TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

RSS-GEN, ISSUE 5, APRIL 2018

RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Signify (China) Investment Co., Ltd.

Building no.9, Lane 888, Tianlin Road,Minhang District, Shanghai, 200233, China

FCC ID: 2AGBW9290022411X
IC: 20812-2411X

Report Type:	**Product Name:**
Original Report	LED Lamp

Report Number:	RXM190528050-00B
Report Date:	2019-06-11
Reviewed By:	Dean Lau RF Supervisor
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	LED Lamp
EUT Model:	9290022411
FCC ID:	2AGBW9290022411X
IC:	20812-2411X
Rated input:	AC 110-130V; 50-60 Hz
External Dimension:	100.95mm(L)*58.56mm(W)*58.56mm(H)
Serial Number:	190528050
EUT Received Date:	2019.05.31

Objective

This report is prepared on behalf of ***Signify (China) Investment Co., Ltd.*** in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205,15.207, 15.209, 15.247 rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

No Related submittals.

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 KDB 558074 D01 15.247 Meas Guidance v05, and RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

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

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

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 Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

The device supports BLE mode and Zigbee.

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, 20 and 39.

For Zigbee, 16 channels are provided for testing.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	…	…
…	…	…	…
…	…	…	…
..	…	25	2475
18	2440	26	2480

EUT was tested with channel 11, 19 and 26.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Test software: 'RF_TEST.s37' was used for testing, which were provided by manufacturer.

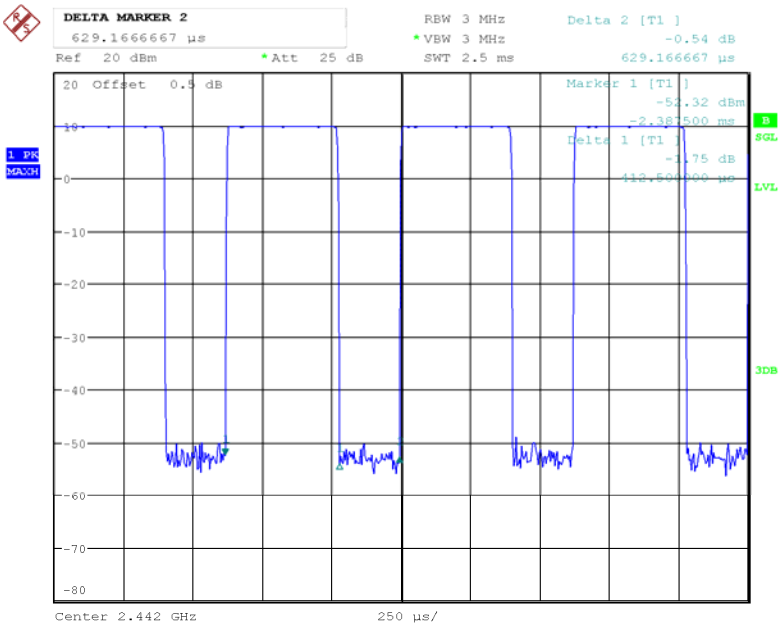
Mode	Channel	Frequency (MHz)	Power level
BLE 1M	Low	2402	10
	Middle	2442	10
	High	2480	10
BLE 2M	Low	2402	10
	Middle	2442	10
	High	2480	10
Zigbee	Low	2405	13
	Middle	2445	13
	High	2480	13

For Bluetooth LE mode, the maximum power with maximum duty cycle was configured as default setting, software only used for change modes and channels.

The maximum duty cycle as following table:

Test mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
BLE 1M	0.412	0.629	65.50
BLE 2M	0.229	0.629	36.41
ZigBee	3.16	21.17	14.93

BLE-1M



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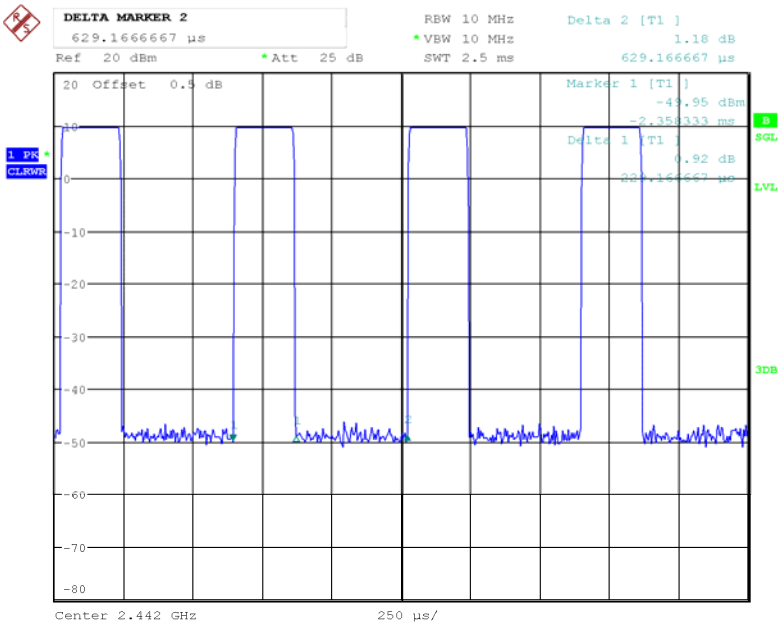
BLE-2M



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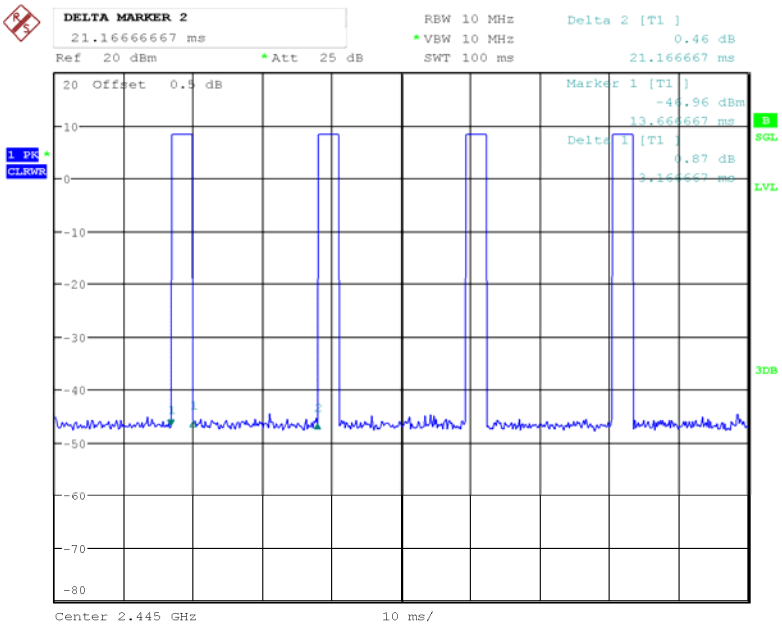
ZigBee



