

* **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:	25.8 °C
Relative Humidity:	51 %
ATM Pressure:	99.7 kPa

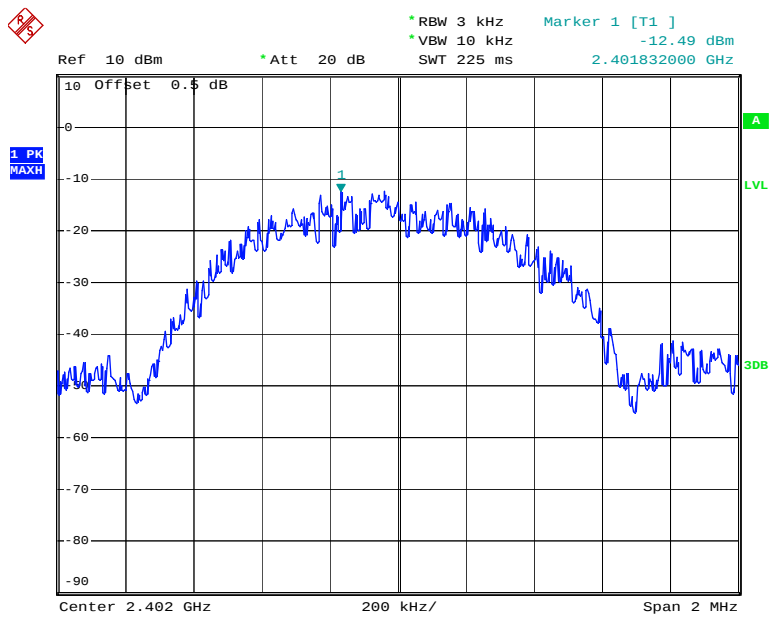
* The testing was performed by Allen Qiao on 2015-07-13.

Test Mode: Transmitting

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

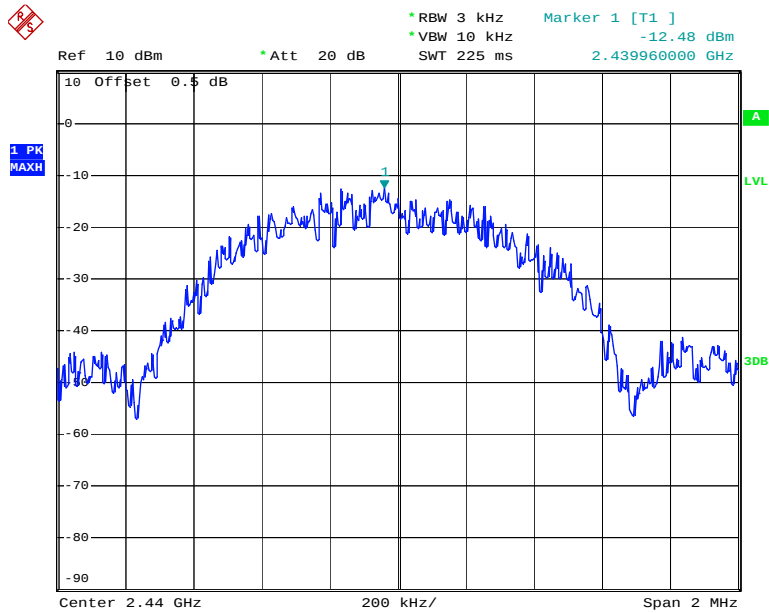
Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402	-12.49	≤ 8
	Middle	2440	-12.48	≤ 8
	High	2480	-13.39	≤ 8

Power Spectral Density, BLE Low Channel



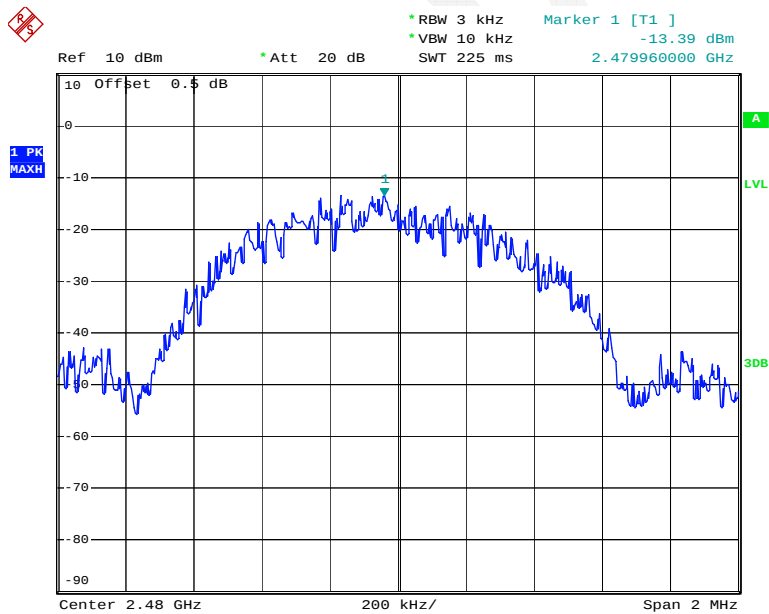
Date: 13.JUL.2015 10:43:27

Power Spectral Density, BLE Middle Channel



Date: 13.JUL.2015 10:43:52

Power Spectral Density, BLE High Channel



Date: 13.JUL.2015 10:44:43

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