FCC PART 15.247

TEST REPORT

For

NXP Semiconductors

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

FCC ID: XXMFRDMKW41Z

Report Type:	Product Type:
Original Report	FRDM-KW41Z Freedom Development Platform

Test Engineer:	Chris Wang
Report Number:	RKS160720003-00A
Report Date:	2016-08-11
Reviewed By:	Jesse Huang EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) Chenghu Road,Kunshan Development Zone No.248,Kunshan, Jiangsu, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The NXP Semiconductors' s product, model number: FRDM-KW41Z(FCC ID: XXMFRDMKW41Z), the EUT in this report was a FRDM-KW41Z Freedom Development Platform, which was measured approximately: 91mm(L) x 53mm(W) x 23mm(H) , rated input voltage: DC 5.0V.

** All measurement and test data in this report was gathered from production sample serial number: 20160714013 (Assigned by BACL, Kunshan). The EUT was received on 2016-07-14.*

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)

NA.

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 lever 4

Support Equipment List and Details

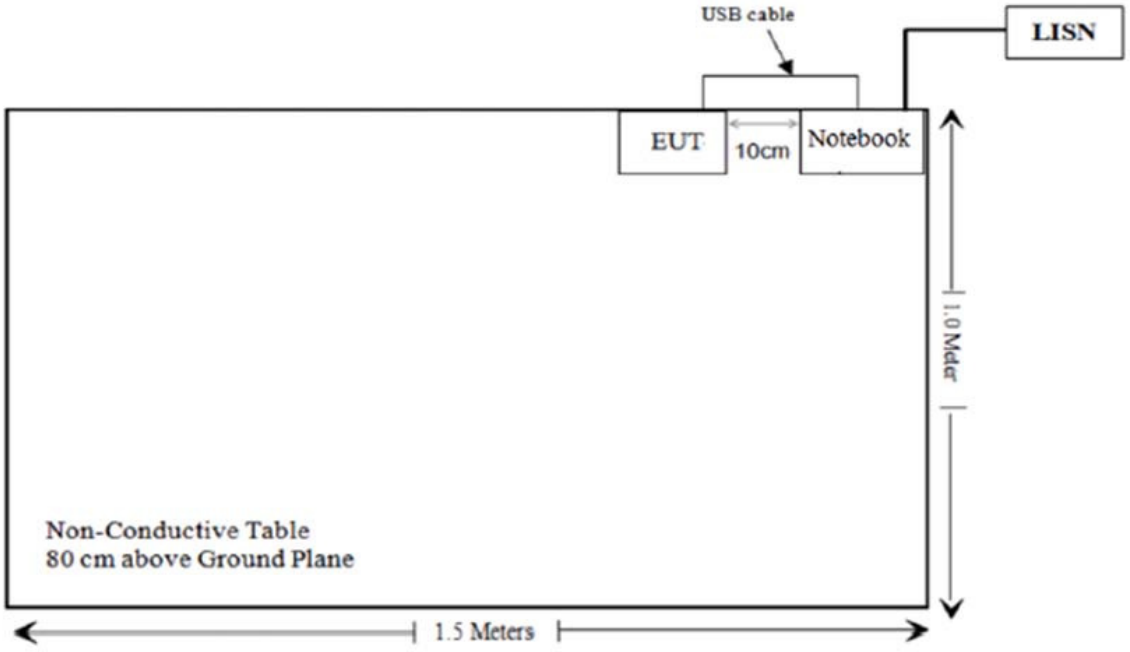
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152

External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	To
USB Cable	Un-shielding	0.9	EUT	Notebook

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1310& §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	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& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4 \pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Bluetooth LE	2440	4.58	2.87	3.5	2.24	20	0.001	1.0
Zigbee	2445	4.58	2.87	3.5	2.24	20	0.001	1.0

Note: BLE Mode:The target power :3±0.5 dBm, which declared by the Manufacturer.
Zigbee Mode:The target power :3±0.5 dBm, which declared by the Manufacturer.

Result: The device meet FCC MPE at 20 cm distance.

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 4.58dBi, 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

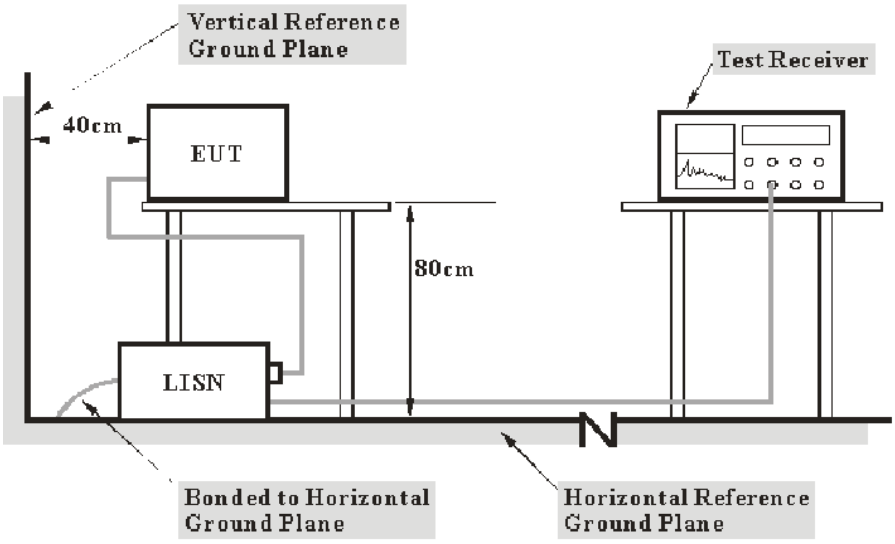
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe 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:

Correction Factor = LISN VDF + 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:

Margin = Limit – 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:

8.89 dB at **0.166000 MHz** in the **Line** conducted mode for BLE

10.31 dB at **0.166000 MHz** in the **Neutral** conducted mode for Zigbee

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

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

In BACL, $U_{(Lm)}$ 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

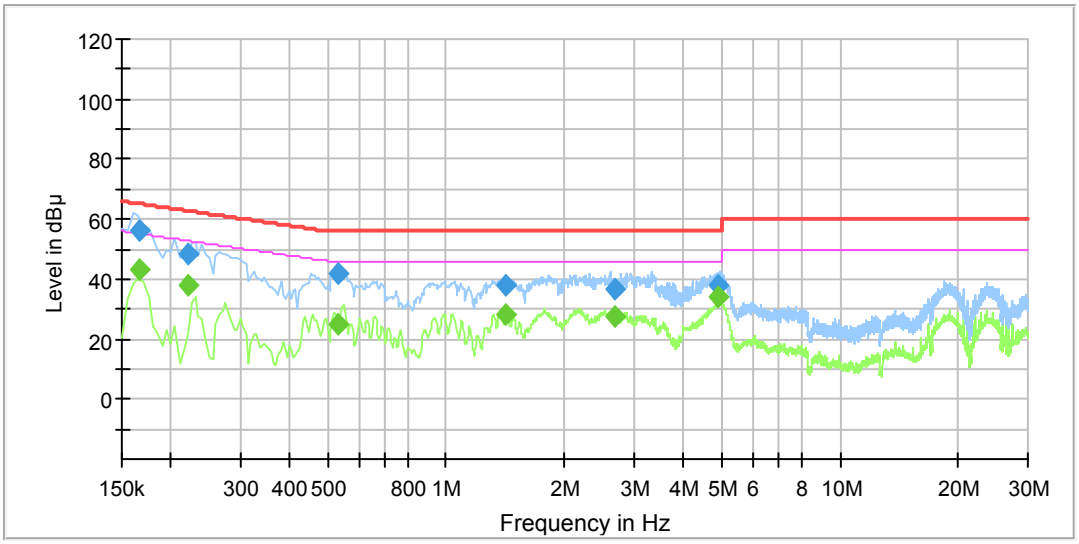
Temperature:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

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

EUT operation mode: Transmitting

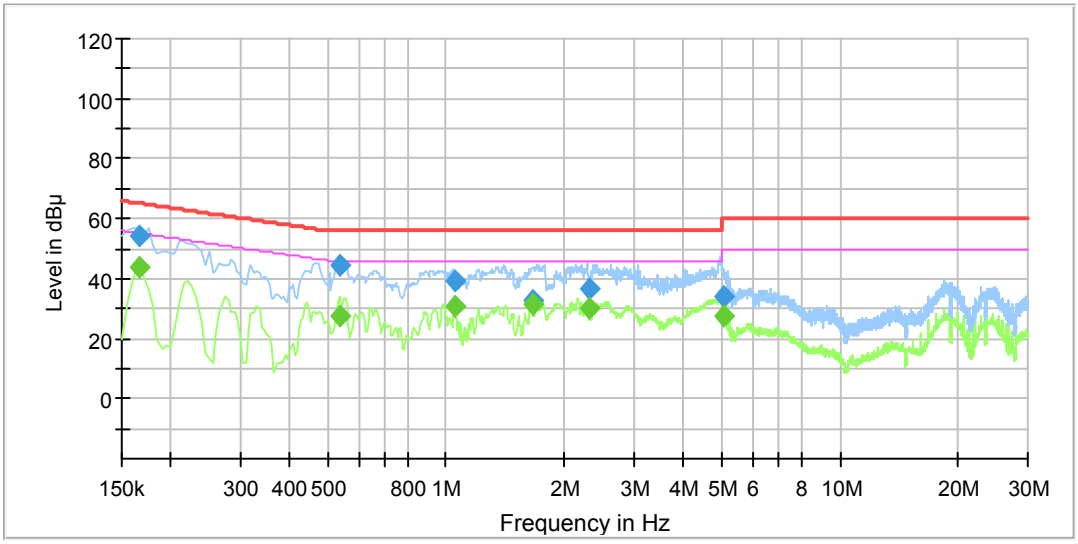
BLE Mode:

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166000	---	43.21	9.000	L1	11.0	11.95	55.16	Compliance
0.166000	56.27	---	9.000	L1	11.0	8.89	65.16	Compliance
0.222000	---	38.05	9.000	L1	11.0	14.69	52.74	Compliance
0.222000	48.32	---	9.000	L1	11.0	14.42	62.74	Compliance
0.532000	---	25.02	9.000	L1	11.0	20.98	46.00	Compliance
0.532000	41.54	---	9.000	L1	11.0	14.46	56.00	Compliance
1.417000	---	27.94	9.000	L1	11.1	18.06	46.00	Compliance
1.417000	37.76	---	9.000	L1	11.1	18.24	56.00	Compliance
2.691000	---	27.57	9.000	L1	11.2	18.43	46.00	Compliance
2.691000	36.90	---	9.000	L1	11.2	19.10	56.00	Compliance
4.894000	---	34.31	9.000	L1	11.3	11.69	46.00	Compliance
4.894000	38.03	---	9.000	L1	11.3	17.97	56.00	Compliance

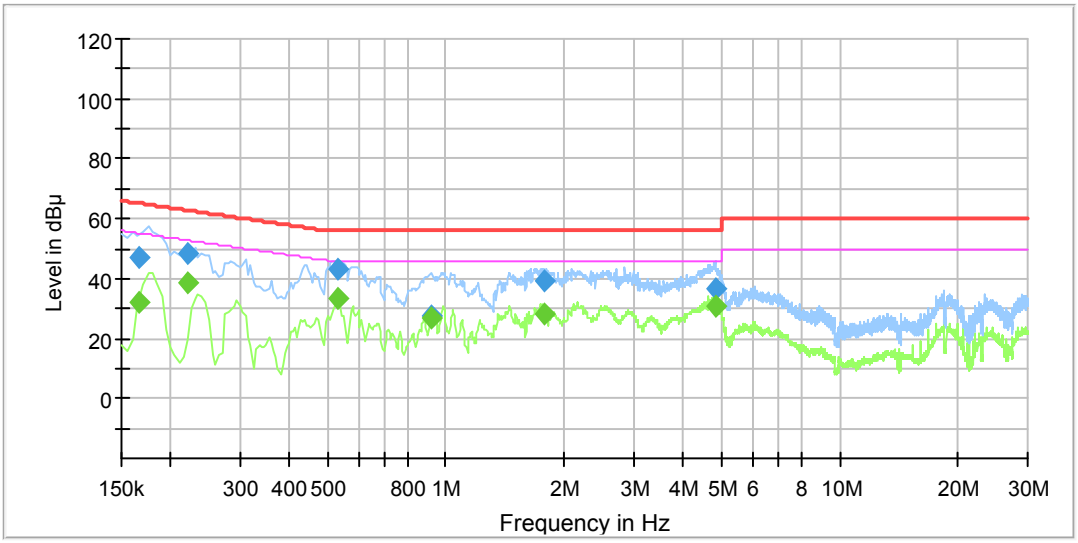
AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166000	---	44.12	9.000	N	11.0	11.04	55.16	Compliance
0.166000	54.43	---	9.000	N	11.0	10.73	65.16	Compliance
0.537000	---	27.75	9.000	N	11.0	18.25	46.00	Compliance
0.537000	44.21	---	9.000	N	11.0	11.79	56.00	Compliance
1.047000	---	30.56	9.000	N	11.1	15.44	46.00	Compliance
1.047000	39.04	---	9.000	N	11.1	16.96	56.00	Compliance
1.658000	---	31.48	9.000	N	11.2	14.52	46.00	Compliance
1.658000	32.70	---	9.000	N	11.2	23.30	56.00	Compliance
2.323000	---	30.27	9.000	N	11.3	15.73	46.00	Compliance
2.323000	36.80	---	9.000	N	11.3	19.20	56.00	Compliance
5.045000	---	27.60	9.000	N	11.4	22.40	50.00	Compliance
5.045000	34.00	---	9.000	N	11.4	26.00	60.00	Compliance

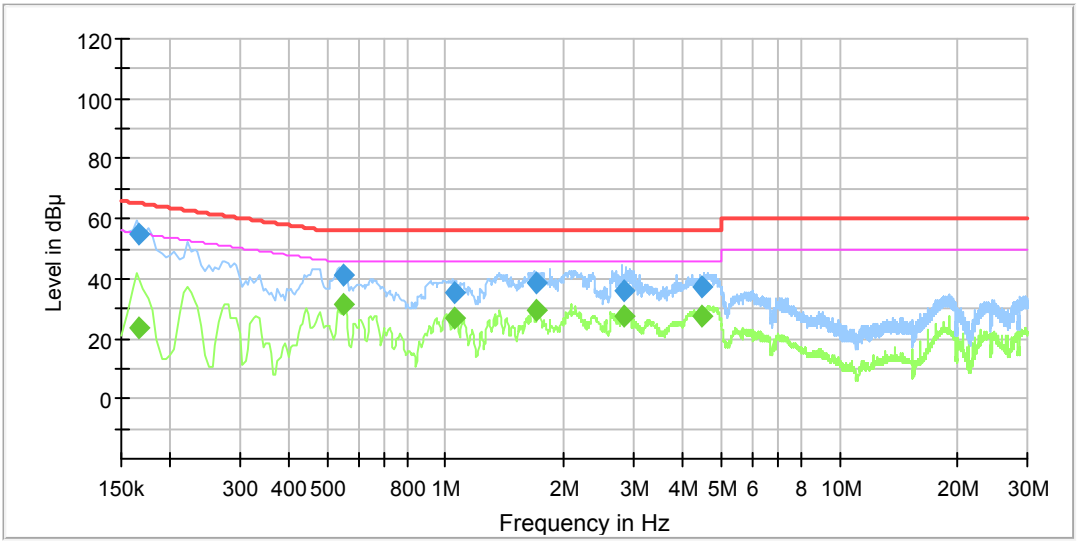
Zigbee Mode:

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.166000	---	32.24	9.000	L1	11.0	22.92	55.16	Compliance
0.166000	47.02	---	9.000	L1	11.0	18.14	65.16	Compliance
0.220000	---	38.90	9.000	L1	11.0	13.92	52.82	Compliance
0.220000	48.10	---	9.000	L1	11.0	14.72	62.82	Compliance
0.534000	---	33.19	9.000	L1	11.0	12.81	46.00	Compliance
0.534000	43.44	---	9.000	L1	11.0	12.56	56.00	Compliance
0.918000	---	26.71	9.000	L1	11.1	19.29	46.00	Compliance
0.918000	27.22	---	9.000	L1	11.1	28.78	56.00	Compliance
1.777000	---	28.23	9.000	L1	11.2	17.77	46.00	Compliance
1.777000	38.95	---	9.000	L1	11.2	17.05	56.00	Compliance
4.870000	---	30.60	9.000	L1	11.3	15.40	46.00	Compliance
4.870000	36.74	---	9.000	L1	11.3	19.26	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
0.166000	---	23.93	9.000	N	11.0	31.23	55.16	Compliance
0.166000	54.85	---	9.000	N	11.0	10.31	65.16	Compliance
0.550000	---	31.29	9.000	N	11.0	14.71	46.00	Compliance
0.550000	40.92	---	9.000	N	11.0	15.08	56.00	Compliance
1.047000	---	26.87	9.000	N	11.1	19.13	46.00	Compliance
1.047000	35.24	---	9.000	N	11.1	20.76	56.00	Compliance
1.706000	---	29.45	9.000	N	11.2	16.55	46.00	Compliance
1.706000	38.36	---	9.000	N	11.2	17.64	56.00	Compliance
2.829000	---	27.24	9.000	N	11.3	18.76	46.00	Compliance
2.829000	35.88	---	9.000	N	11.3	20.12	56.00	Compliance
4.462000	---	27.55	9.000	N	11.3	18.45	46.00	Compliance
4.462000	37.44	---	9.000	N	11.3	18.56	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;

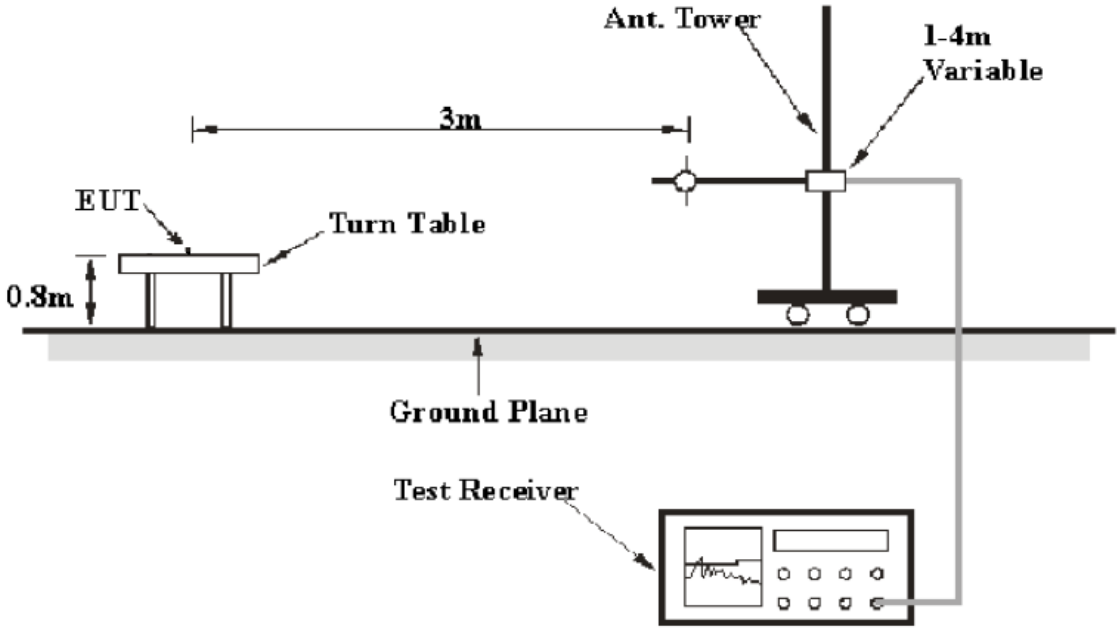
Measurement Uncertainty

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.