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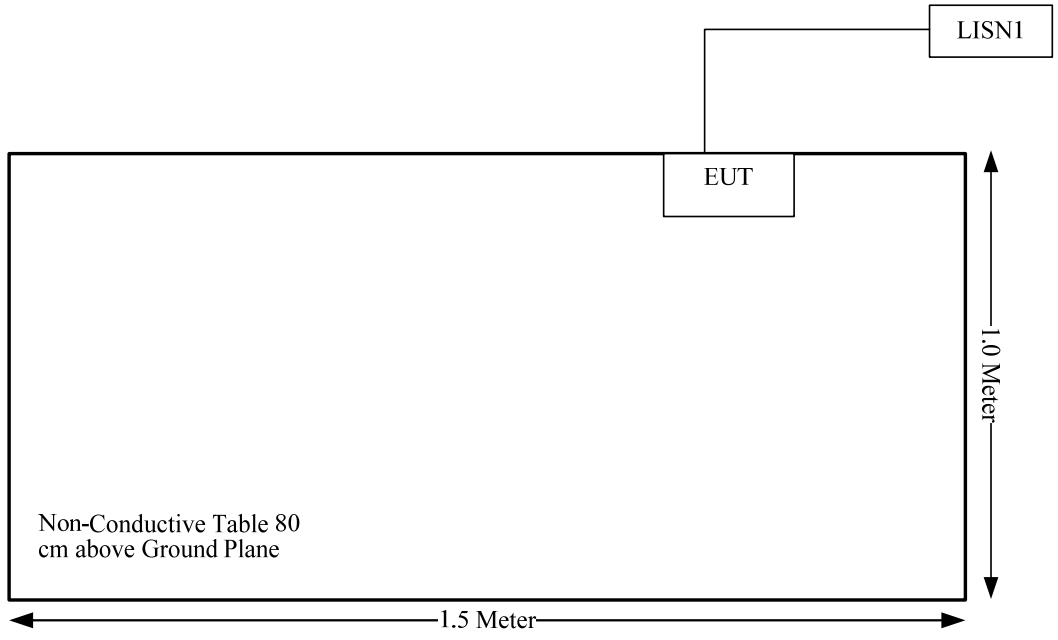
Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissable Exposure (MPE)	Compliance
RSS-102 § 2.5.2	Exemption Limits For Routine Evaluation-RF Exposure Evaluation	Compliance
FCC§15.203, RSS-Gen Clause 6.8	Antenna Requirement	Compliance
FCC§15.207 (a), RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
FCC§15.205, §15.209, FCC §15.247(d), RSS-247 Clause 5.5 RSS-Gen Clause 8.10	Spurious Emissions	Compliance
FCC§15.247 (a)(2), RSS-247 Clause 5.2 a) RSS-Gen Clause 6.7	6 dB Bandwidth	Compliance
FCC§15.247(b)(3), RSS-247 Clause 5.4 d)	Maximum Conducted Output Power	Compliance
FCC§15.247(d), RSS-247 Clause5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC§15.247(e), RSS-247 Clause5.2 b)	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/f²)	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.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = 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**		**Conducted output power including Tune-up Tolerance**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
		(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
Zigbee	2405-2480	-1	0.79	10	10.00	20	0.00158	1.0
BLE 1M	2402-2480	-1	0.79	10	10.00	20	0.00158	1.0
BLE 2M	2402-2480	-1	0.79	10	10.00	20	0.00158	1.0

Note: All modes can't transmit simultaneously.

Result: The device meet FCC MPE at 20 cm distance

RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION – RF EXPOSURE EVALUATION

Applicable Standard

According to RSS-102 § (2.5.2):

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Calculated Data:

The maximum power including tune-up tolerance is 10dBm@ 2.4GHz band, the maximum antenna gain is -1 dBi, so the maximum e.r.i.p. is 9dBm (0.0079W)

Exemption from Routine Evaluation Limit is:
$1.31 \times 10^{-2} f^{0.6834} = 1.31 \times 10^{-2} \times 2402^{0.6834} = 2.68 > 0.0079$W

So the device is compliance exemption from Routine Evaluation Limits –RF exposure Evaluation.

Result: Compliance

FCC §15.203& RSS-GEN CLAUSE 6.8 - 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 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.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Information And Connector Construction

The EUT has one internal antenna arrangement for BT and Zigbee, fulfill the requirement of this section. Please refer to the EUT photos and below information:

Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency
PCB	50	-1.0 dBi

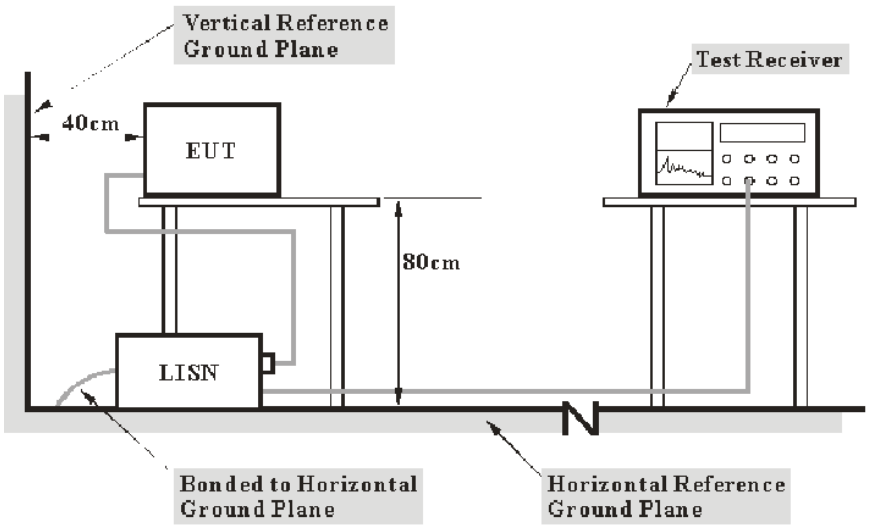
Result: Compliance.

