

FCC PART 15.247

TEST REPORT

For

NXP Semiconductors

6501 West William Cannon Dr Mail Drop OE-48 Austin Texas United States

FCC ID: XXMUSBKW41Z

Report Type: Original Report	Product Type: USB-KW41Z Packet Sniffer USB Dongle
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The NXP Semiconductors' s product, model number: USB-KW41Z(FCC ID: XXMUSBKW41Z), the EUT in this report was a USB-KW41Z Packet Sniffer USB Dongle, which was measured approximately: 79mm(L) x 23mm(W) x 14.7mm(H), rated input voltage: DC 5.0V.

** All measurement and test data in this report was gathered from production sample serial number: 20160713001*

(Assigned by BAACL, Kunshan). The EUT was received on 2016-07-13.

Objective

This report is prepared on behalf of NXP Semiconductors in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

FCC Part 15B JBP submissions with FCC ID: XXMUSBKW41Z.

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 and FCC KDB558074 D01 DTS Meas Guidance v03r05.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with RF radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the Chenghu Lake Road, Kunshan Development Zone No.248, Kunshan, Jiangsu, China

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication 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 November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. 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

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.

For Zigbee mode, 3 channels are provided for testing:

Low Channel: 2405MHz, Middle Channel: 2445MHz, High Channel: 2480 MHz

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

RF Test

The worst case was performed under:
Power level 4

Support Equipment List and Details

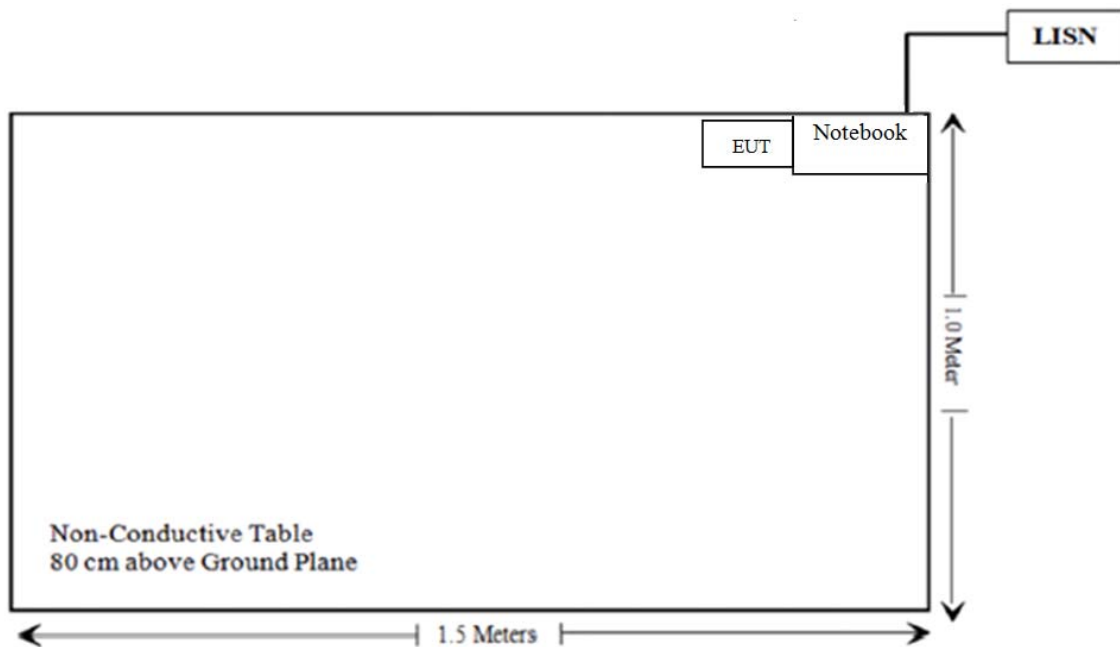
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152

External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	To
N/A	N/A	N/A	N/A	N/A

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§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 ≤ 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

BLE Mode:

The maximum conducted peak output power = 4.5dBm (2.82mW) at 2402~2480MHz
 $[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 2.82/5 * (\sqrt{2.480}) = 0.888 < 3.0$

Zigbee Mode:

The maximum conducted peak output power = 4.5dBm (2.82mW) at 2402~2480MHz
 $[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 2.82/5 * (\sqrt{2.480}) = 0.888 < 3.0$

Note: BLE Mode: The target power : 4 ± 0.5 dBm, which declared by the Manufacturer.

Note: Zigbee Mode: The target power : 4 ± 0.5 dBm, which declared by the Manufacturer.

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.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has a PCB antenna for Bluetooth LE and Zigbee, which the antenna gain is 2.58dBi, 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

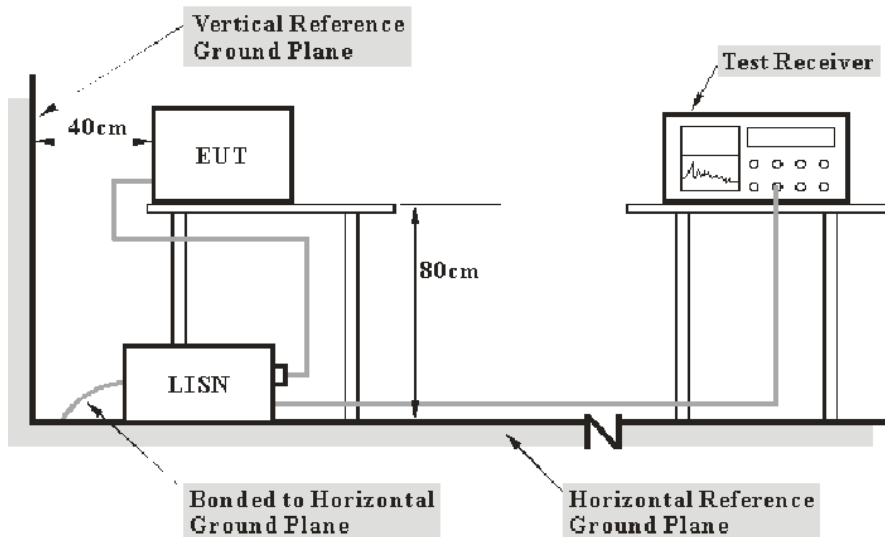
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements may be receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Kunshan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

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 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 outlet of the 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	934115/007	2015-11-12	2016-11-11
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2015-11-12	2016-11-11
Rohde & Schwarz	LISN	ESH3-Z5	892239/018	2016-06-23	2017-06-22
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-19	2017-06-18
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2015-10-01	2016-10-01
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	--	--

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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

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

Test Results Summary

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

13.88 dB at 0.155 MHz in the **Line** conducted mode for BLE

13.33 dB at 0.155 MHz in the **Line** conducted mode for Zigbee

Refer to CISPR16-4-2 and CISPR 16-4-1, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BAEL, $U_{(L_m)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

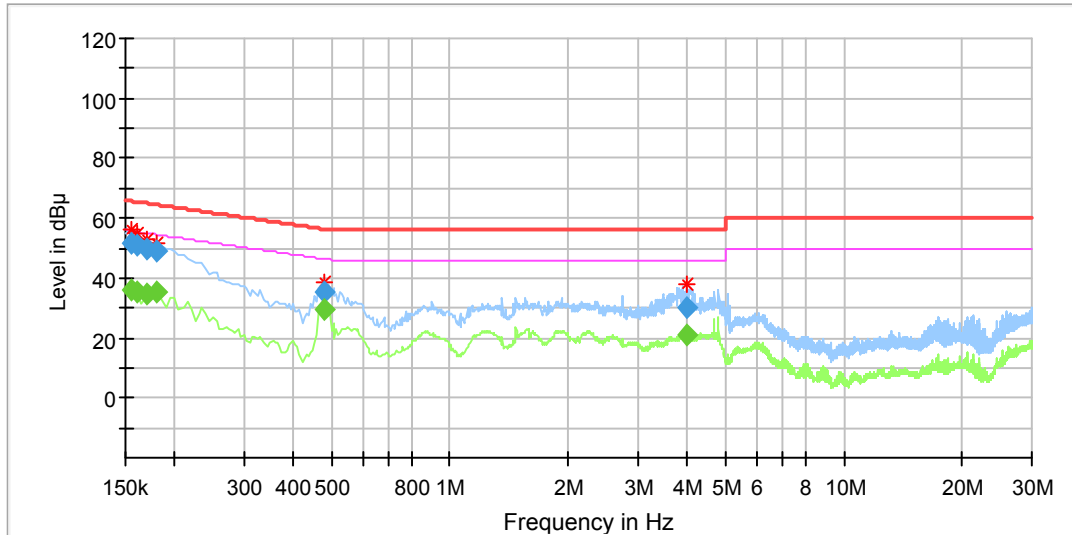
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-07-22.

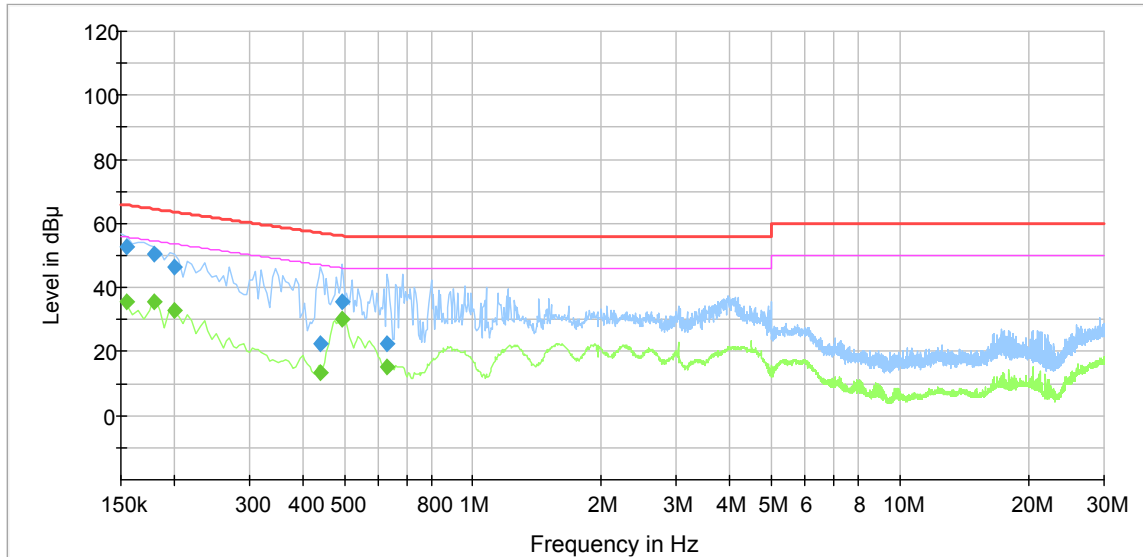
EUT operation mode: Transmitting

**BLE Mode:
AC 120V/60 Hz, Line**



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.155000	---	35.86	9	L1	10.3	19.87	55.73	Compliance
0.155000	51.85	---	9	L1	10.3	13.88	65.73	Compliance
0.160000	---	35.06	9	L1	10.3	20.40	55.46	Compliance
0.160000	50.81	---	9	L1	10.3	14.65	65.46	Compliance
0.170000	---	34.62	9	L1	10.3	20.34	54.96	Compliance
0.170000	49.39	---	9	L1	10.3	15.57	64.96	Compliance
0.180000	---	35.34	9	L1	10.3	19.15	54.49	Compliance
0.180000	48.93	---	9	L1	10.3	15.56	64.49	Compliance
0.480000	---	29.79	9	L1	10.3	16.55	46.34	Compliance
0.480000	35.13	---	9	L1	10.3	21.21	56.34	Compliance
3.975000	---	21.03	9	L1	10.5	24.97	46.00	Compliance
3.975000	30.42	---	9	L1	10.5	25.58	56.00	Compliance