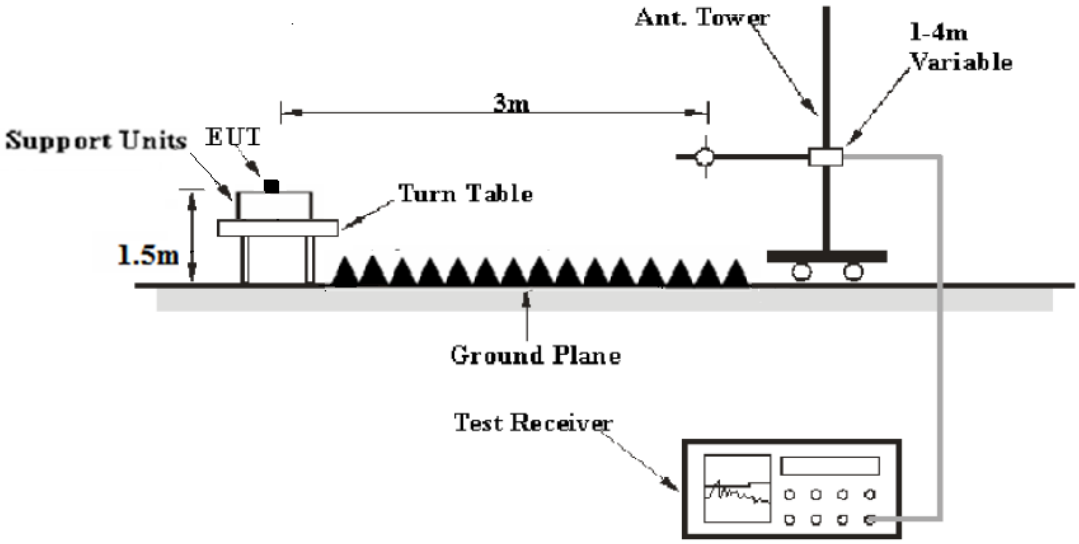
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement at antenna port. And the uncertainty will not be taken into consideration 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	10 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 Instrunent	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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – 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.

2.27 dB at **44.792500 MHz** in the **Vertical** polarization For BLE Mode

12.74 dB at **7440 MHz** in the **Vertical** polarization For Zigbee Mode

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

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

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

Test Data

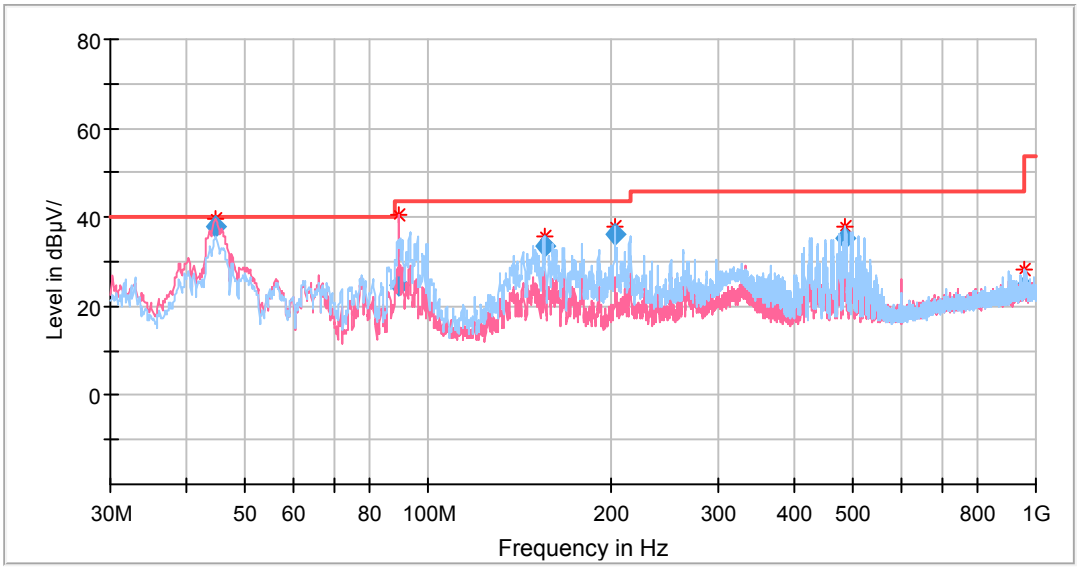
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-07-27.

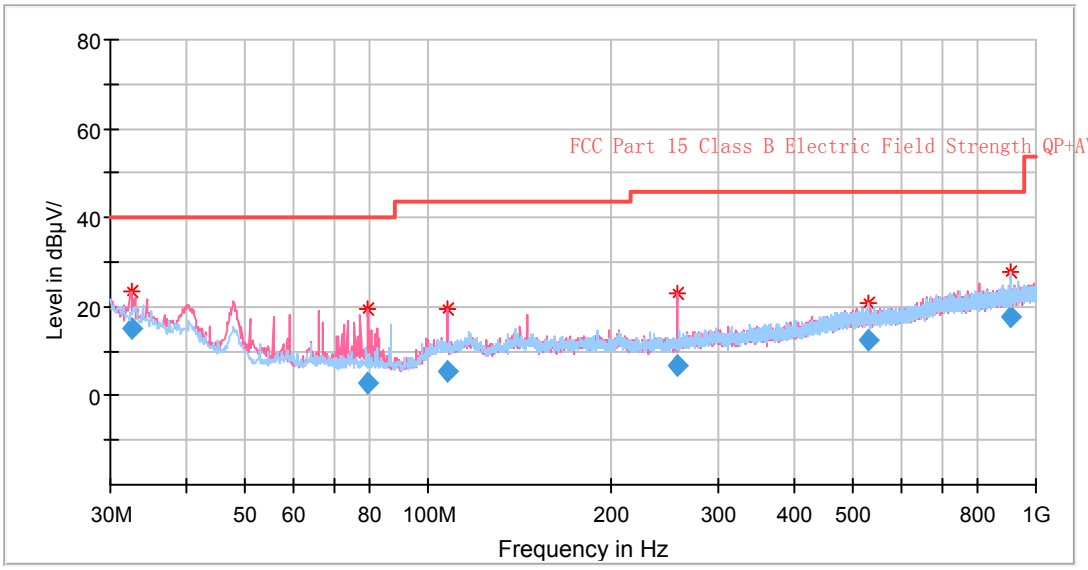
30 MHz-1 GHz:

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 µ V/m)	Margin (dB)
44.792500	51.03	QP	246.0	101.0	V	-13.3	37.73	40.00	2.27
89.412500	41.54	QP	0.0	199.0	V	-17.0	24.54	43.50	18.96
155.130000	45.75	QP	240.0	199.0	H	-12.2	33.55	43.50	9.95
202.902500	48.77	QP	46.0	199.0	H	-12.5	36.27	43.50	7.23
485.415000	41.16	QP	205.0	101.0	H	-6.0	35.16	46.00	10.84
954.773750	24.80	QP	233.0	101.0	H	-0.3	24.50	46.00	21.50

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 µ V/m)	Margin (dB)
32.425000	21.67	QP	276.0	101.0	V	-6.5	15.17	40.00	24.83
79.712500	19.85	QP	43.0	101.0	V	-17.0	2.85	40.00	37.15
107.357500	18.52	QP	353.0	101.0	V	-13.0	5.52	43.50	37.98
257.707500	18.34	QP	104.0	101.0	V	-11.7	6.64	46.00	39.36
530.883750	18.03	QP	0.0	199.0	H	-5.5	12.53	46.00	33.47
908.092500	18.52	QP	34.0	199.0	H	-0.8	17.72	46.00	28.28