FCC §15.207 (a) & RSS-GEN CLAUSE 8.8– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a), RSS-Gen§8.8.

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 and the RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC 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

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 limit. The equation for margin calculation is as follows:

Margin = Limit – 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	2018/12/10	2019/12/10
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2018-09-05	2019-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2018/12/10	2019/12/10

*** 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

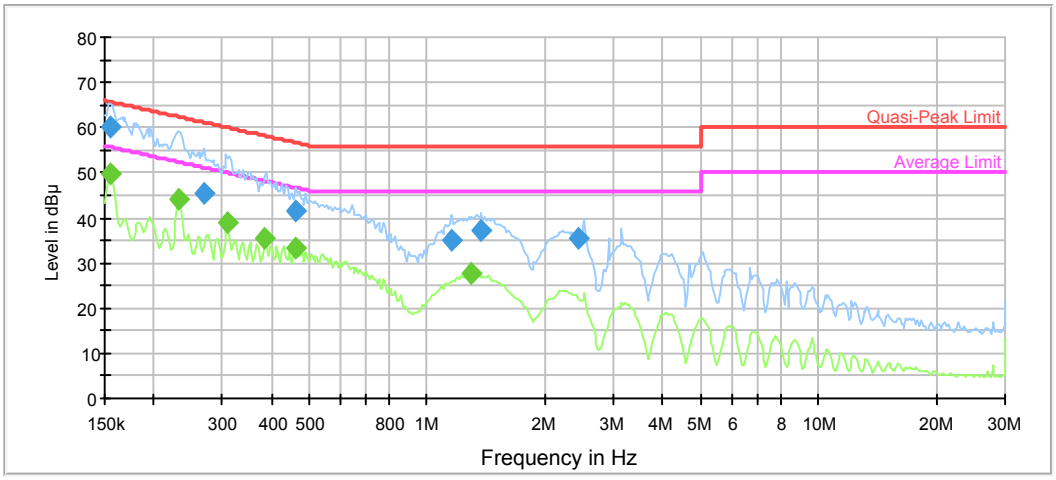
Temperature:	28°C
Relative Humidity:	66 %
ATM Pressure:	100.7kPa

The testing was performed by Ade Xiao on 2019-06-05.

Test Mode: Transmitting (Pre-scan BLE 1M and BLE 2M, BLE 1M low channel was the worst case)

AC120 V, 60 Hz, Line:

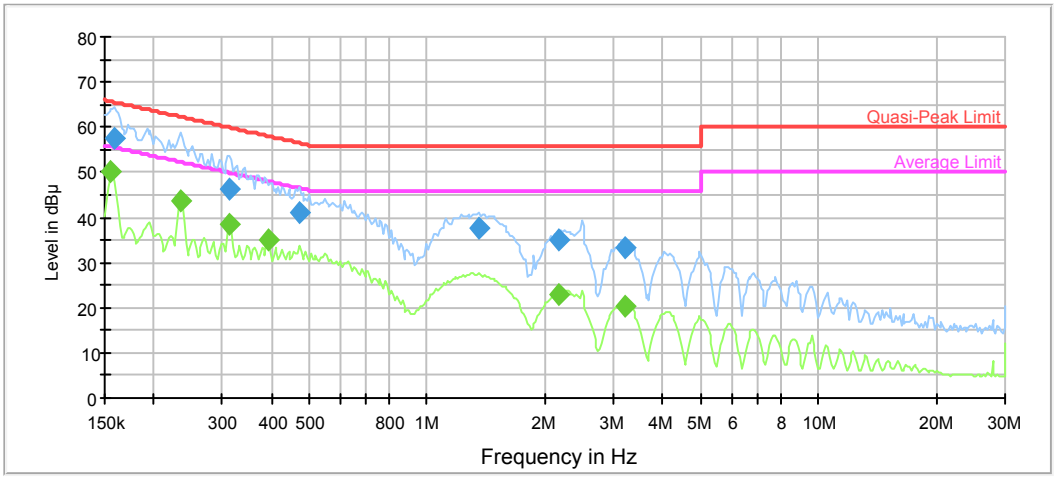
Mode: BLE 1M Low channel



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	60.2	9.000	L1	11.1	5.5	65.7	Compliance
0.269807	45.6	9.000	L1	10.2	15.6	61.1	Compliance
0.461750	41.3	9.000	L1	9.9	15.3	56.7	Compliance
1.153382	35.2	9.000	L1	9.8	20.8	56.0	Compliance
1.379615	37.1	9.000	L1	9.8	18.9	56.0	Compliance
2.421856	35.5	9.000	L1	9.8	20.5	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	49.8	9.000	L1	11.1	5.8	55.7	Compliance
0.232398	44.0	9.000	L1	10.4	8.4	52.4	Compliance
0.310136	39.1	9.000	L1	10.1	10.9	50.0	Compliance
0.386031	35.6	9.000	L1	10.0	12.5	48.1	Compliance
0.461750	33.2	9.000	L1	9.9	13.5	46.7	Compliance
1.291856	27.8	9.000	L1	9.8	18.2	46.0	Compliance

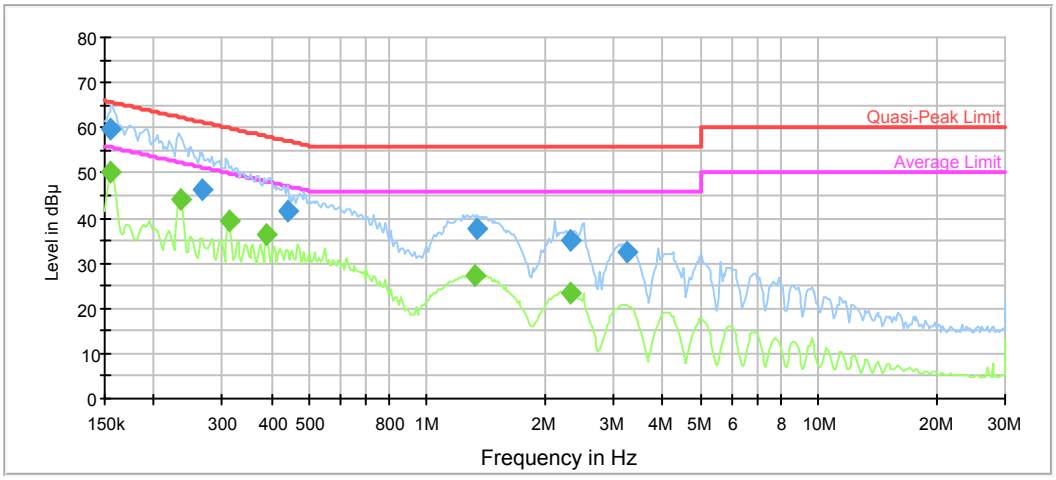
AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.159228	57.7	9.000	N	11.0	7.8	65.5	Compliance
0.313237	46.1	9.000	N	10.1	13.8	59.9	Compliance
0.471031	41.2	9.000	N	9.9	15.3	56.5	Compliance
1.352431	37.6	9.000	N	9.8	18.4	56.0	Compliance
2.181856	35.1	9.000	N	9.8	20.9	56.0	Compliance
3.221974	33.2	9.000	N	9.8	22.8	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	50.2	9.000	N	11.1	5.5	55.7	Compliance
0.234722	43.6	9.000	N	10.4	8.7	52.3	Compliance
0.313237	38.6	9.000	N	10.1	11.3	49.9	Compliance
0.393790	35.2	9.000	N	10.0	12.8	48.0	Compliance
2.181856	23.0	9.000	N	9.8	23.0	46.0	Compliance
3.221974	20.4	9.000	N	9.8	25.6	46.0	Compliance