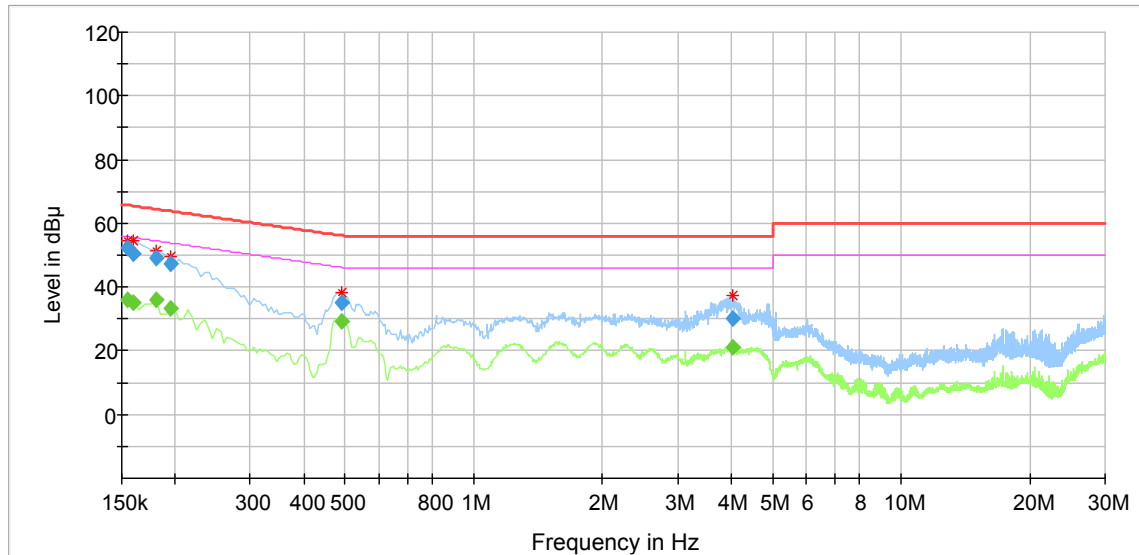
AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.155000	---	35.69	9	N	10.3	20.04	55.73	Compliance
0.155000	52.85	---	9	N	10.3	12.88	65.73	Compliance
0.180000	---	35.63	9	N	10.3	18.86	54.49	Compliance
0.180000	50.30	---	9	N	10.3	14.19	64.49	Compliance
0.200000	---	32.84	9	N	10.3	20.77	53.61	Compliance
0.200000	46.29	---	9	N	10.3	17.32	63.61	Compliance
0.440000	---	13.37	9	N	10.3	33.69	47.06	Compliance
0.440000	22.55	---	9	N	10.3	34.51	57.06	Compliance
0.495000	---	30.14	9	N	10.3	15.94	46.08	Compliance
0.495000	35.49	---	9	N	10.3	20.59	56.08	Compliance
0.630000	---	15.21	9	N	10.3	30.79	46.00	Compliance
0.630000	22.52	---	9	N	10.3	33.48	56.00	Compliance

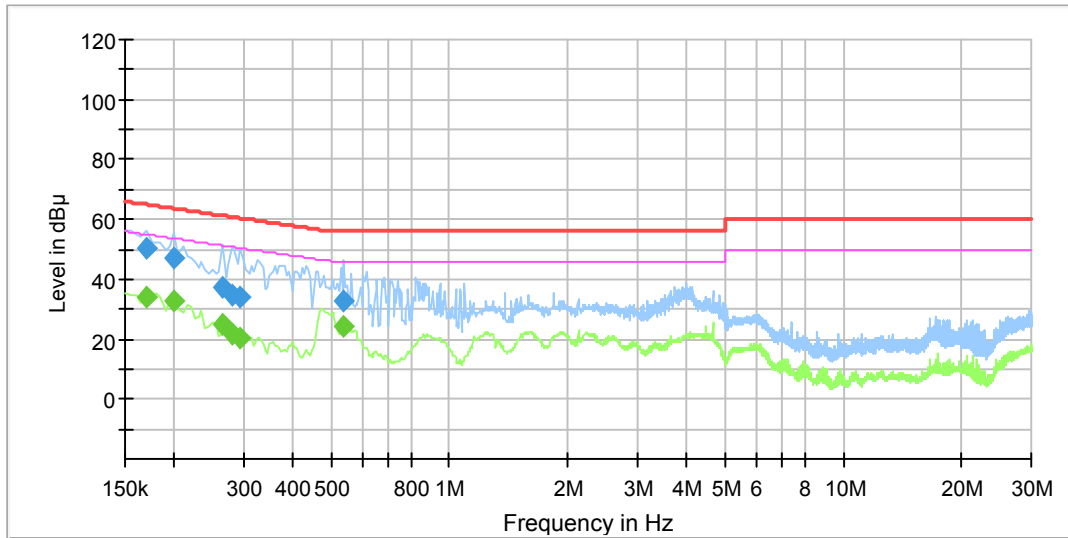
Zigbee Mode:

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.155000	---	35.78	9.000	L1	10.3	19.95	55.73	Compliance
0.155000	52.43	---	9.000	L1	10.3	13.30	65.73	Compliance
0.160000	---	35.06	9.000	L1	10.3	20.40	55.46	Compliance
0.160000	50.52	---	9.000	L1	10.3	14.94	65.46	Compliance
0.180000	---	36.18	9.000	L1	10.3	18.31	54.49	Compliance
0.180000	49.27	---	9.000	L1	10.3	15.22	64.49	Compliance
0.195000	---	33.48	9.000	L1	10.3	20.34	53.82	Compliance
0.195000	47.50	---	9.000	L1	10.3	16.32	63.82	Compliance
0.490000	---	29.07	9.000	L1	10.3	17.10	46.17	Compliance
0.490000	35.16	---	9.000	L1	10.3	21.01	56.17	Compliance
4.030000	---	20.91	9.000	L1	10.5	25.09	46.00	Compliance
4.030000	30.04	---	9.000	L1	10.5	25.96	56.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170000	---	34.34	9.000	N	10.3	20.62	54.96	Compliance
0.170000	50.46	---	9.000	N	10.3	14.50	64.96	Compliance
0.200000	---	32.63	9.000	N	10.3	20.98	53.61	Compliance
0.200000	47.06	---	9.000	N	10.3	16.55	63.61	Compliance
0.265000	---	25.20	9.000	N	10.3	26.07	51.27	Compliance
0.265000	37.45	---	9.000	N	10.3	23.82	61.27	Compliance
0.280000	---	21.36	9.000	N	10.3	29.46	50.82	Compliance
0.280000	34.90	---	9.000	N	10.3	25.92	60.82	Compliance
0.295000	---	20.07	9.000	N	10.3	30.31	50.38	Compliance
0.295000	33.76	---	9.000	N	10.3	26.62	60.38	Compliance
0.540000	---	24.03	9.000	N	10.3	21.97	46.00	Compliance
0.540000	32.88	---	9.000	N	10.3	23.12	56.00	Compliance

- Note:**
- 1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
 - 2) Corrected Amplitude = Reading + Corr.
 - 3) Margin = Limit –Corrected Amplitude

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

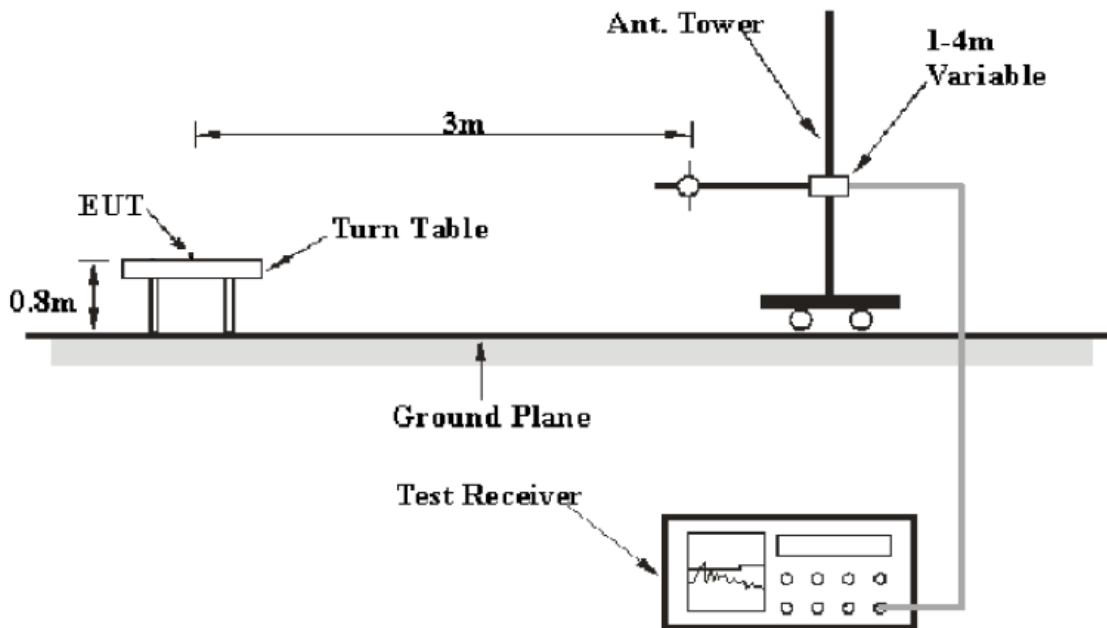
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

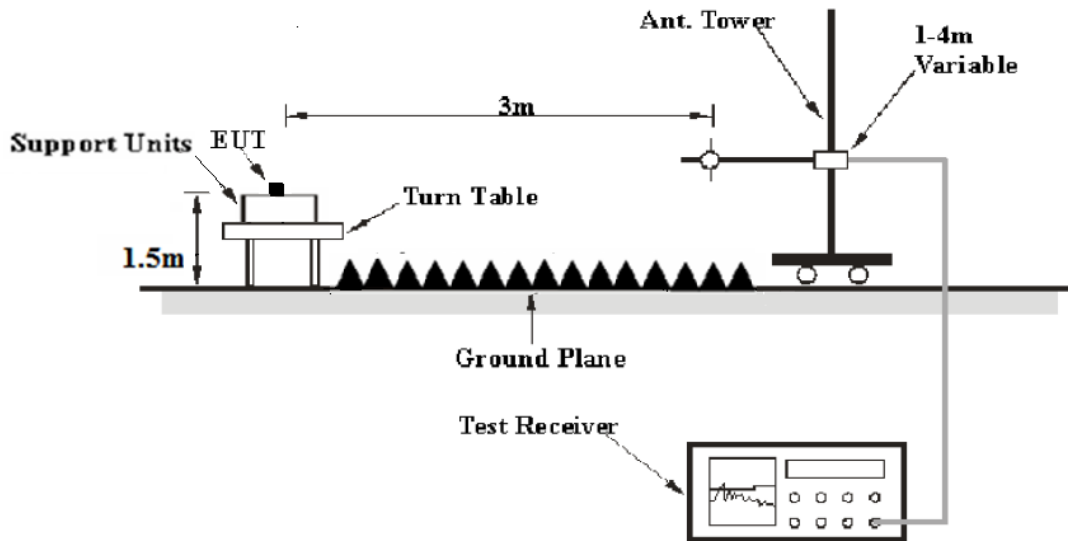
Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement at antenna port. And the uncertainty will not be taken into consideration for the test data recorded in the report

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters 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 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	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	1 Hz	/	Ave.