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 μ V/m)	Margin (dB)
Low Channel (2402 MHz)									
2402	96.36	PK	117.0	150.0	V	3.0	99.36	/	/
2402	89.57	Ave	117.0	150.0	V	3.0	92.57	/	/
2402	94.64	PK	42.0	150.0	H	3.0	97.64	/	/
2402	87.28	Ave	42.0	150.0	H	3.0	90.28	/	/
2385	33.22	Ave	47.0	150.0	V	4.9	38.12	54	15.88
2385	42.78	PK	47.0	150.0	V	4.9	47.68	74	26.32
2390	52.09	PK	118.0	150.0	H	4.9	56.99	74	17.01
2390	22.71	Ave	118.0	150.0	H	4.9	27.61	54	26.39
4804	18.63	Ave	93.0	150.0	V	13.7	32.33	54	21.67
4804	34.31	PK	93.0	150.0	V	13.7	48.01	74	25.99
6962	33.94	PK	48.0	200.0	V	18.9	52.84	74	21.16
6962	20.85	Ave	48.0	200.0	V	18.9	39.75	54	14.25
7206	29.42	PK	143.0	150.0	H	20.5	49.92	74	24.08
7206	15.84	Ave	143.0	150.0	H	20.5	36.34	54	17.66
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)
Middle Channel (2440MHz)									
2440	96.07	PK	135.0	150.0	V	2.6	98.67	/	/
2440	89.61	Ave	135.0	150.0	V	2.6	92.21	/	/
2440	94.74	PK	201.0	150.0	H	2.6	97.34	/	/
2440	88.62	Ave	201.0	150.0	H	2.6	91.22	/	/
2431	33.22	PK	127.0	200.0	H	4.9	38.12	74	35.88
2431	19.07	Ave	127.0	200.0	H	4.9	23.97	54	30.03
2445	33.00	PK	14.0	150.0	V	4.9	37.90	74	36.10
2445	19.09	Ave	14.0	150.0	V	4.9	23.99	54	30.01
4880	35.32	PK	150.0	150.0	V	13.6	48.92	74	25.08
4880	18.52	Ave	150.0	150.0	V	13.6	32.12	54	21.88
6976	20.90	Ave	233.0	150.0	V	18.9	39.80	54	14.20
6976	35.08	PK	233.0	150.0	V	18.9	53.98	74	20.02
7320	30.63	PK	11.0	150.0	V	20.0	50.63	74	23.37
7320	17.39	Ave	11.0	150.0	V	20.0	37.39	54	16.61

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)
High Channel (2480 MHz)									
2480	95.67	PK	190.0	150.0	V	3.2	98.87	/	/
2480	88.43	Ave	190.0	150.0	V	3.2	91.63	/	/
2480	96.69	PK	30.0	150.0	H	3.2	99.89	/	/
2480	89.13	Ave	30.0	150.0	H	3.2	92.33	/	/
2483.5	29.23	Ave	251.0	150.0	V	5.0	34.23	54	19.77
2483.5	53.32	PK	251.0	150.0	V	5.0	58.32	74	15.68
2497	32.29	PK	32.0	150.0	H	5.0	37.29	74	36.71
2497	19.02	Ave	32.0	150.0	H	5.0	24.02	54	29.98
4960	18.28	Ave	153.0	150.0	V	14.1	32.38	54	21.62
4960	33.55	PK	153.0	150.0	V	14.1	47.65	74	26.35
6990	34.23	PK	151.0	200.0	V	19.	53.23	74	20.77
6990	21.25	Ave	151.0	200.0	V	19.0	40.25	54	13.75
7440	20.85	Ave	340.0	150.0	V	21.2	42.05	54	11.95
7440	33.69	PK	340.0	150.0	V	21.2	54.89	74	19.11

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 μ V/m)	Margin (dB)
Low Channel (2405MHz)									
2405	95.88	PK	285.0	150.0	V	4.9	100.78	/	/
2405	89.75	Ave	285.0	150.0	V	4.9	94.65	/	/
2405	95.26	PK	135.0	150.0	H	4.9	100.16	/	/
2405	88.92	Ave	135.0	150.0	H	4.9	93.82	/	/
2366	33.96	PK	14.0	150.0	V	4.8	38.76	74	35.24
2366	20.93	Ave	14.0	150.0	V	4.8	25.73	54	28.27
2390	36.35	PK	233.0	150.0	V	4.9	41.25	74	32.75
2390	23.04	Ave	233.0	150.0	V	4.9	27.94	54	26.06
4810	32.37	PK	284.0	150.0	V	13.3	45.67	74	28.33
4810	19.08	Ave	284.0	150.0	V	13.3	32.38	54	21.62
6653	22.39	Ave	0.0	150.0	H	17.8	40.19	54	13.81
6653	35.59	PK	0.0	150.0	H	17.8	53.39	74	20.61
7215	31.56	PK	335.0	250.0	H	19.7	51.26	74	22.74
7215	18.49	Ave	335.0	250.0	H	19.7	38.19	54	15.81

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 (dBμV/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	/	/
1814	20.92	Ave	223.0	250.0	H	3.7	24.62	54	29.38
1814	34.58	PK	223.0	250.0	H	3.7	38.28	74	35.72
4890	18.99	Ave	86.0	150.0	V	13.6	32.59	54	21.41
4890	32.75	PK	86.0	150.0	V	13.6	46.35	74	27.65
6639	22.44	Ave	133.0	150.0	V	17.7	40.14	54	13.86
6639	35.61	PK	133.0	150.0	V	17.7	53.31	74	20.69
6990	34.75	PK	17.0	150.0	V	19.0	53.75	74	20.25
6990	21.63	Ave	17.0	150.0	V	19.0	40.63	54	13.37
7335	30.84	PK	258.0	150.0	H	20.0	50.84	74	23.16
7335	17.39	Ave	258.0	150.0	H	20.0	37.39	54	16.61

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 (dBμV/m)	Margin (dB)
High Channel (2480 MHz)									
2480	95.66	PK	252.0	150.0	V	5.0	100.66	/	/
2480	88.36	Ave	252.0	150.0	V	5.0	93.36	/	/
2480	94.88	PK	346.0	150.0	H	5.0	99.88	/	/
2480	87.73	Ave	346.0	150.0	H	5.0	92.73	/	/
2483.5	37.19	PK	232.0	150.0	H	5.0	42.19	74	31.81
2483.5	24.53	Ave	232.0	150.0	H	5.0	29.53	54	24.47
2509	33.37	PK	45.0	150.0	V	5.0	38.37	74	35.63
2509	20.05	Ave	45.0	150.0	V	5.0	25.05	54	28.95
4960	18.48	Ave	96.0	150.0	V	13.9	32.38	54	21.62
4960	31.54	PK	96.0	150.0	V	13.9	45.44	74	28.56
6990	21.25	Ave	285.0	150.0	V	19.0	40.25	54	13.75
6990	34.6	PK	285.0	150.0	V	19.0	53.60	74	20.40
7440	20.86	Ave	70.0	200.0	V	20.4	41.26	54	12.74
7440	33.08	PK	70.0	200.0	V	20.4	53.48	74	20.52

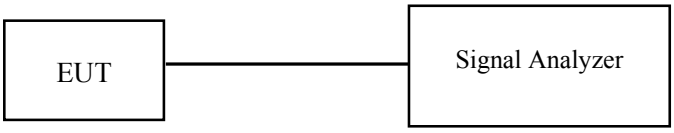
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

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

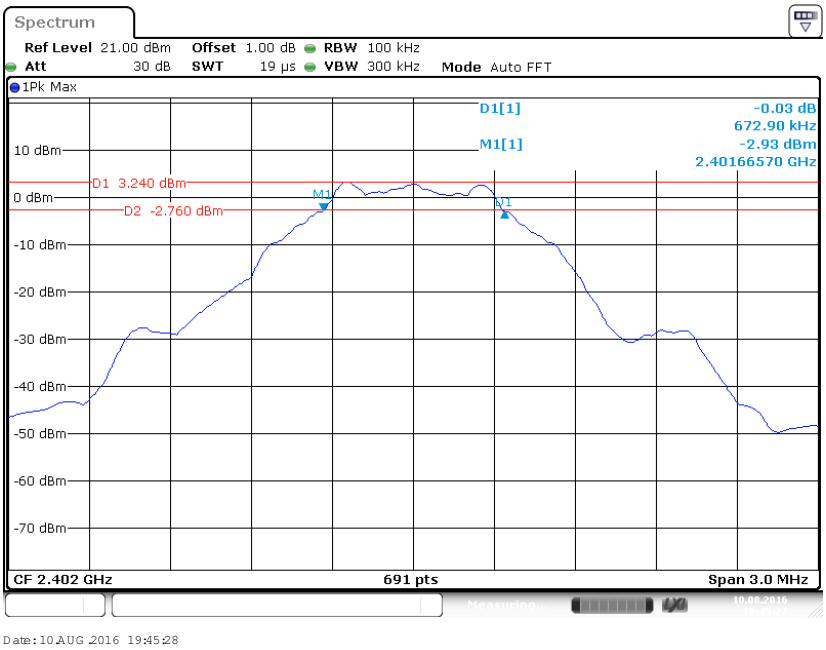
Test Result: Pass.

Please refer to the following tables and plots.