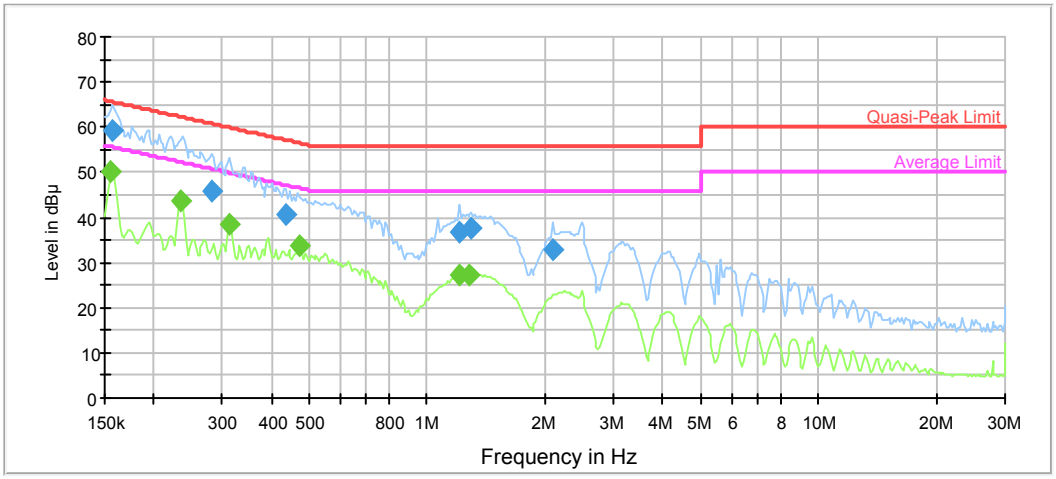
Mode: Zigbee



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	59.7	9.000	L1	11.1	6.0	65.7	Compliance
0.267135	46.3	9.000	L1	10.3	14.9	61.2	Compliance
0.439339	41.6	9.000	L1	9.9	15.5	57.1	Compliance
1.339041	37.6	9.000	L1	9.8	18.4	56.0	Compliance
2.321856	35.1	9.000	L1	9.8	20.9	56.0	Compliance
3.241974	32.4	9.000	L1	9.8	23.6	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	50.2	9.000	L1	11.1	5.5	55.7	Compliance
0.234722	43.9	9.000	L1	10.4	8.4	52.3	Compliance
0.313237	39.1	9.000	L1	10.1	10.7	49.9	Compliance
0.389891	36.3	9.000	L1	10.0	11.8	48.1	Compliance
1.321856	27.3	9.000	L1	9.8	18.7	46.0	Compliance
2.321974	23.3	9.000	L1	9.8	25.7	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.157652	59.2	9.000	N	11.1	6.4	65.6	Compliance
0.280762	45.8	9.000	N	10.2	15.0	60.8	Compliance
0.434989	40.5	9.000	N	9.9	16.7	57.2	Compliance
1.212216	36.9	9.000	N	9.8	19.1	56.0	Compliance
1.299660	37.6	9.000	N	9.8	18.4	56.0	Compliance
2.095345	33.0	9.000	N	9.8	23.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	50.1	9.000	N	11.1	5.6	55.7	Compliance
0.234722	43.5	9.000	N	10.4	8.8	52.3	Compliance
0.313237	38.6	9.000	N	10.1	11.3	49.9	Compliance
0.471031	33.8	9.000	N	9.9	12.7	46.5	Compliance
1.212216	27.1	9.000	N	9.8	18.9	46.0	Compliance
1.286792	27.3	9.000	N	9.8	18.7	46.0	Compliance

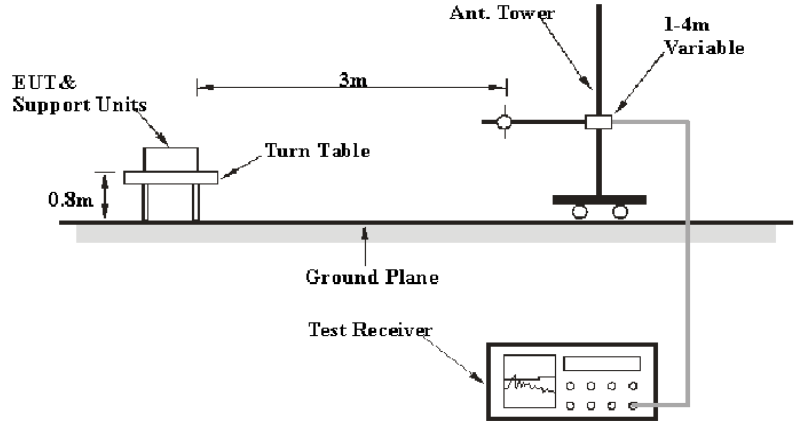
FCC §15.209, §15.205, §15.247(d) & RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10- SPURIOUS EMISSIONS

Applicable Standard

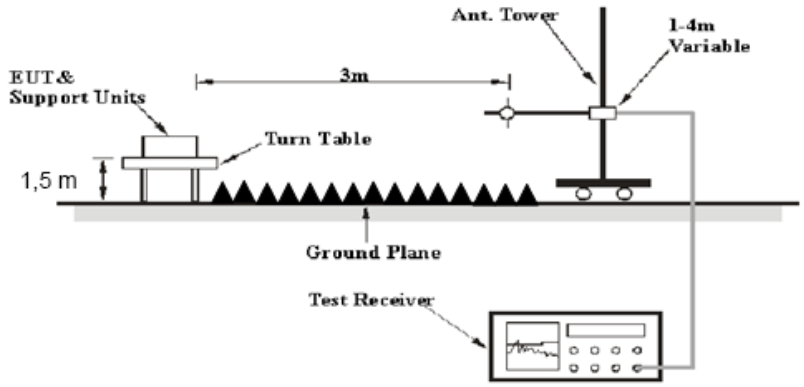
FCC §15.247 (d); §15.209; §15.205, RSS-247 §5.5, RSS-GEN §8.10.