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrument	Amplifier	330	171377	2015-09-16	2016-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2015-11-12	2016-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2015-11-07	2016-11-06
ETS	Horn Antenna	3115	6229	2015-11-07	2016-11-06
EMCO	Horn Antenna	3116	9510-2384	2015-11-07	2016-11-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11
Mini	Pre-amplifier	ZVA-183-S+	857001418	2015-09-16	2016-09-16
DUCOMMUN	Pre-amplifier	ALN-22093530-01	990147	2015-09-16	2016-09-16
champrotek	Chamber	Chamber A	1#	2015-09-17	2016-09-17
R&S	Auto test Software	EMC32	V 09.10.0	-	-
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-010	KS-LAB-010	2015-12-16	2016-12-15

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

Corrected Amplitude & Margin Calculation

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

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

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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

5.67 dB at 675.050000 MHz in the **Horizontal** polarization For BLE Mode

7.54 dB at 2483.5 MHz in the **Horizontal** polarization For Zigbee Mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL, $U_{(L_m)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

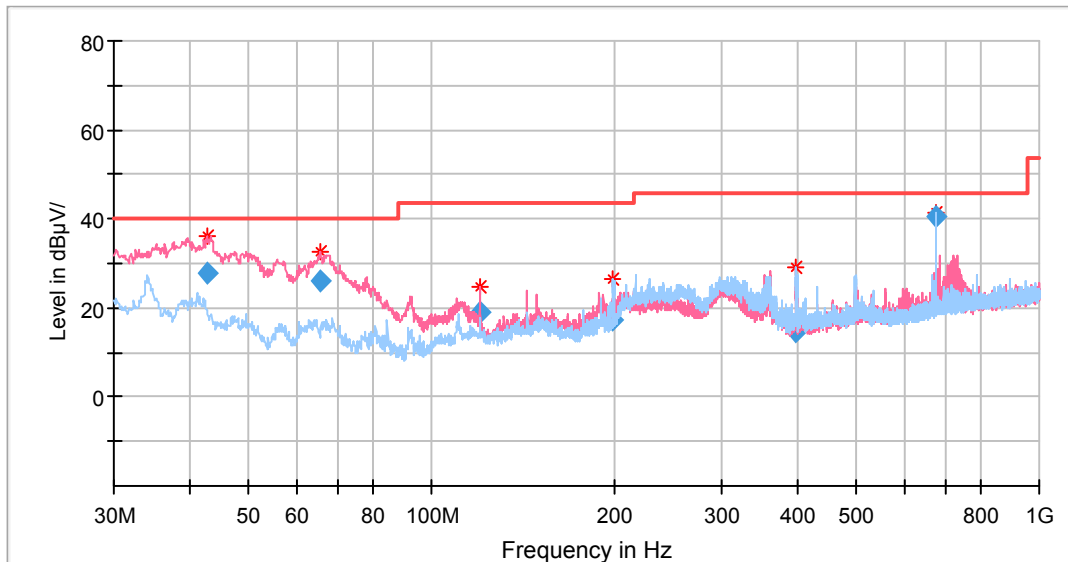
Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-08-01.

EUT operation mode: Transmitting

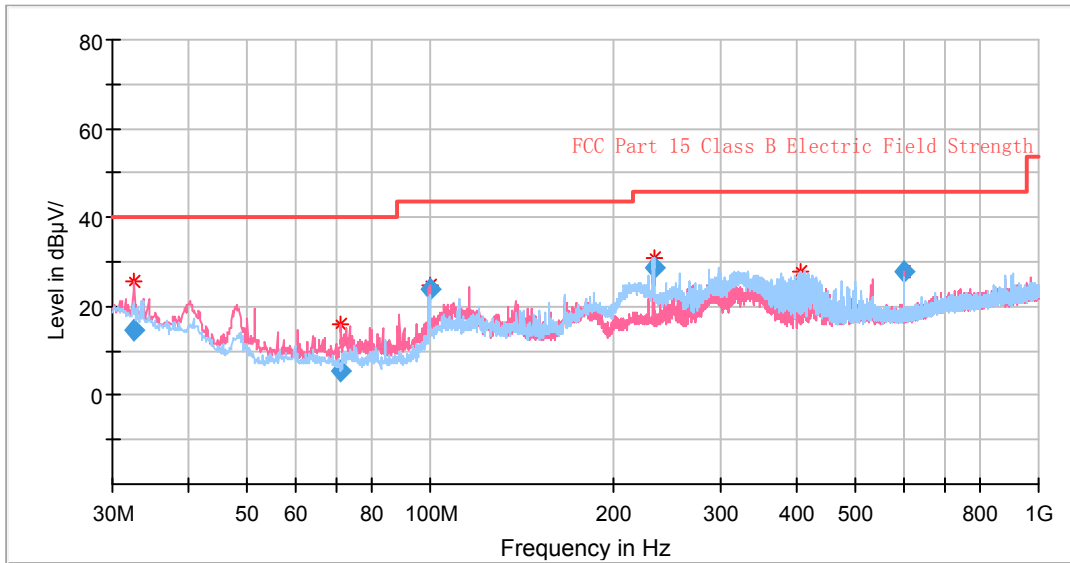
30 MHz-1 GHz:

BLE Model:



Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µ V/m)	Margin (dB)
42.610000	39.75	QP	180.0	101.0	V	-12.0	27.75	40.00	12.25
65.526250	42.88	QP	171.0	101.0	V	-17.0	25.88	40.00	14.12
119.967500	30.58	QP	291.0	101.0	V	-11.7	18.88	43.50	24.62
199.143750	29.62	QP	258.0	101.0	H	-12.5	17.12	43.50	26.38
398.357500	23.32	QP	258.0	101.0	H	-8.5	14.82	46.00	31.18
675.050000	43.53	QP	208.0	199.0	H	-3.2	40.33	46.00	5.67

Zigbee Model:



Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µ V/m)	Margin (dB)
32.546250	21.35	QP	197.0	101.0	V	-6.6	14.75	40.00	25.25
71.346250	22.73	QP	65.0	101.0	V	-17.1	5.63	40.00	34.37
99.597500	37.67	QP	52.0	101.0	V	-13.9	23.77	43.50	19.73
233.215000	40.85	QP	276.0	101.0	H	-12.2	28.65	46.00	17.35
405.026250	33.27	QP	253.0	101.0	H	-8.4	24.87	46.00	21.13
599.996250	33.21	QP	216.0	101.0	V	-5.2	28.01	46.00	17.99

1GHz-25GHz

EUT operation mode: Transmitting

BLE Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µV/m)	Margin (dB)
Low Channel (2402 MHz)									
2402	96.89	PK	33.0	150.0	V	3.0	99.89	/	/
2402	89.53	Ave	33.0	150.0	V	3.0	92.53	/	/
2402	94.16	PK	313.0	150.0	H	3.0	97.16	/	/
2402	87.06	Ave	313.0	150.0	H	3.0	90.06	/	/
2386	48.39	PK	315.0	150.0	H	4.9	53.29	74	20.71
2386	21.25	Ave	315.0	150.0	H	4.9	26.15	54	27.85
2390	42.77	PK	34.0	150.0	V	4.9	47.67	74	26.33
2390	20.85	Ave	34.0	150.0	V	4.9	25.75	54	28.25
4804	36.03	PK	327.0	150.0	H	13.7	49.73	74	24.27
4804	19.13	Ave	327.0	150.0	H	13.7	32.83	54	21.17
6990	21.63	Ave	130.0	200.0	H	19.0	40.63	54	13.37
6990	34.62	PK	130.0	200.0	H	19.0	53.62	74	20.38
7206	17.33	Ave	252.0	150.0	V	19.7	37.03	54	16.97
7206	31.05	PK	252.0	150.0	V	19.7	50.75	74	23.25
Middle Channel (2440MHz)									
2440	95.76	PK	124.0	150.0	V	2.6	98.36	/	/
2440	88.83	Ave	124.0	150.0	V	2.6	91.43	/	/
2440	93.43	PK	244.0	150.0	H	2.6	96.03	/	/
2440	88.94	Ave	244.0	150.0	H	2.6	91.54	/	/
3062	34.97	PK	37.0	200.0	V	7.0	41.97	74	32.03
3062	21.67	Ave	37.0	200.0	V	7.0	28.67	54	25.33
4880	35.27	PK	339.0	150.0	H	13.6	48.87	74	25.13
4880	19.54	Ave	339.0	150.0	H	13.6	33.14	54	20.86
5868	20.92	Ave	172.0	150.0	H	15.2	36.12	54	17.88
5868	34.16	PK	172.0	150.0	H	15.2	49.36	74	24.64
6625	35.34	PK	219.0	150.0	V	17.7	53.04	74	20.96
6625	22.39	Ave	219.0	150.0	V	17.7	40.09	54	13.91
7320	17.39	Ave	265.0	150.0	V	20.0	37.39	54	16.61
7320	32.01	PK	265.0	150.0	V	20.0	52.01	74	21.99

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µV/m)	Margin (dB)
High Channel (2480 MHz)									
2480	95.56	PK	31.0	150.0	V	3.2	98.76	/	/
2480	87.93	Ave	31.0	150.0	V	3.2	91.13	/	/
2480	94.43	PK	312.0	150.0	H	3.2	97.63	/	/
2480	88.12	Ave	312.0	150.0	H	3.2	91.32	/	/
2483.5	57.33	PK	110.0	150.0	V	5.0	62.33	74	11.67
2483.5	33.22	Ave	110.0	150.0	V	5.0	38.22	54	15.78
2492	20.88	Ave	296.0	150.0	H	5.0	25.88	54	28.12
2492	48.02	PK	296.0	150.0	H	5.0	53.02	74	20.98
4960	32.00	PK	328.0	150.0	H	14.1	46.10	74	27.90
4960	18.28	Ave	328.0	150.0	H	14.1	32.38	54	21.62
6990	34.47	PK	48.0	200.0	V	19.0	53.47	74	20.53
6990	21.63	Ave	48.0	200.0	V	19.0	40.63	54	13.37
7440	18.72	Ave	267.0	150.0	V	21.2	39.92	54	14.08
7440	31.96	PK	267.0	150.0	V	21.2	53.16	74	20.84