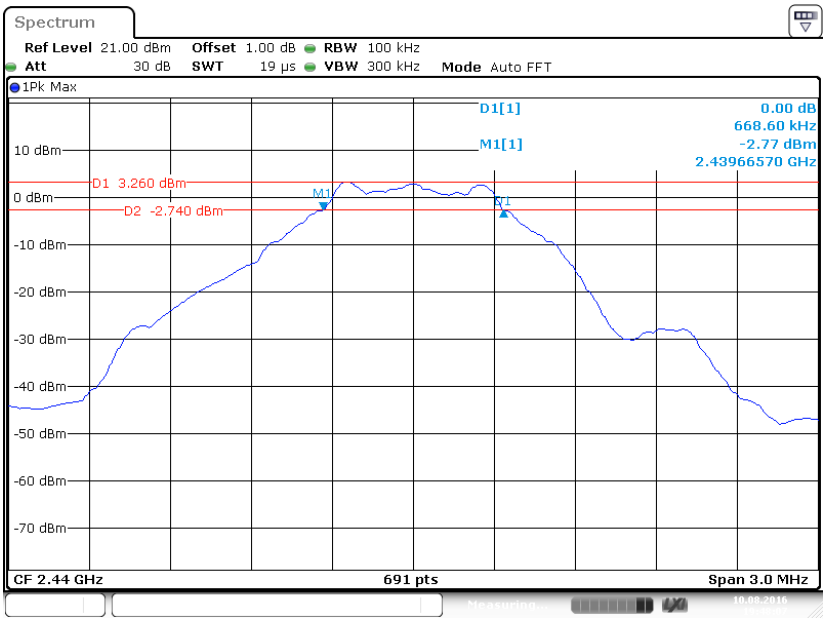
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
BLE Mode			
Low	2402	0.673	≥500
Middle	2440	0.669	≥500
High	2480	0.669	≥500
Zigbee Mode			
Low	2405	1.641	≥500
Middle	2445	1.632	≥500
High	2480	1.637	≥500

Low Channel for BLE Mode

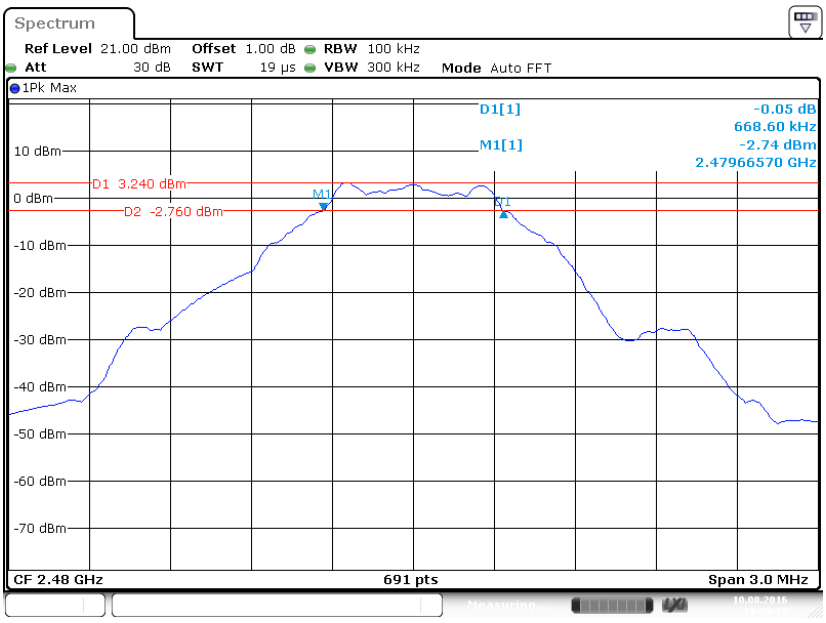


Middle Channel for BLE Mode



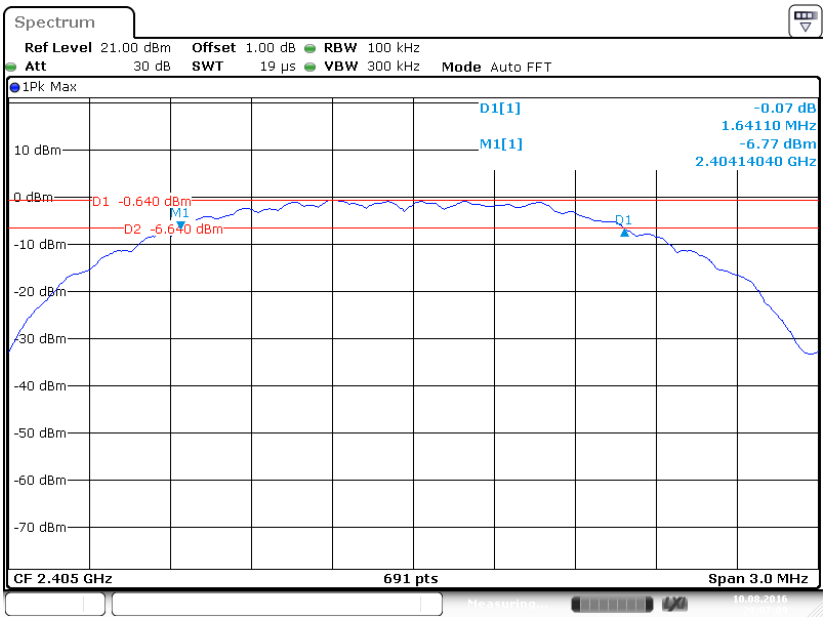
Date: 10.AUG.2016 19:48:07

High Channel for BLE Mode



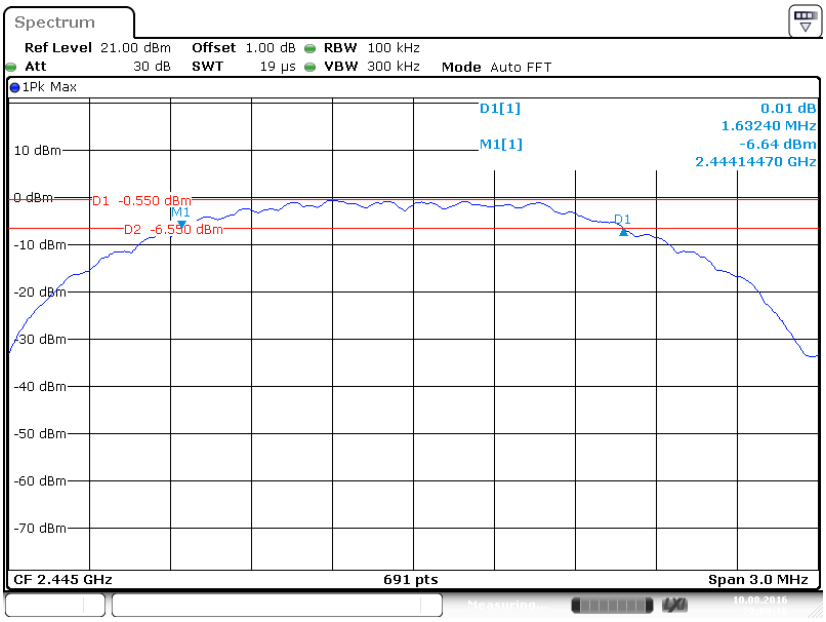
Date: 10.AUG.2016 19:50:10

Low Channel for Zigbee Mode



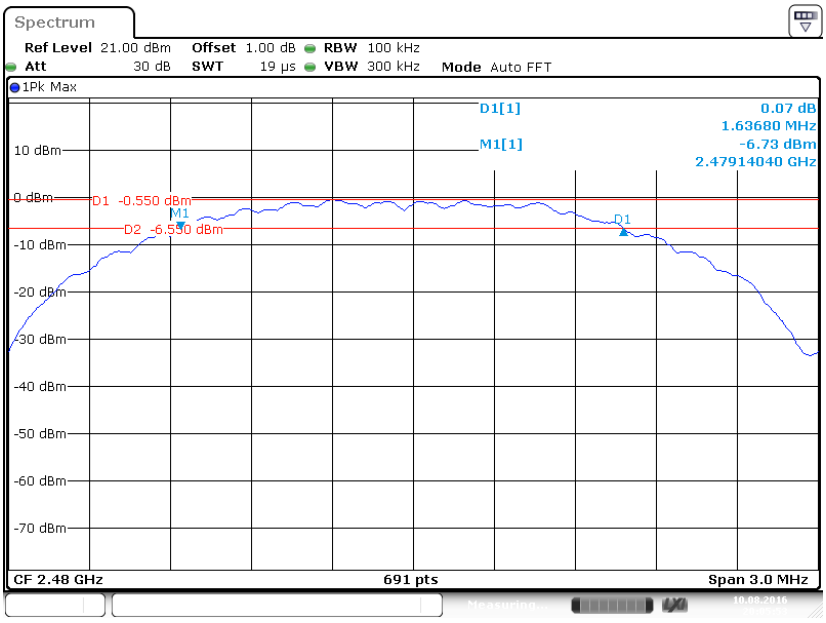
Date: 10.AUG.2016 20:07:10

Middle Channel for Zigbee Mode



Date: 10.AUG.2016 20:09:17

High Channel for Zigbee Mode



Date: 10.AUG.2016 20:05:53

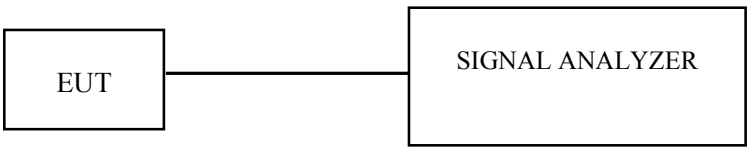
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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	2016-09-02	2017-09-02
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