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 10 meters chamber for the range 30MHz to 1GHz and the 3 meters chamber B test site for above 1GHz, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247, the RSS-247 §5.5,RSS-Gen §8.10 limits..

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

30MHz-1000MHz:

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

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

1GHz- 26.5GHz:

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

Note: T is minimum transmission duration

Test Procedure

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

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

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2018-12-11	2019-12-11
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2020-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2019-01-05	2020-01-04
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2018-06-27	2019-06-27
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2018-06-27	2019-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2018-06-16	2019-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2018-06-16	2019-06-16

*** 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:	28°C
Relative Humidity:	66 %
ATM Pressure:	100.7kPa

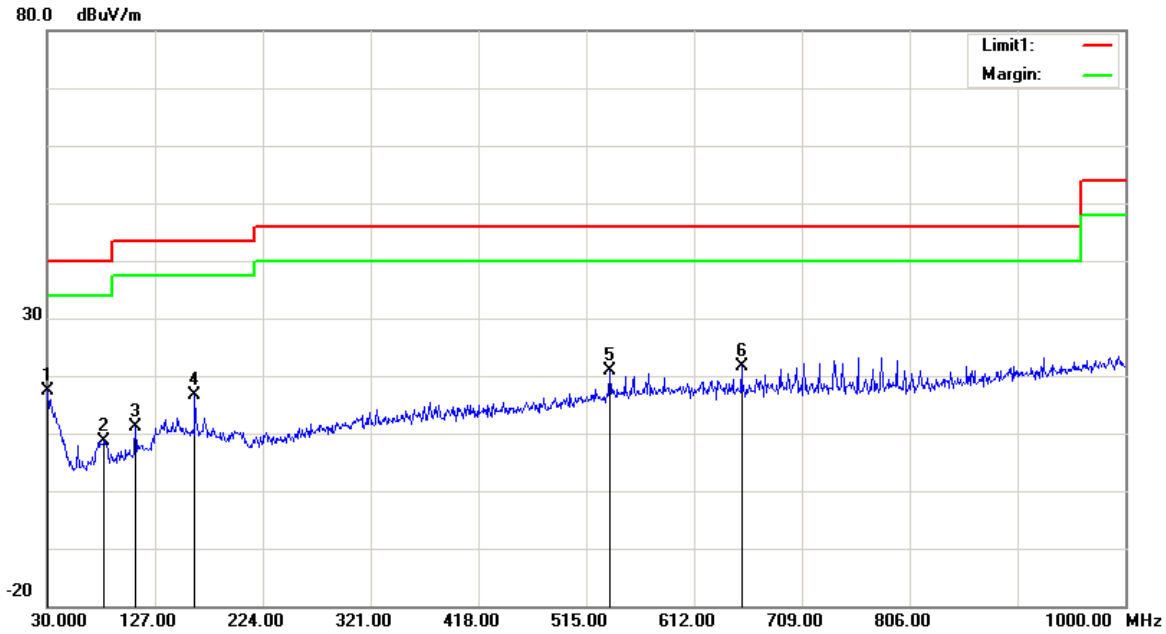
** The testing was performed by Neil Liao&Sunny Cen on 2019-06-05*

Test Mode: Transmitting

1) 30MHz-1GHz (High channel was the worst):

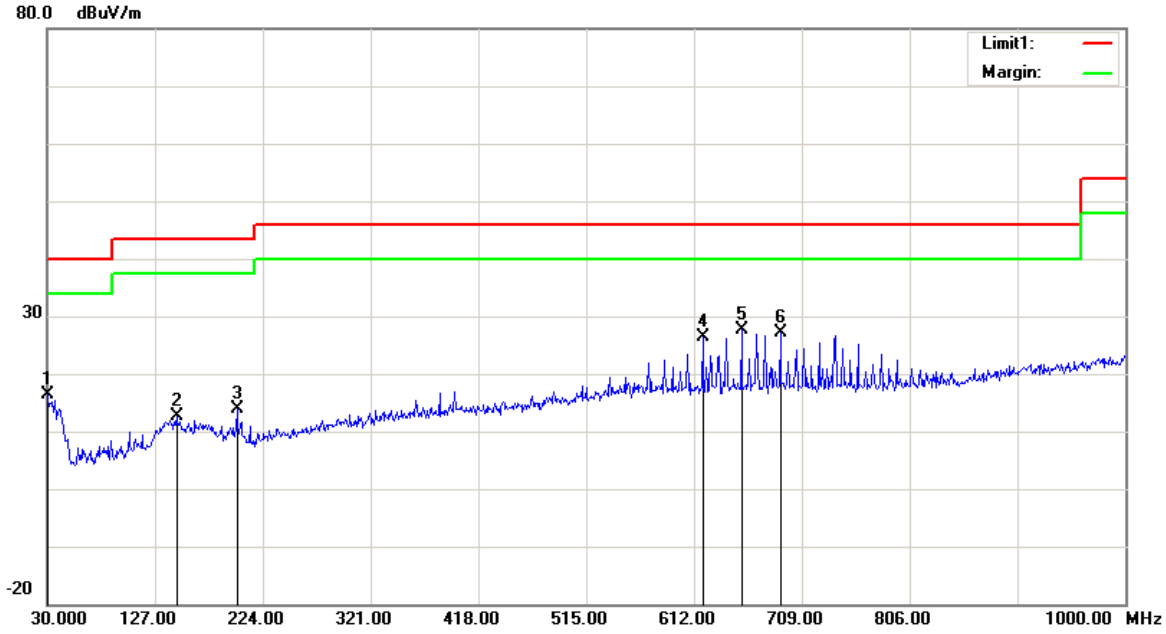
Mode: BLE 1M

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	29.67	peak	-12.40	17.27	40.00	22.73
81.4100	32.05	peak	-23.43	8.62	40.00	31.38
109.5400	31.65	peak	-20.54	11.11	43.50	32.39
162.8900	33.44	peak	-16.88	16.56	43.50	26.94
536.3400	29.74	peak	-8.79	20.95	46.00	25.05
654.6800	28.33	peak	-6.59	21.74	46.00	24.26