Zigbee Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µV/m)	Margin (dB)
Low Channel (2405MHz)									
2405	92.36	PK	239.0	150.0	V	4.9	97.26	/	/
2405	86.83	Ave	239.0	150.0	V	4.9	91.73	/	/
2405	91.26	PK	175.0	150.0	H	4.9	96.16	/	/
2405	85.62	Ave	175.0	150.0	H	4.9	90.52	/	/
2370	33.15	PK	228.0	150.0	V	4.9	38.05	74	35.95
2370	20.41	Ave	228.0	150.0	V	4.9	25.31	54	28.69
2390	34.58	PK	337.0	150.0	V	4.9	39.48	74	34.52
2390	20.85	Ave	337.0	150.0	V	4.9	25.75	54	28.25
4810	19.08	Ave	317.0	150.0	H	13.3	32.38	54	21.62
4810	32.38	PK	317.0	150.0	H	13.3	45.68	74	28.32
6625	22.39	Ave	27.0	150.0	V	17.7	40.09	54	13.91
6625	35.71	PK	27.0	150.0	V	17.7	53.41	74	20.59
7215	31.20	PK	32.0	250.0	H	19.7	50.90	74	23.10
7215	17.93	Ave	32.0	250.0	H	19.7	37.63	54	16.37

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µV/m)	Margin (dB)
Middle Channel (2445MHz)									
2445	95.01	PK	303.0	150.0	V	4.9	99.91	/	/
2445	88.72	Ave	303.0	150.0	V	4.9	93.62	/	/
2445	93.75	PK	127.0	150.0	H	4.9	98.65	/	/
2445	87.67	Ave	127.0	150.0	H	4.9	92.57	/	/
3062	21.29	Ave	20.0	250.0	V	7.0	28.29	54	25.71
3062	34.93	PK	20.0	250.0	V	7.0	41.93	74	32.07
4890	32.69	PK	102.0	150.0	V	13.6	46.29	74	27.71
4890	18.52	Ave	102.0	150.0	V	13.6	32.12	54	21.88
6653	35.57	PK	163.0	150.0	V	17.8	53.37	74	20.63
6653	22.39	Ave	163.0	150.0	V	17.8	40.19	54	13.81
6990	21.25	Ave	40.0	150.0	H	19.0	40.25	54	13.75
6990	34.86	PK	40.0	150.0	H	19.0	53.86	74	20.14
7335	31.41	PK	98.0	150.0	V	20.1	51.51	74	22.49
7335	17.33	Ave	98.0	150.0	V	20.1	37.43	54	16.57
High Channel (2480 MHz)									
2480	93.53	PK	64.0	150.0	V	5.0	98.53	/	/
2480	87.31	Ave	64.0	150.0	V	5.0	92.31	/	/
2480	91.12	PK	68.0	150.0	H	5.0	96.12	/	/
2480	85.04	Ave	68.0	150.0	H	5.0	90.04	/	/
2483.5	55.09	PK	120.0	150.0	H	5.0	60.09	74	13.91
2483.5	41.46	Ave	120.0	150.0	H	5.0	46.46	54	7.54
2520	33.10	PK	77.0	150.0	V	5.0	38.10	74	35.90
2520	23.37	Ave	77.0	150.0	V	5.0	28.37	54	25.63
4960	18.48	Ave	55.0	150.0	V	13.9	32.38	54	21.62
4960	32.19	PK	55.0	150.0	V	13.9	46.09	74	27.91
6990	34.32	PK	195.0	150.0	V	19.0	53.32	74	20.68
6990	21.25	Ave	195.0	150.0	V	19.0	40.25	54	13.75
7440	19.52	Ave	109.0	200.0	H	20.4	39.92	54	14.08
7440	32.47	PK	109.0	200.0	H	20.4	52.87	74	21.13

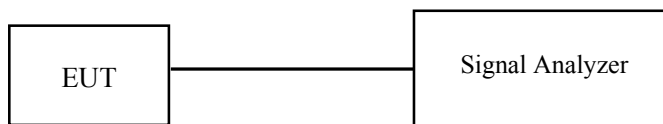
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	SIGNAL ANALYZER	FSV40	101116	2015-09-02	2016-09-02
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-08-10.

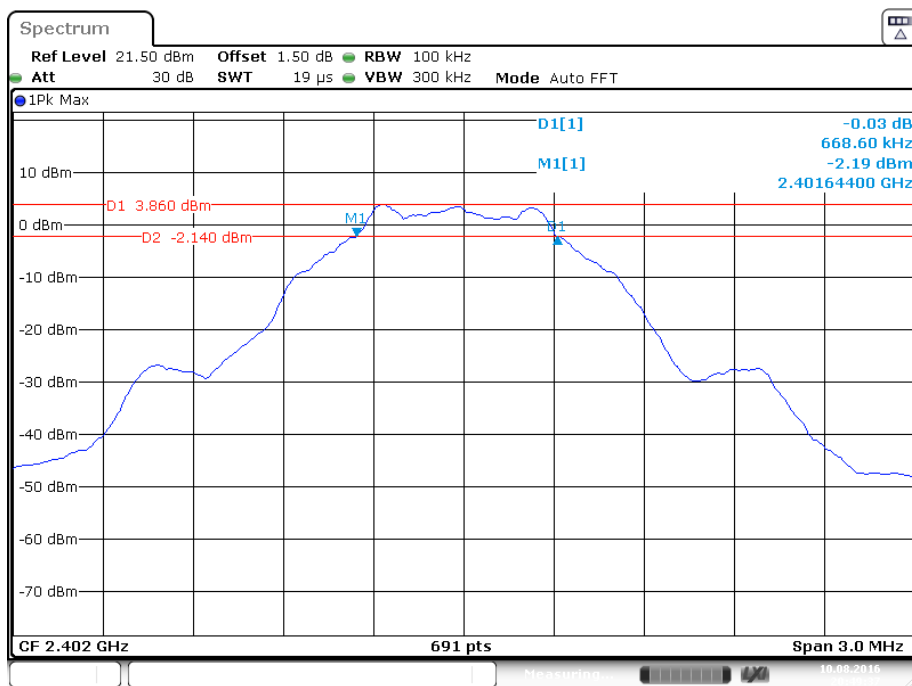
Test Result: Pass.

Please refer to the following tables and plots.

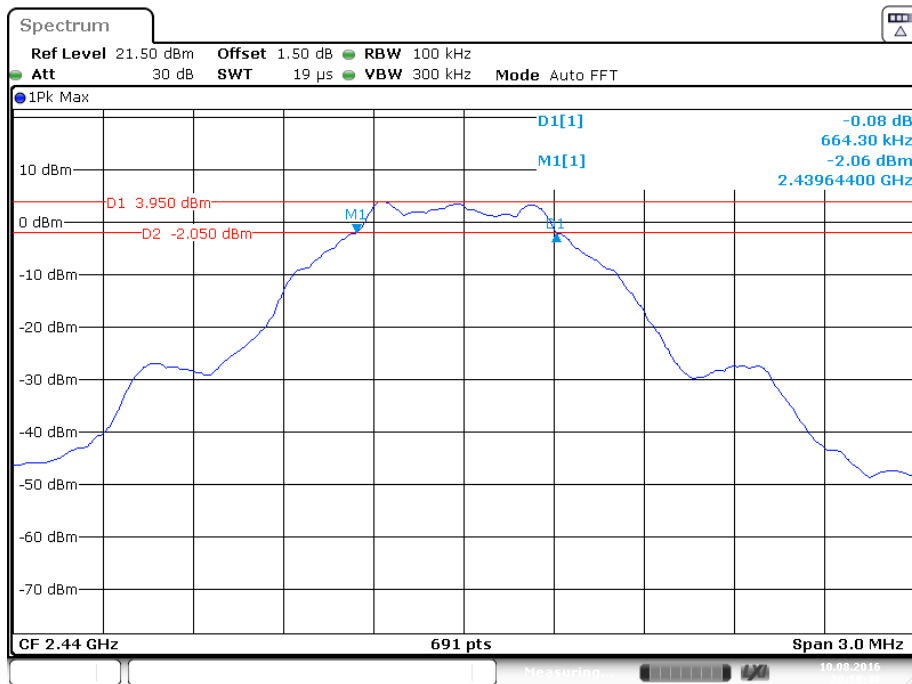
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
BLE Mode			
Low	2402	0.669	≥ 500
Middle	2440	0.664	≥ 500
High	2480	0.664	≥ 500
Zigbee Mode			
Low	2405	1.637	≥ 500
Middle	2445	1.637	≥ 500
High	2480	1.628	≥ 500