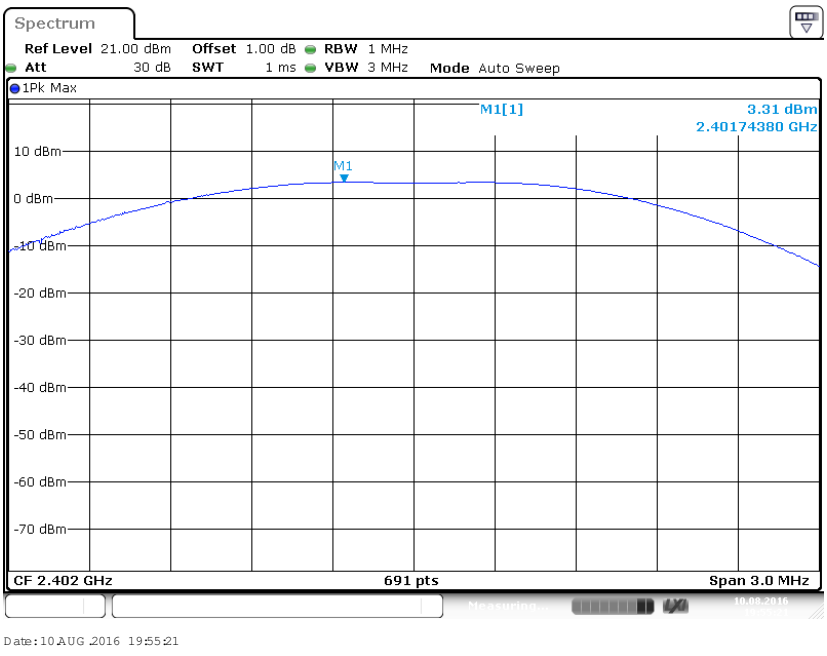
Temperature:	27 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

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

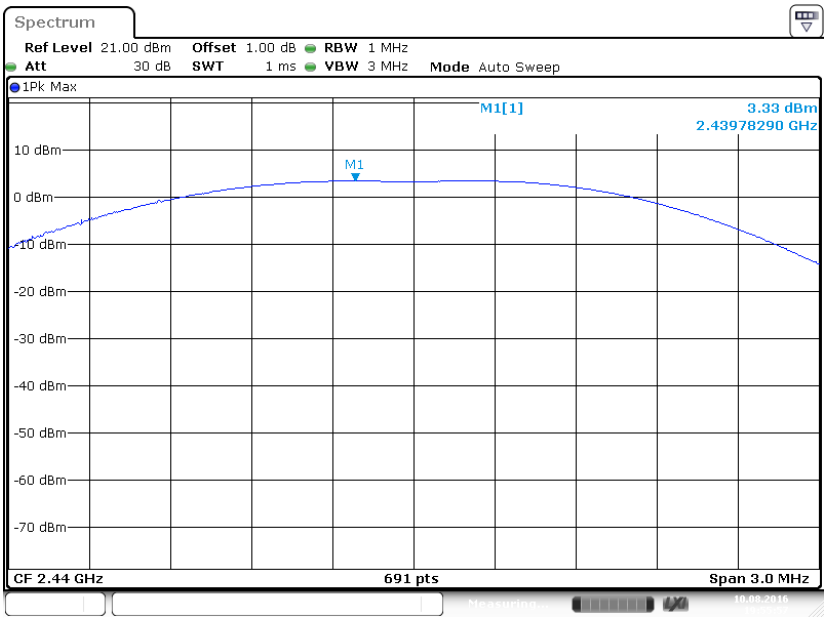
EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE Mode				
Low	2402	3.31	30	Pass
Middle	2440	3.33	30	Pass
High	2480	3.31	30	Pass
Zigbee Mode				
Low	2405	3.33	30	Pass
Middle	2445	3.34	30	Pass
High	2480	3.34	30	Pass

Low Channel for BLE Mode



Middle Channel for BLE Mode



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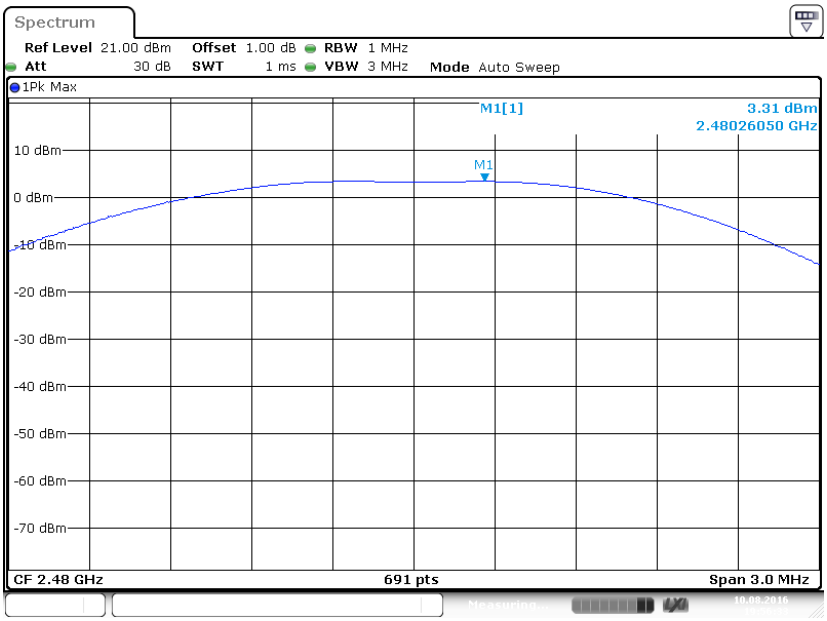
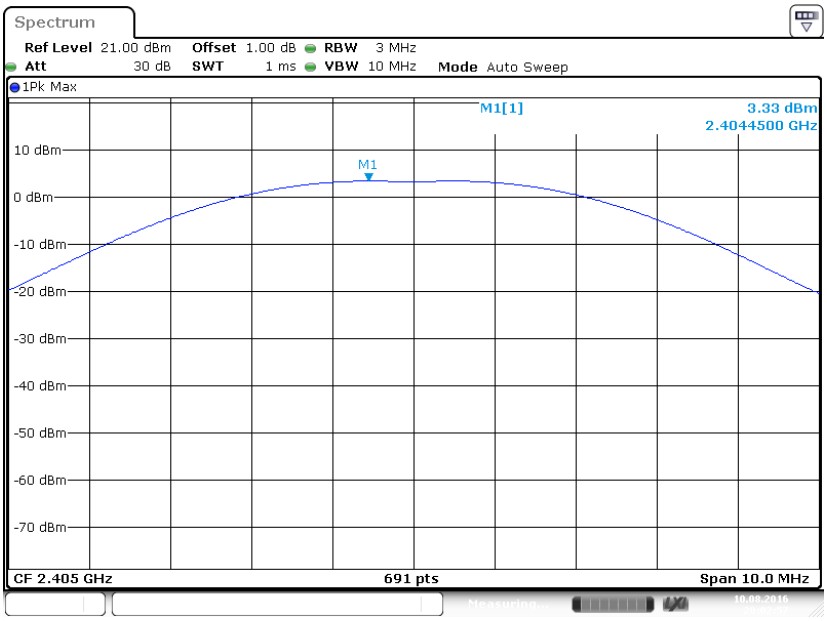
High Channel for BLE Mode