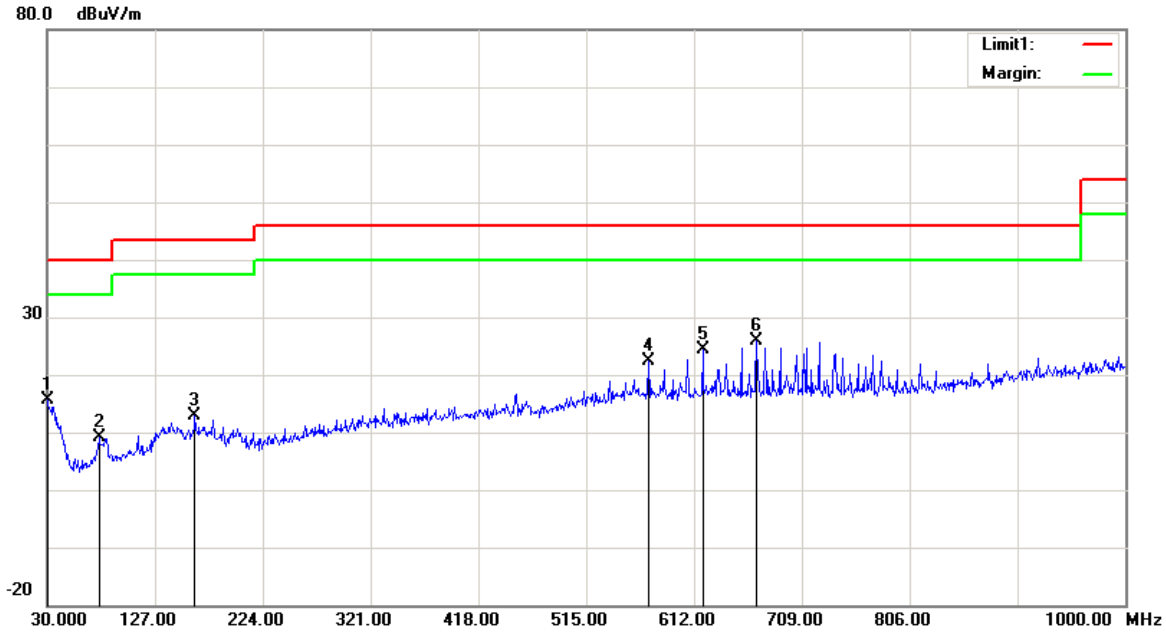
Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	28.30	peak	-11.95	16.35	40.00	23.65
146.4000	29.30	peak	-16.77	12.53	43.50	30.97
200.7200	30.82	peak	-16.90	13.92	43.50	29.58
619.7600	33.49	peak	-7.18	26.31	46.00	19.69
654.6800	34.13	peak	-6.59	27.54	46.00	18.46
689.6000	33.12	peak	-5.94	27.18	46.00	18.82

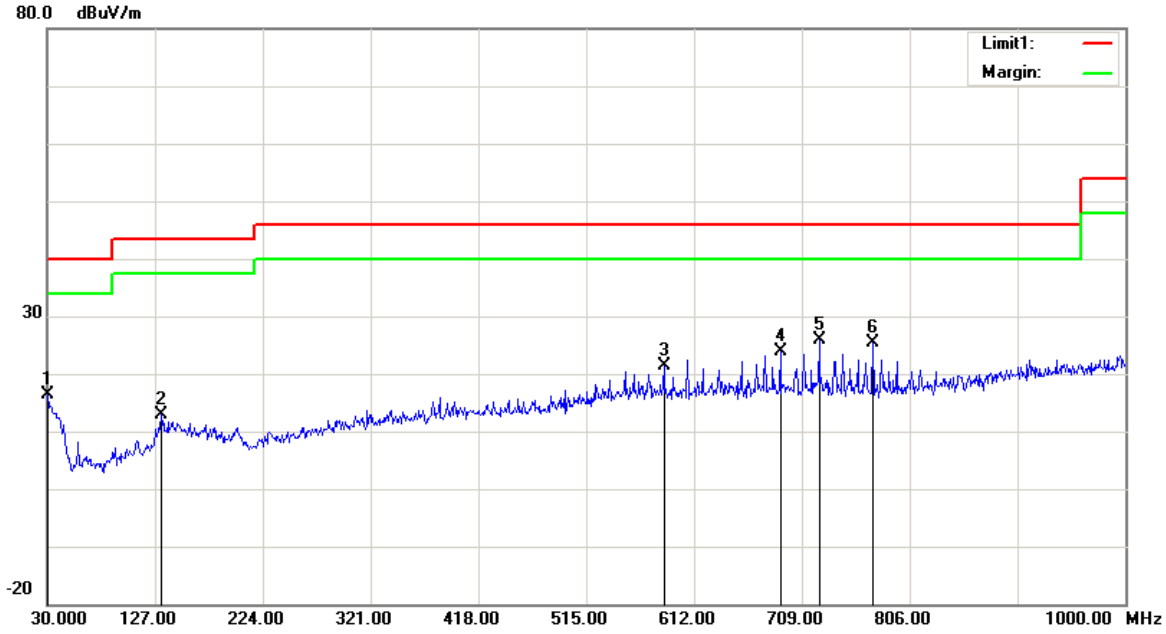
Mode: BLE 2M

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	27.61	peak	-11.95	15.66	40.00	24.34
76.5600	32.97	peak	-23.74	9.23	40.00	30.77
162.8900	29.76	peak	-16.88	12.88	43.50	30.62
571.2600	30.17	peak	-7.67	22.50	46.00	23.50
619.7600	31.55	peak	-7.18	24.37	46.00	21.63
668.2600	32.27	peak	-6.30	25.97	46.00	20.03