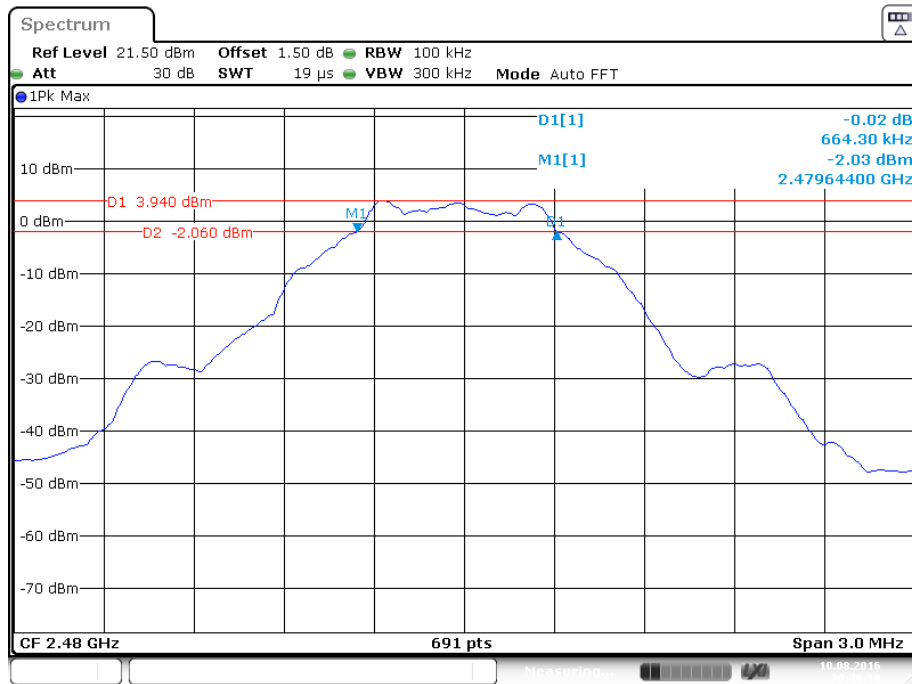
Low Channel for BLE Mode



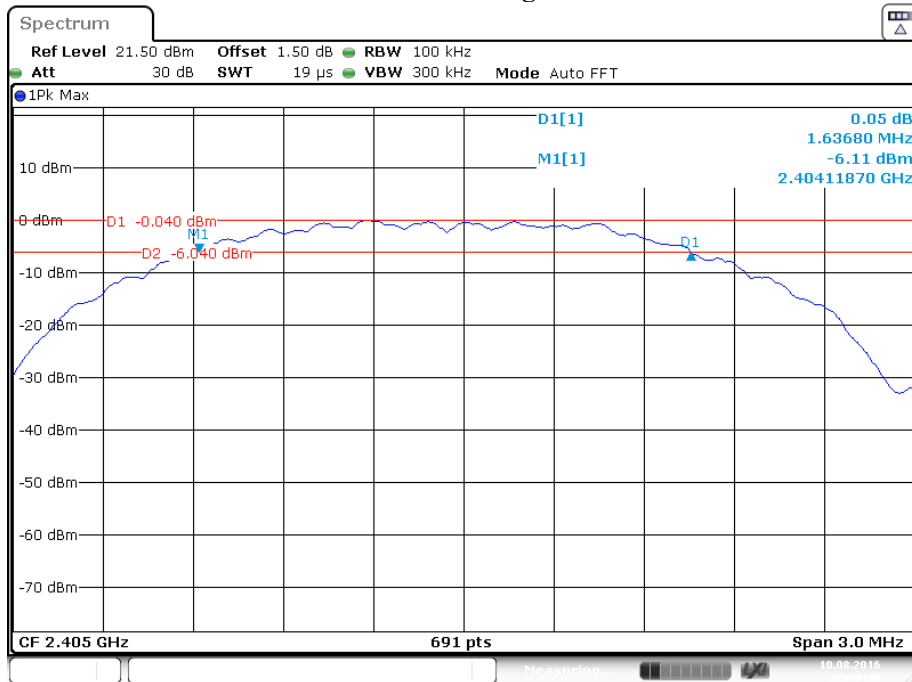
Middle Channel for BLE Mode



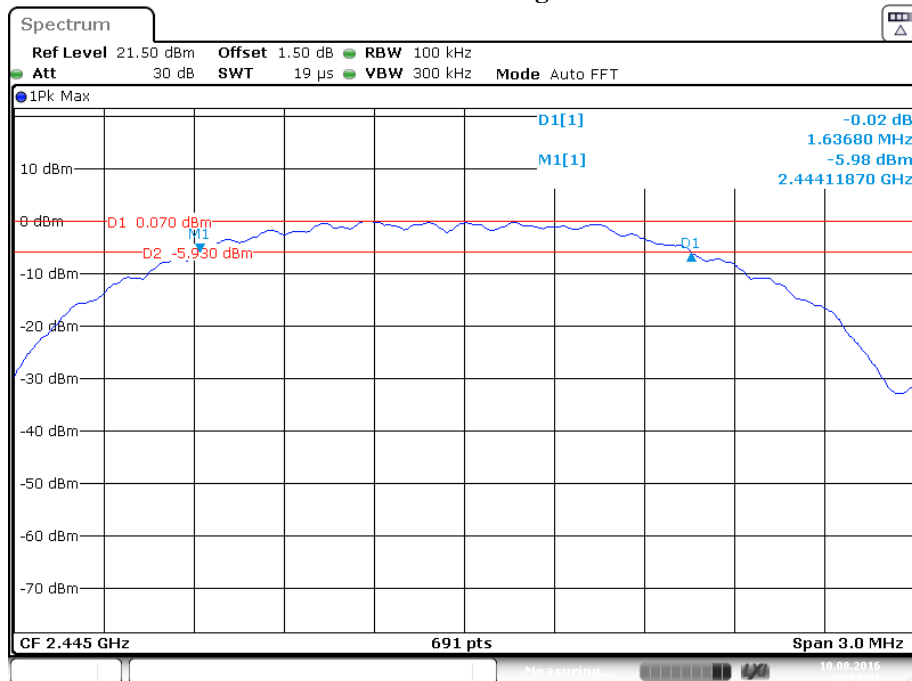
High Channel for BLE Mode



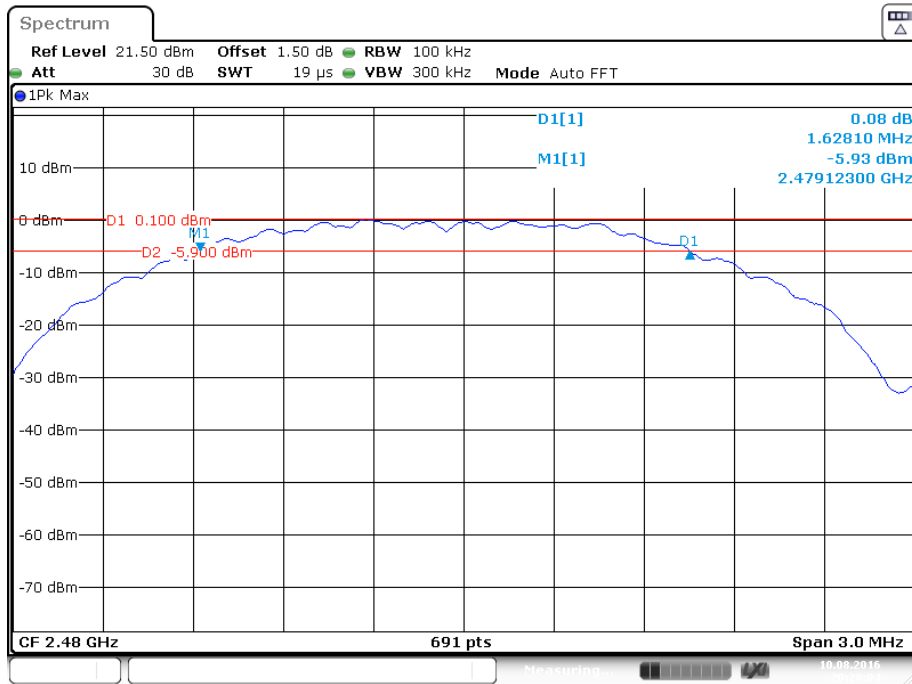
Low Channel for Zigbee Mode



Middle Channel for Zigbee Mode



High Channel for Zigbee Mode



Date: 10 AUG 2016 20:28:04

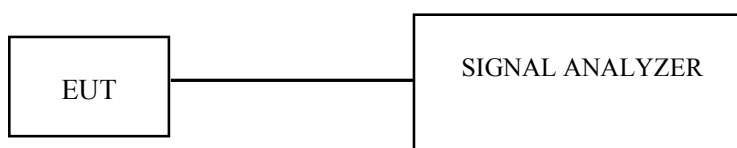
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 one 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
Rohde & Schwarz	SIGNAL ANALYZER	FSV40	101116	2015-09-02	2016-09-02
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

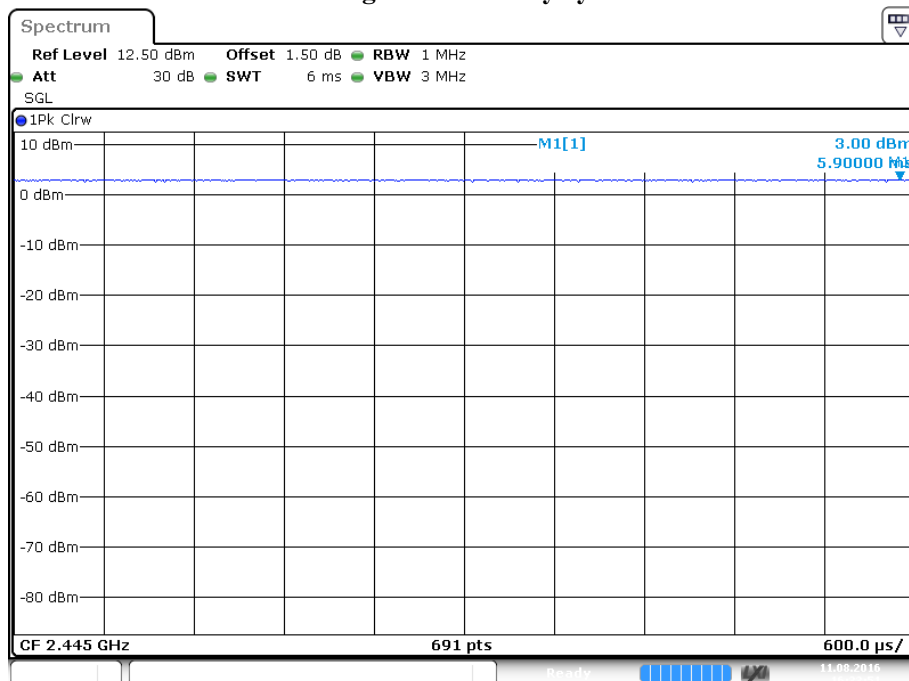
Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-08-10 to 2016-08-12 .

EUT operation mode: Transmitting

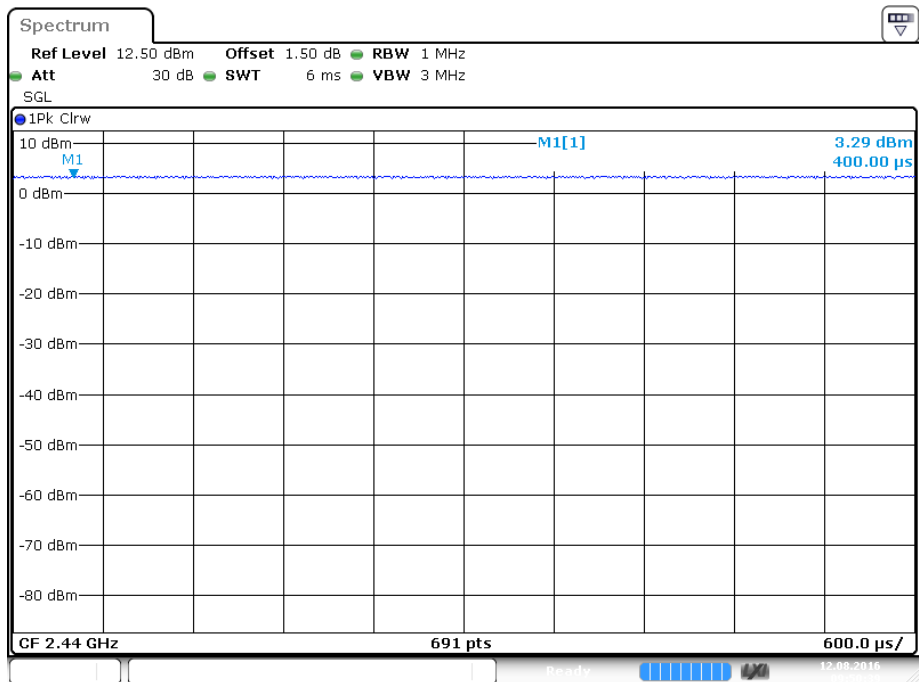
Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE Mode				
Low	2402	3.94	30	Pass
Middle	2440	4.02	30	Pass
High	2480	3.99	30	Pass
Zigbee Mode				
Low	2405	3.93	30	Pass
Middle	2445	4.00	30	Pass
High	2480	4.00	30	Pass