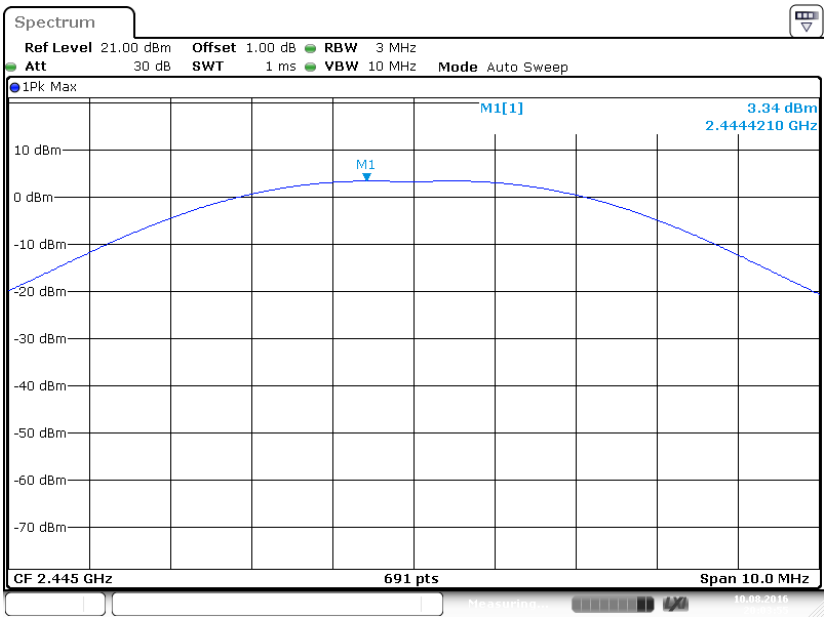
Date:10.AUG.2016 19:56:33

Low Channel for Zigbee Mode



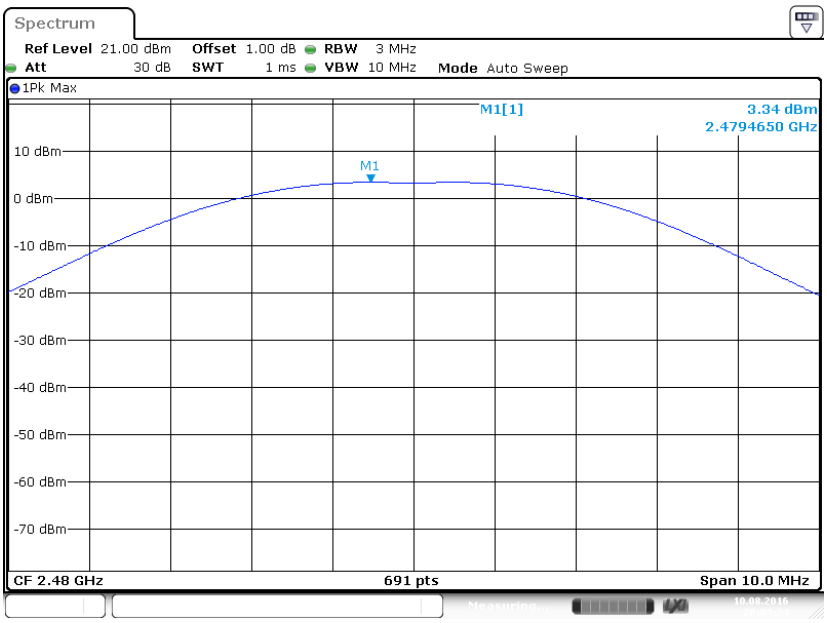
Date:10.AUG.2016 20:02:57

Middle Channel for Zigbee Mode



Date:10.AUG.2016 20:03:55

High Channel for Zigbee Mode



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

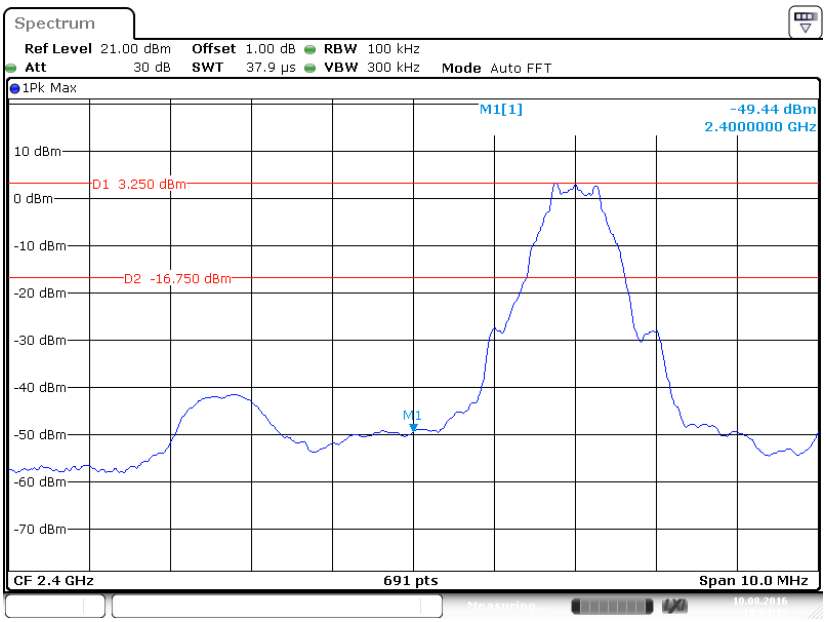
Temperature:	27 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

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

Test Result: *Compliance*

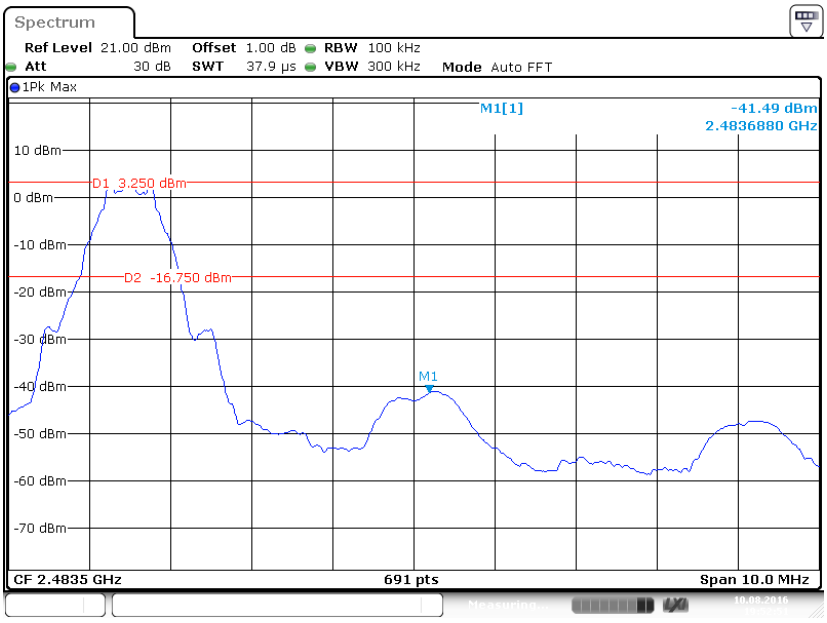
Please refer to the following table and plots.

BLE Mode, Band Edge, Left Side



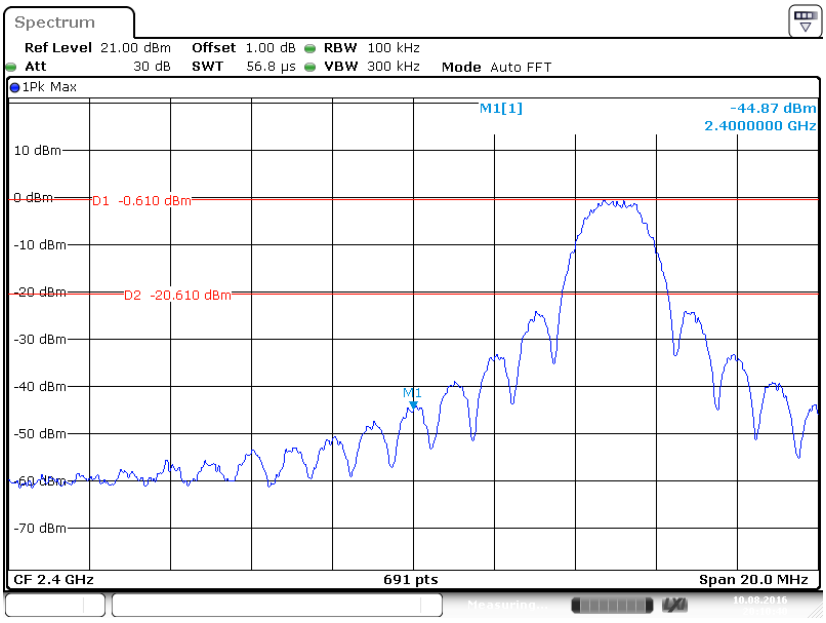
Date: 10.AUG.2016 19:54:13

BLE Mode, Band Edge, Right Side



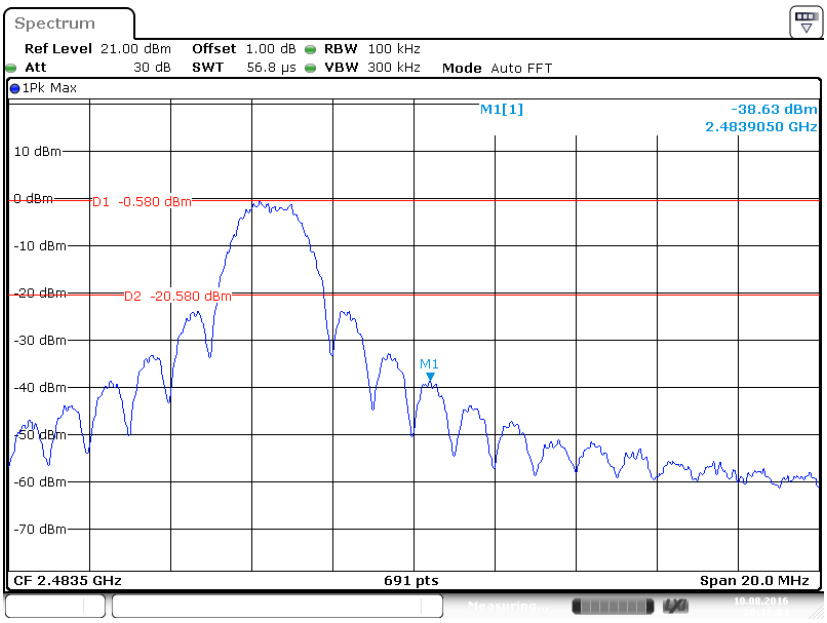
Date: 10.AUG.2016 19:52:51

Zigbee Mode, Band Edge, Left Side



Date:10.AUG.2016 20:10:41

Zigbee Mode, Band Edge, Right Side



Date:10.AUG.2016 20:12:05

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: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×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 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

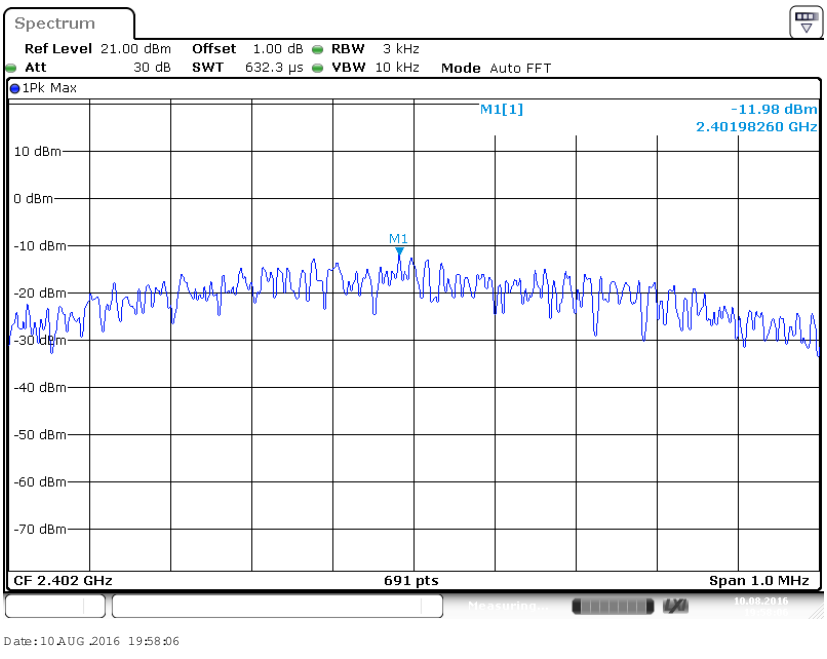
The testing was performed by Chris Wang on 2016-08-10.