Zigbee Mode duty cycle



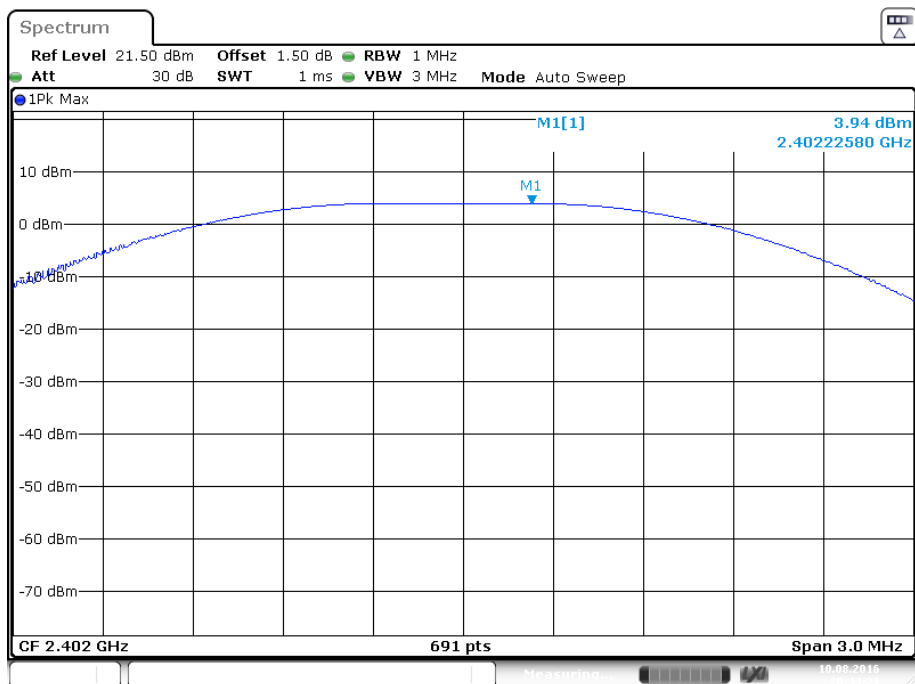
Date: 11 AUG 2016 16:33:51

BLE Mode duty cycle



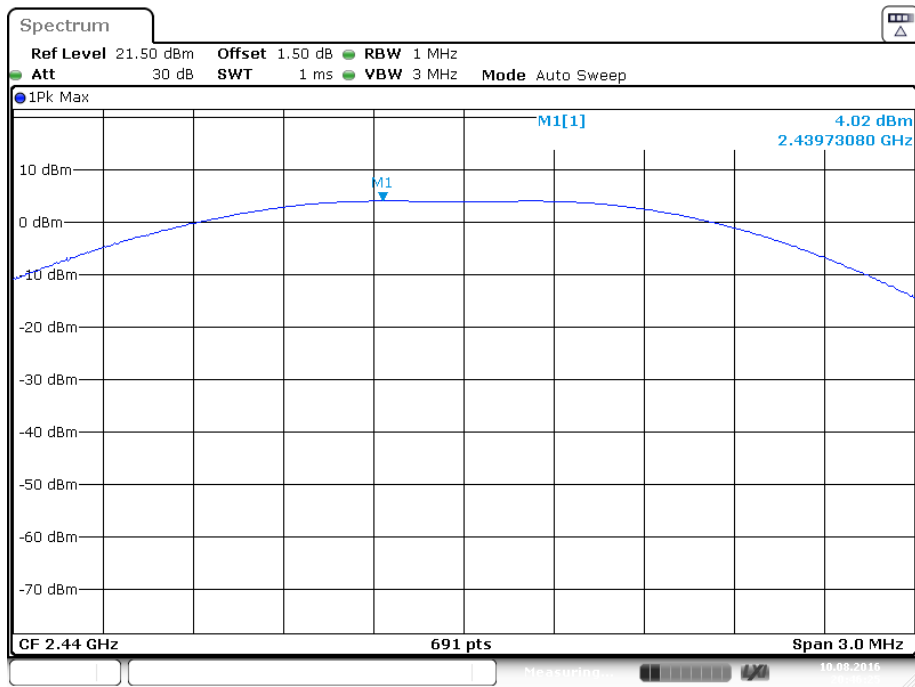
Date: 12 AUG 2016 09:50:39

Low Channel for BLE Mode

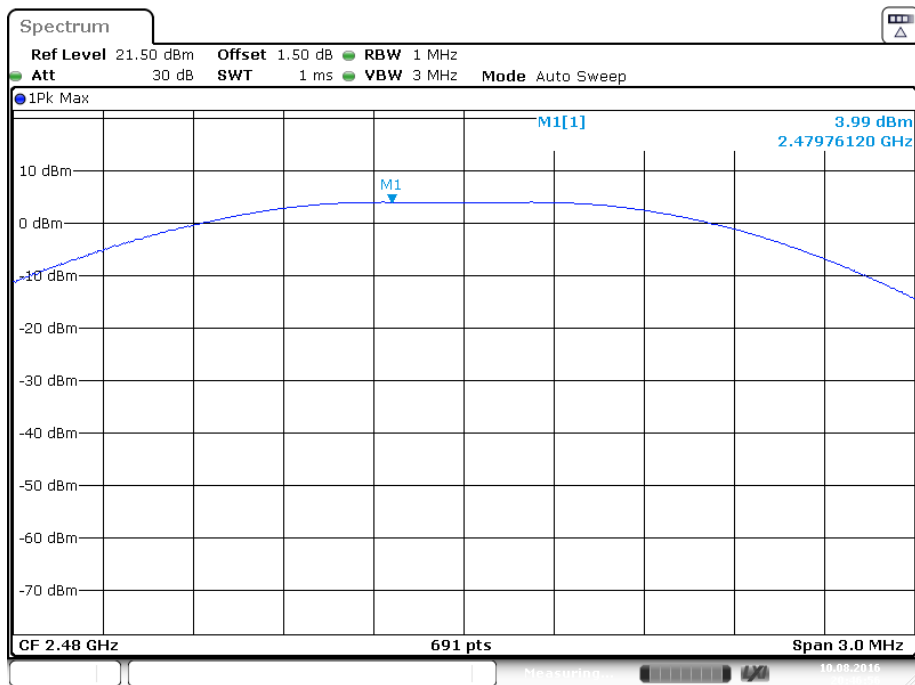


Date: 10 AUG 2016 20:44:21

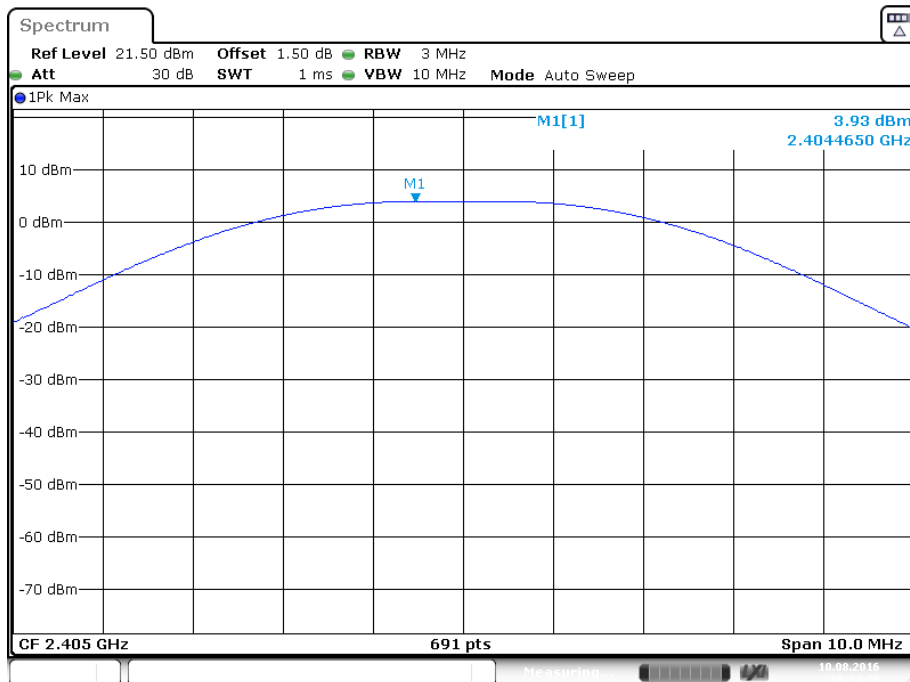
Middle Channel for BLE Mode



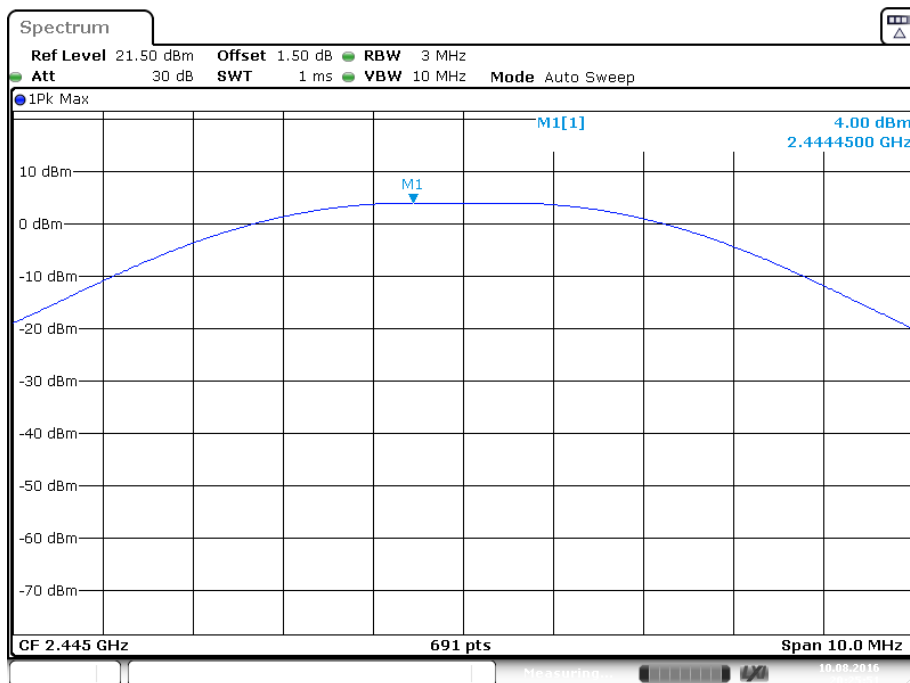
High Channel for BLE Mode



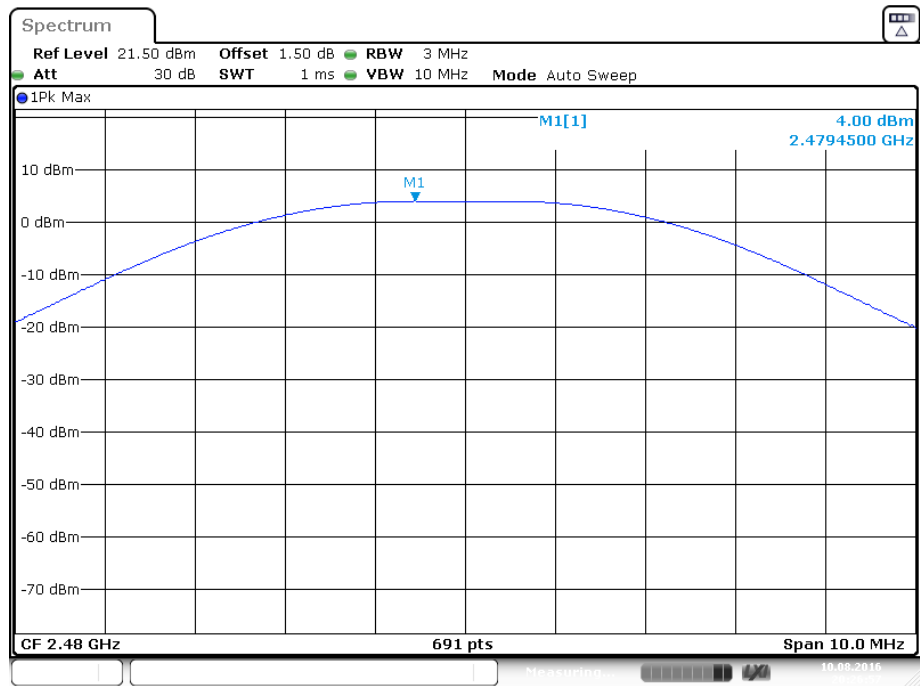
Low Channel for Zigbee Mode



Middle Channel for Zigbee Mode



High Channel for Zigbee Mode



Date: 10 AUG 2016 20:26:57

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
Rohde & Schwarz	SIGNAL ANALYZER	FSV40	101116	2015-09-02	2016-09-02
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

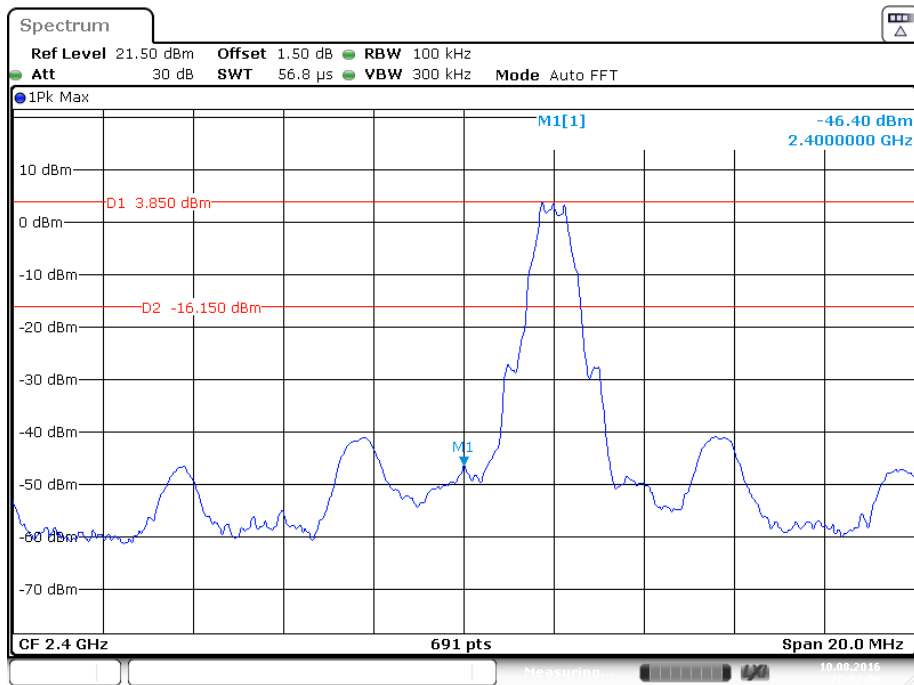
Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-08-10.

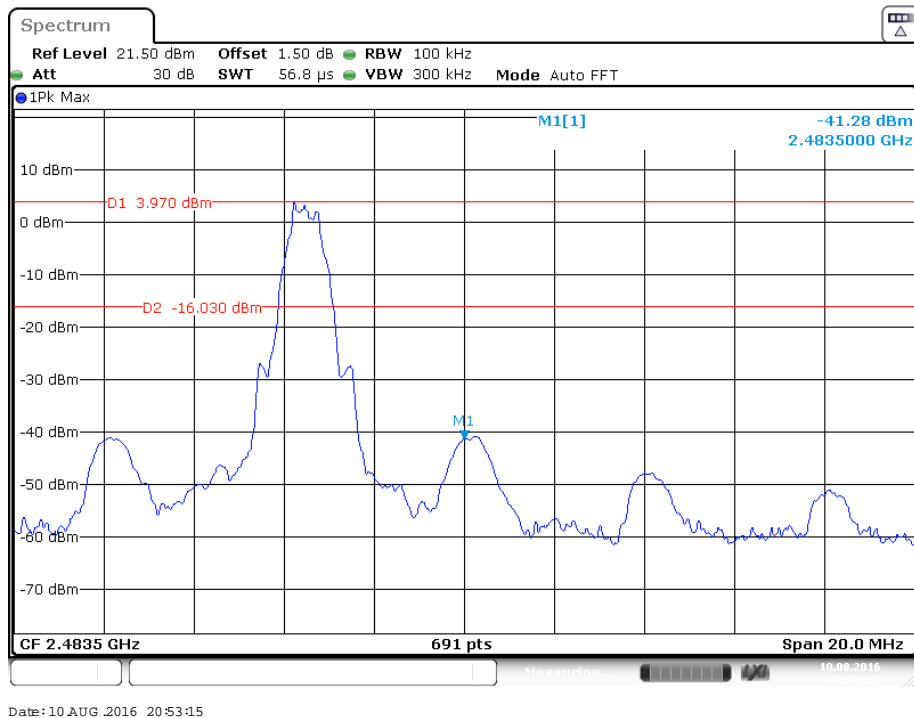
Test Result: *Compliance*

Please refer to the following table and plots.

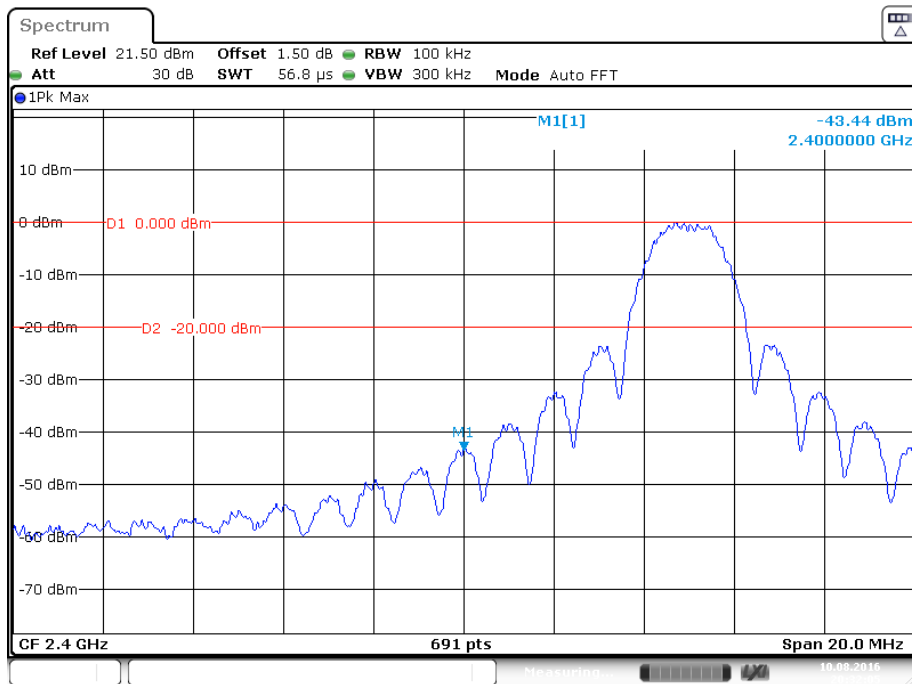
BLE Mode, Band Edge, Left Side



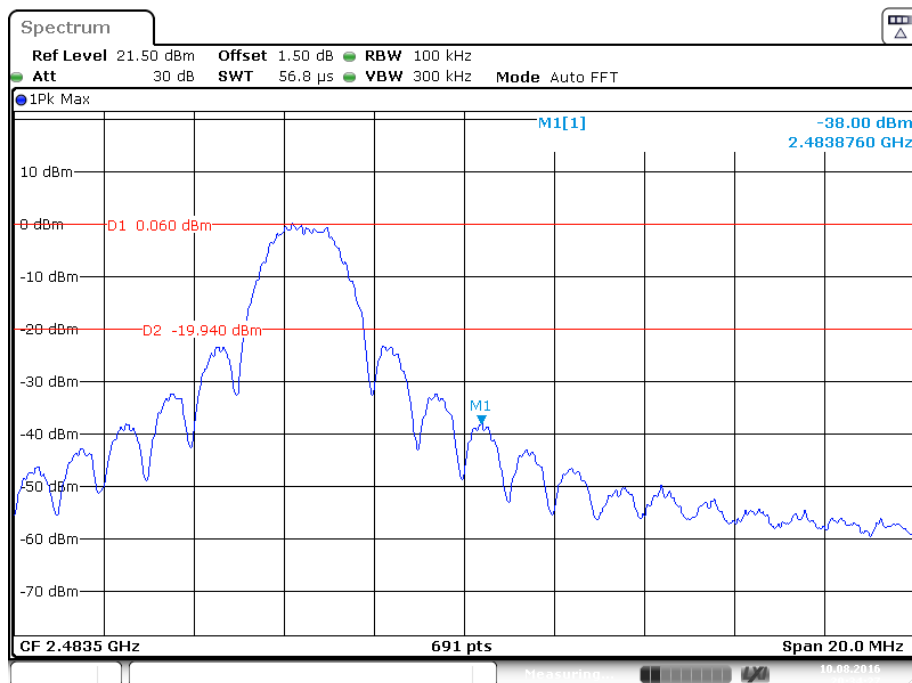
BLE Mode, Band Edge, Right Side



Zigbee Mode, Band Edge, Left Side



Zigbee Mode, Band Edge, Right 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 KDB558074 D01 DTS Meas Guidance v03r05 sub-clause 10.2

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. 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
Rohde & Schwarz	SIGNAL ANALYZER	FSV40	101116	2015-09-02	2016-09-02
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

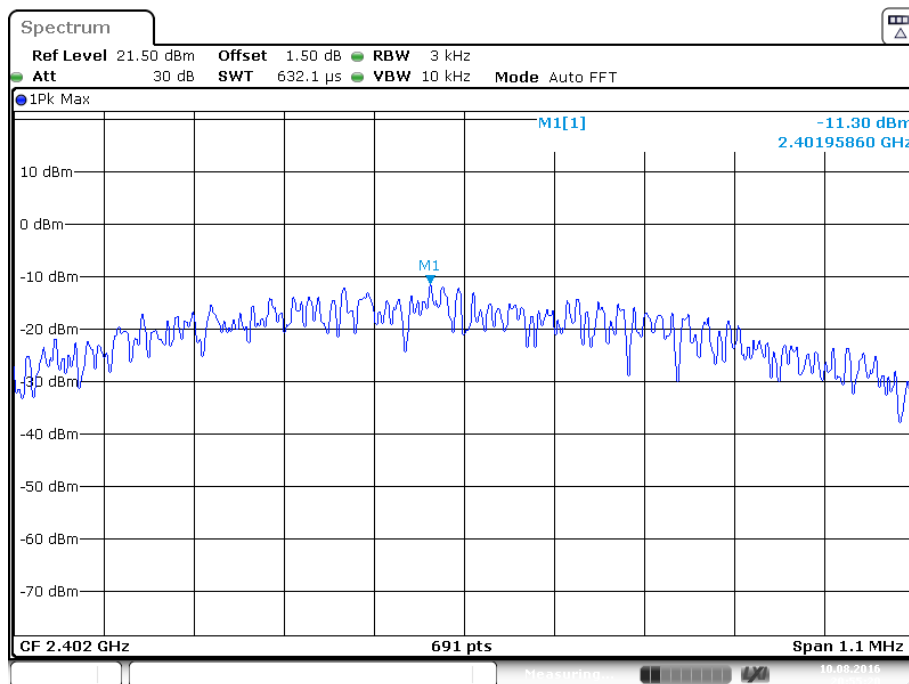
The testing was performed by Chris Wang on 2016-08-10.