EUT operation mode: Transmitting

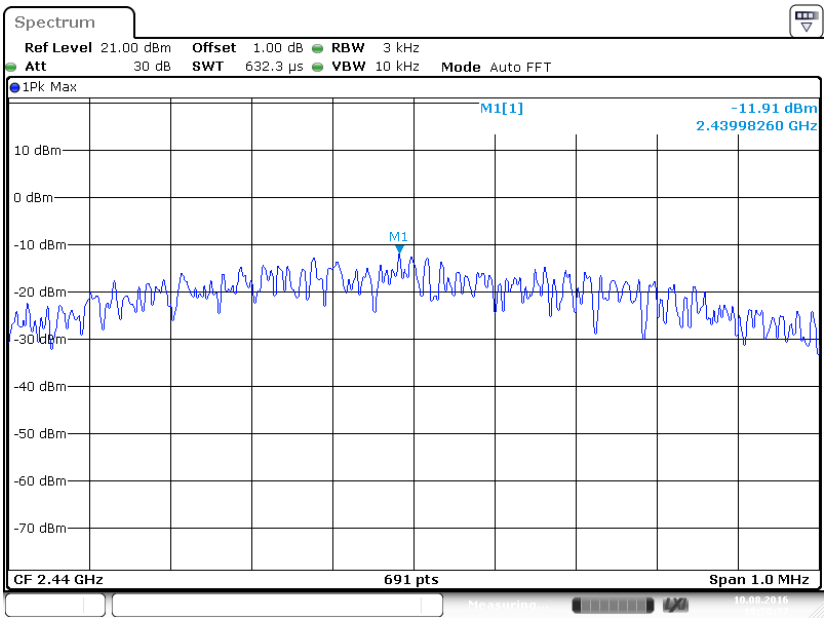
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE Mode			
Low	2402	-11.98	≤8
Middle	2440	-11.91	≤8
High	2480	-11.90	≤8
Zigbee Mode			
Low	2405	-12.46	≤8
Middle	2445	-12.48	≤8
High	2480	-12.50	≤8

Power Spectral Density, BLE Low Channel



Power Spectral Density, BLE Middle Channel



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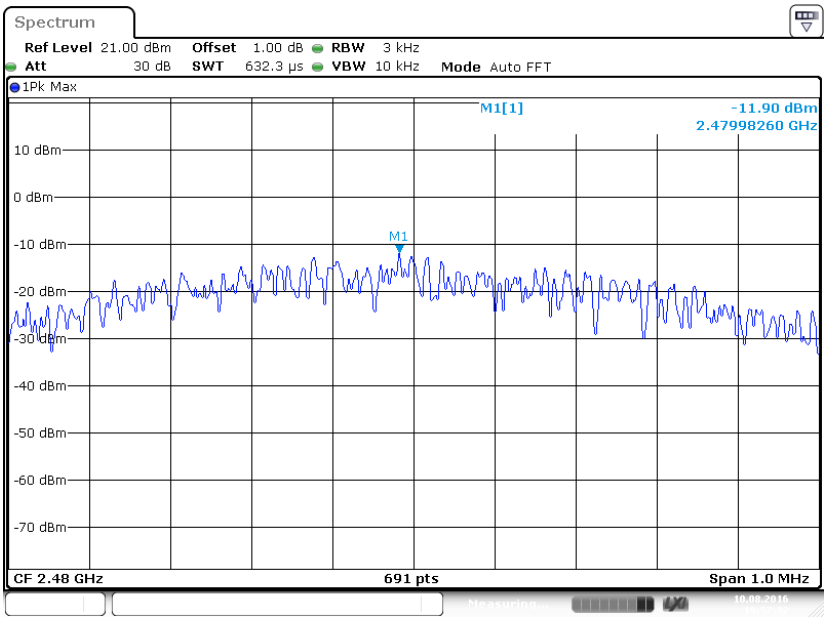
Power Spectral Density, BLE High Channel



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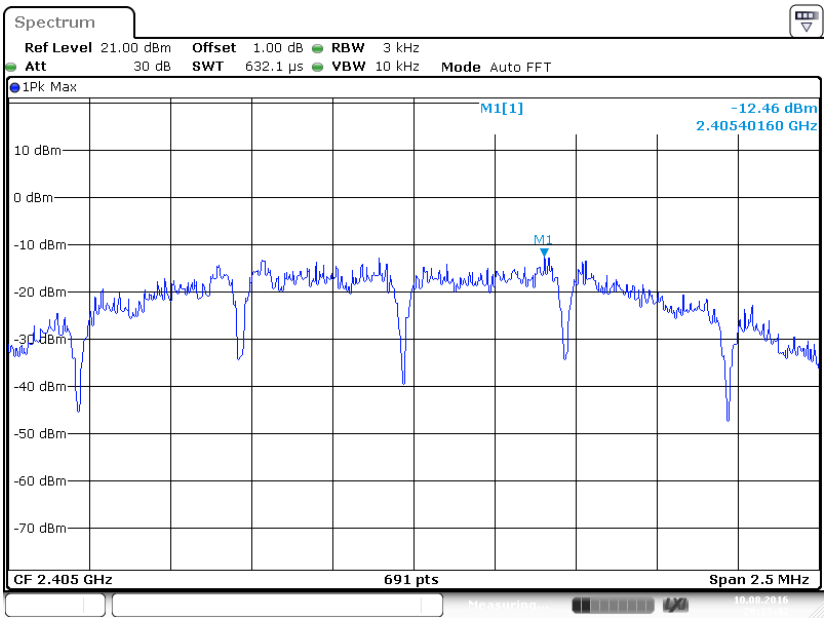
Power Spectral Density, Zigbee Low Channel



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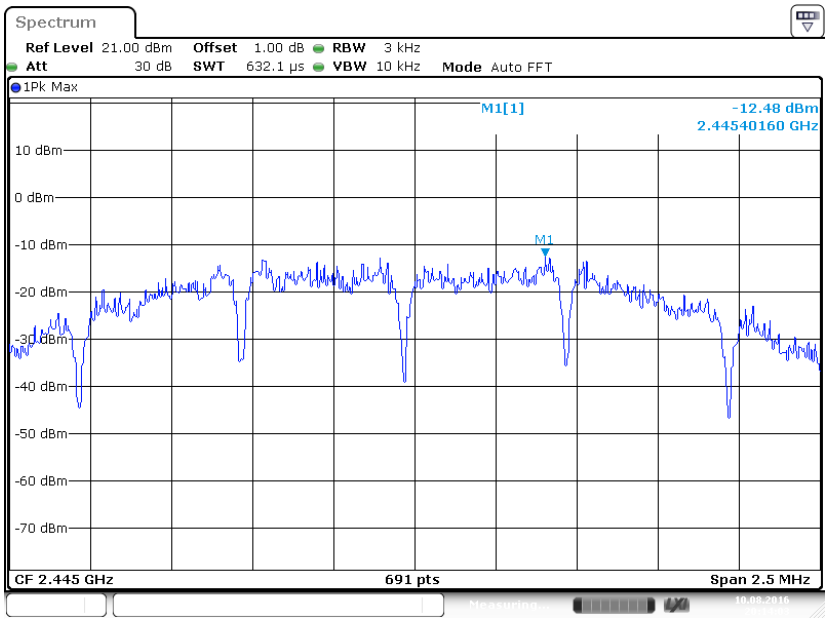
Power Spectral Density, Zigbee Middle Channel



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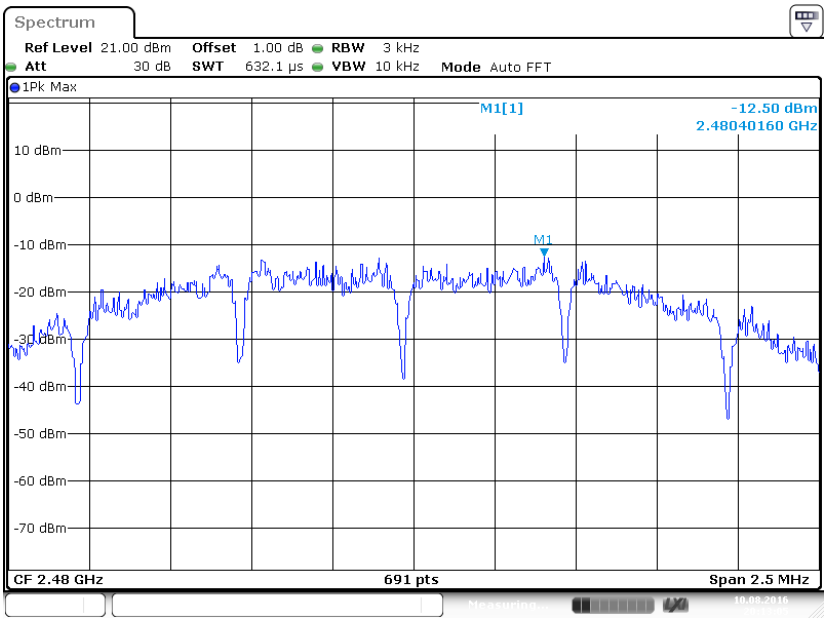
Power Spectral Density, Zigbee High Channel



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