EUT operation mode: Transmitting

Test Result: Pass

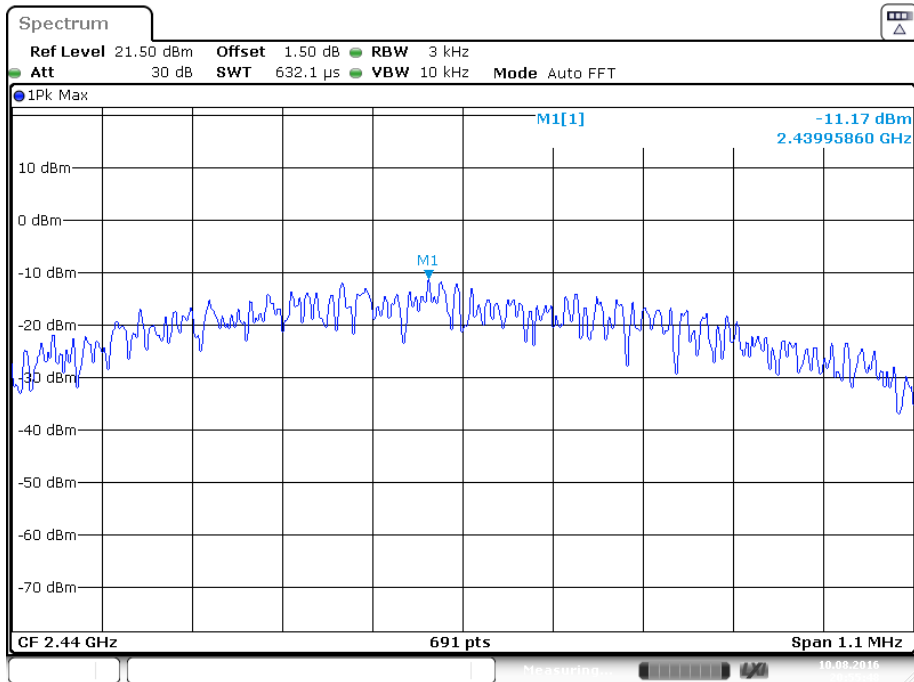
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE Mode			
Low	2402	-11.30	≤8
Middle	2440	-11.17	≤8
High	2480	-11.21	≤8
Zigbee Mode			
Low	2405	-11.83	≤8
Middle	2445	-11.79	≤8
High	2480	-11.81	≤8

Power Spectral Density, BLE Low Channel



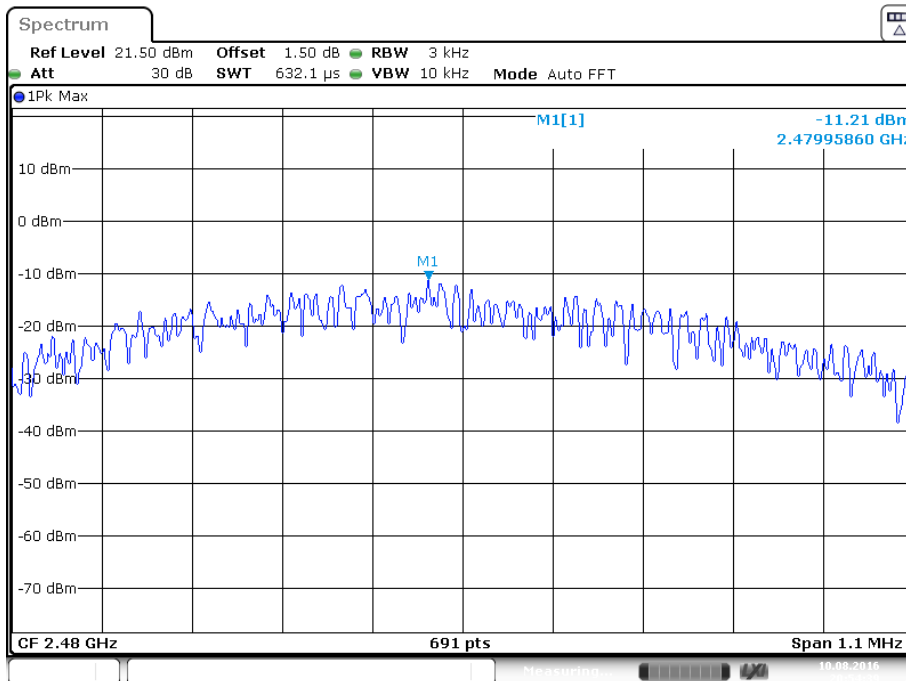
Date: 10 AUG 2016 20:55:21

Power Spectral Density, BLE Middle Channel



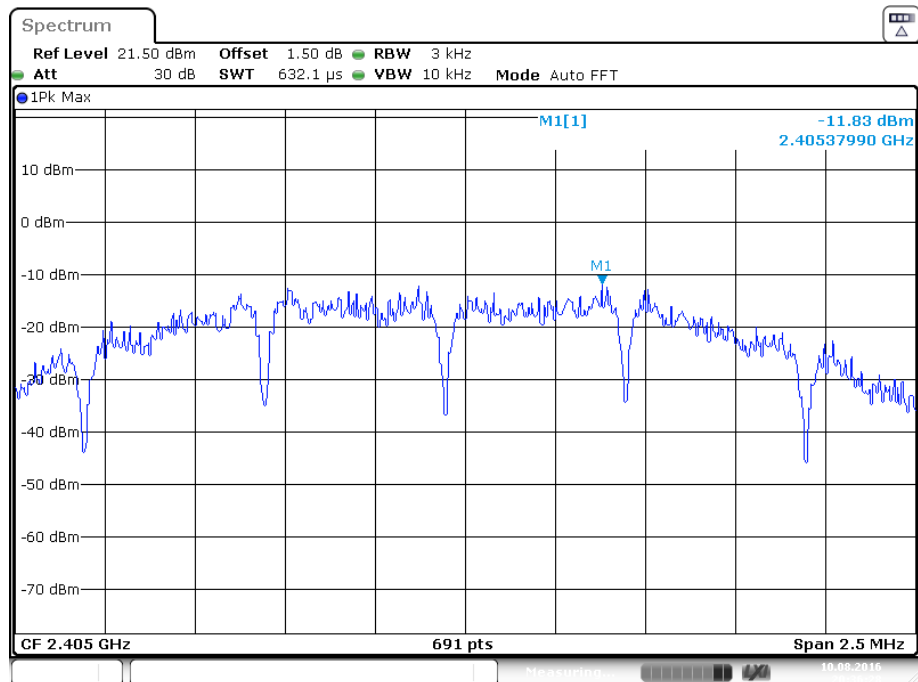
Date: 10 AUG 2016 20:55:48

Power Spectral Density, BLE High Channel



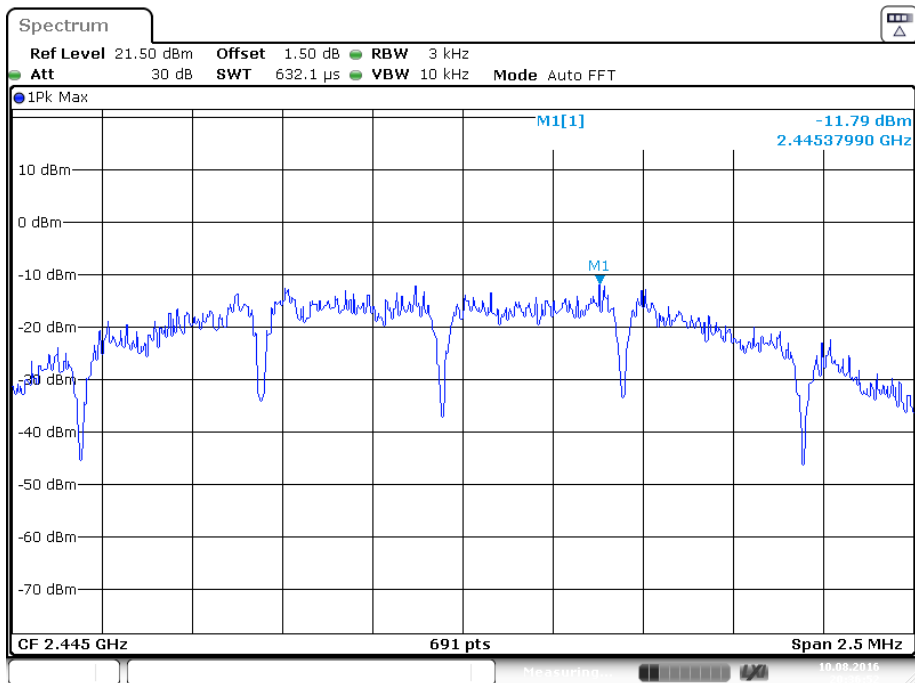
Date: 10 AUG 2016 20:54:39

Power Spectral Density, Zigbee Low Channel



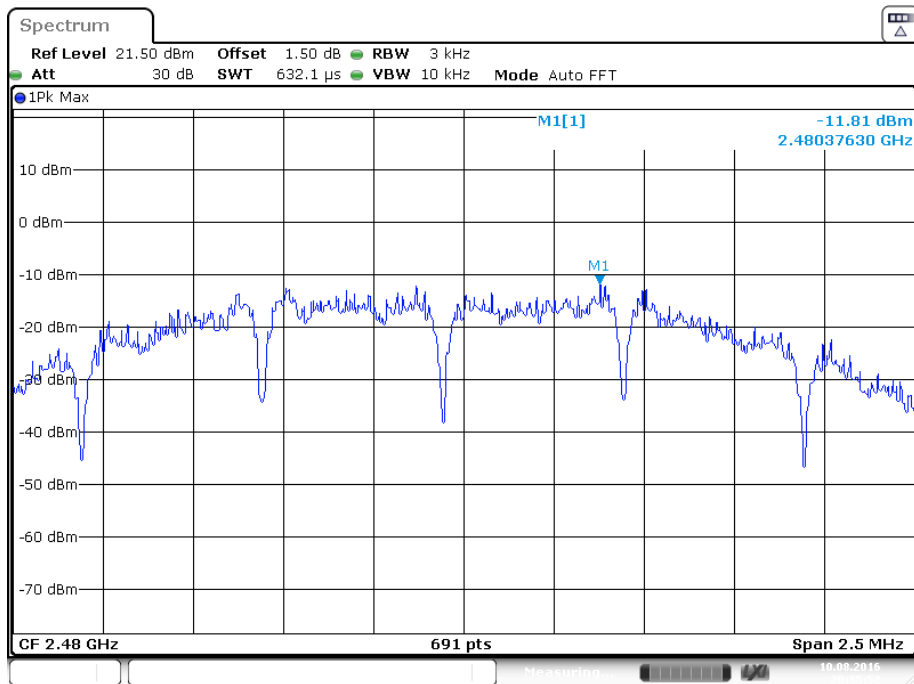
Date: 10 AUG 2016 20:36:28

Power Spectral Density, Zigbee Middle Channel



Date: 10 AUG 2016 20:36:52

Power Spectral Density, Zigbee High Channel



Date: 10 AUG 2016 20:35:52

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