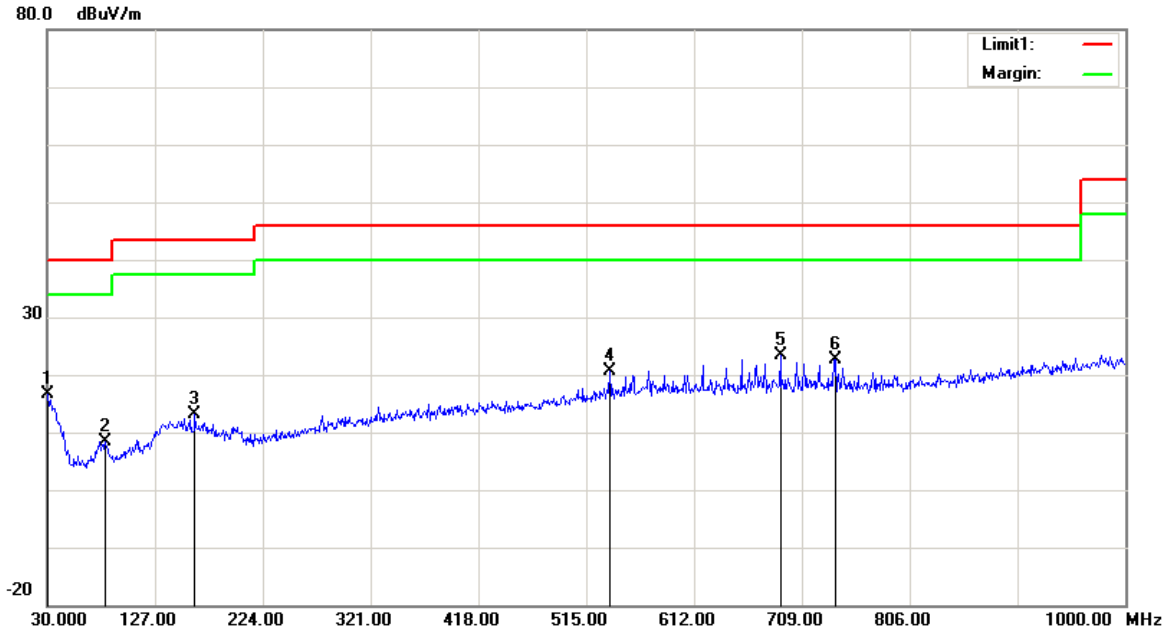
Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	28.23	peak	-11.95	16.28	40.00	23.72
132.8200	30.07	peak	-17.17	12.90	43.50	30.60
584.8400	28.91	peak	-7.47	21.44	46.00	24.56
689.6000	29.91	peak	-5.94	23.97	46.00	22.03
724.5200	31.43	peak	-5.60	25.83	46.00	20.17
773.0200	30.17	peak	-4.87	25.30	46.00	20.70

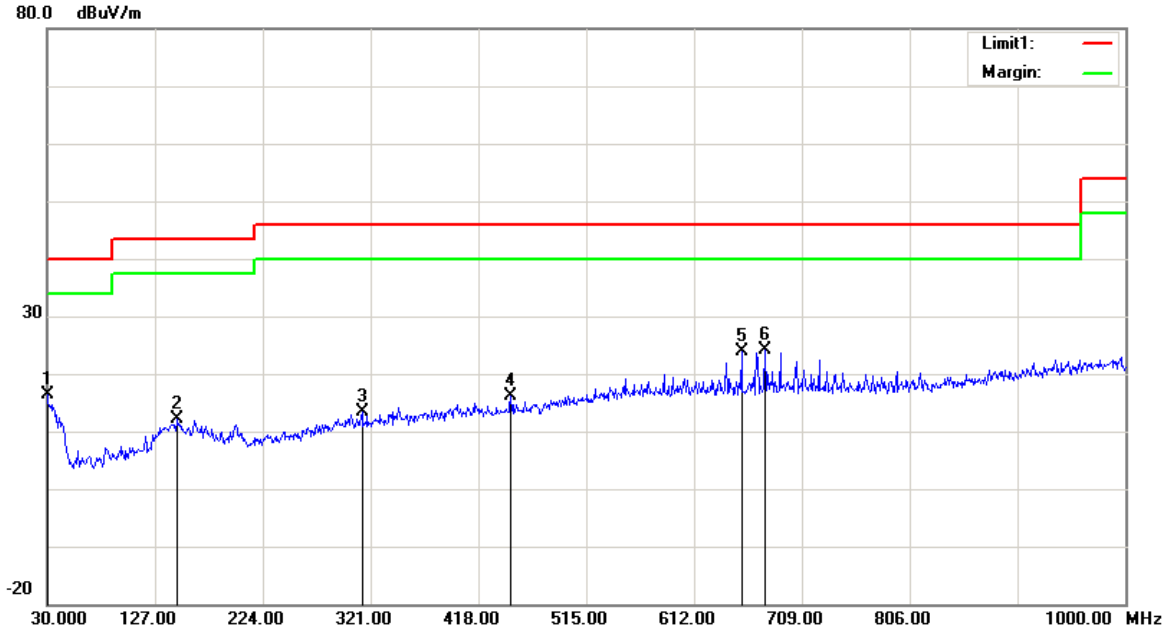
Mode: Zigbee

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	28.91	peak	-12.40	16.51	40.00	23.49
82.3800	31.68	peak	-23.34	8.34	40.00	31.66
162.8900	29.97	peak	-16.88	13.09	43.50	30.41
536.3400	29.48	peak	-8.79	20.69	46.00	25.31
689.6000	29.33	peak	-5.94	23.39	46.00	22.61
739.0700	28.09	peak	-5.37	22.72	46.00	23.28

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	28.28	peak	-11.95	16.33	40.00	23.67
147.3700	28.98	peak	-16.78	12.20	43.50	31.30
313.2400	27.78	peak	-14.43	13.35	46.00	32.65
447.1000	27.60	peak	-11.48	16.12	46.00	29.88
654.6800	30.49	peak	-6.59	23.90	46.00	22.10
676.0200	30.39	peak	-6.18	24.21	46.00	21.79

2) 1-26.5GHz:

BLE 1M Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	68.33	PK	H	28.10	1.80	0.00	98.23	N/A	N/A
2402.00	67.89	AV	H	28.10	1.80	0.00	97.79	N/A	N/A
2402.00	64.30	PK	V	28.10	1.80	0.00	94.20	N/A	N/A
2402.00	63.80	AV	V	28.10	1.80	0.00	93.70	N/A	N/A
2390.00	26.49	PK	H	28.08	1.80	0.00	56.37	74.00	17.63
2390.00	14.69	AV	H	28.08	1.80	0.00	44.57	54.00	9.43
4804.00	57.16	PK	H	32.91	3.17	37.20	56.04	74.00	17.96
4804.00	53.48	AV	H	32.91	3.17	37.20	52.36	54.00	1.64
7206.00	46.02	PK	H	35.74	4.82	37.23	49.35	74.00	24.65
7206.00	32.15	AV	H	35.74	4.82	37.23	35.48	54.00	18.52
Middle Channel:2442 MHz									
2442.00	68.16	PK	H	28.18	1.82	0.00	98.16	N/A	N/A
2442.00	67.41	AV	H	28.18	1.82	0.00	97.41	N/A	N/A
2442.00	64.36	PK	V	28.18	1.82	0.00	94.36	N/A	N/A
2442.00	63.73	AV	V	28.18	1.82	0.00	93.73	N/A	N/A
4884.00	57.63	PK	H	33.07	3.28	37.21	56.77	74.00	17.23
4884.00	53.78	AV	H	33.07	3.28	37.21	52.92	54.00	1.08
7326.00	45.90	PK	H	36.05	4.61	37.38	49.18	74.00	24.82
7326.00	31.90	AV	H	36.05	4.61	37.38	35.18	54.00	18.82
Low Channel:2480 MHz									
2480.00	66.89	PK	H	28.26	1.84	0.00	96.99	N/A	N/A
2480.00	66.12	AV	H	28.26	1.84	0.00	96.22	N/A	N/A
2480.00	62.36	PK	V	28.26	1.84	0.00	92.46	N/A	N/A
2480.00	61.75	AV	V	28.26	1.84	0.00	91.85	N/A	N/A
2483.50	26.67	PK	H	28.27	1.84	0.00	56.78	74.00	17.22
2483.50	15.92	AV	H	28.27	1.84	0.00	46.03	54.00	7.97
4960.00	56.37	PK	H	33.22	3.23	37.25	55.57	74.00	18.43
4960.00	52.18	AV	H	33.22	3.23	37.25	51.38	54.00	2.62
7440.00	46.12	PK	H	36.34	4.41	37.52	49.35	74.00	24.65
7440.00	32.54	AV	H	36.34	4.41	37.52	35.77	54.00	18.23

BLE 2M Mode:

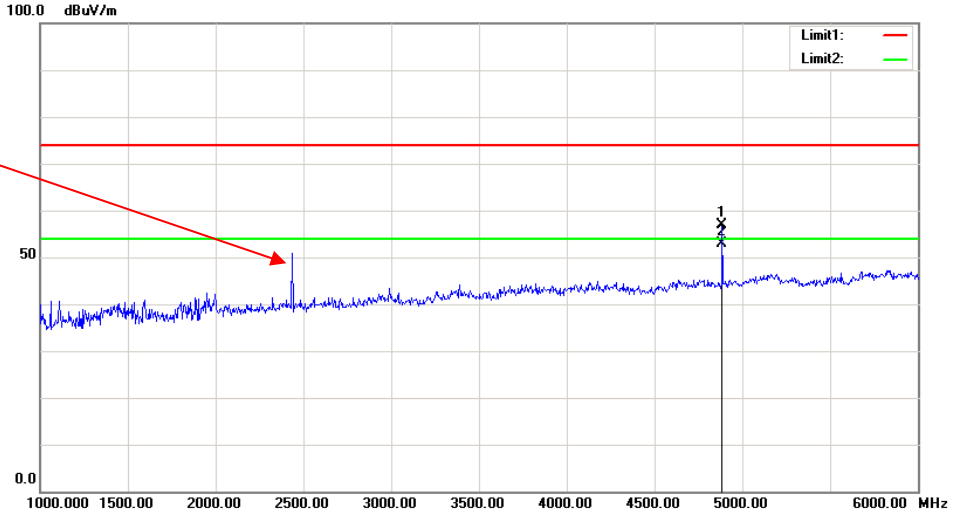
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	68.07	PK	H	28.10	1.80	0.00	97.97	N/A	N/A
2402.00	66.67	AV	H	28.10	1.80	0.00	96.57	N/A	N/A
2402.00	64.15	PK	V	28.10	1.80	0.00	94.05	N/A	N/A
2402.00	62.72	AV	V	28.10	1.80	0.00	92.62	N/A	N/A
2390.00	25.79	PK	H	28.08	1.80	0.00	55.67	74.00	18.33
2390.00	15.48	AV	H	28.08	1.80	0.00	45.36	54.00	8.64
4804.00	58.49	PK	H	32.91	3.17	37.20	57.37	74.00	16.63
4804.00	52.36	AV	H	32.91	3.17	37.20	51.24	54.00	2.76
7206.00	45.36	PK	H	35.74	4.82	37.23	48.69	74.00	25.31
7206.00	32.07	AV	H	35.74	4.82	37.23	35.40	54.00	18.60
Middle channel: 2442 MHz									
2442.00	68.61	PK	H	28.18	1.82	0.00	98.61	N/A	N/A
2442.00	67.21	AV	H	28.18	1.82	0.00	97.21	N/A	N/A
2442.00	64.36	PK	V	28.18	1.82	0.00	94.36	N/A	N/A
2442.00	63.09	AV	V	28.18	1.82	0.00	93.09	N/A	N/A
4884.00	57.60	PK	H	33.07	3.28	37.21	56.74	74.00	17.26
4884.00	51.65	AV	H	33.07	3.28	37.21	50.79	54.00	3.21
7326.00	45.58	PK	H	36.05	4.61	37.38	48.86	74.00	25.14
7326.00	32.10	AV	H	36.05	4.61	37.38	35.38	54.00	18.62
High Channel: 2480 MHz									
2480.00	66.83	PK	H	28.26	1.84	0.00	96.93	N/A	N/A
2480.00	65.41	AV	H	28.26	1.84	0.00	95.51	N/A	N/A
2480.00	62.51	PK	V	28.26	1.84	0.00	92.61	N/A	N/A
2480.00	61.03	AV	V	28.26	1.84	0.00	91.13	N/A	N/A
2483.50	30.48	PK	H	28.27	1.84	0.00	60.59	74.00	13.41
2483.50	19.82	AV	H	28.27	1.84	0.00	49.93	54.00	4.07
4960.00	55.85	PK	H	33.22	3.23	37.25	55.05	74.00	18.95
4960.00	49.66	AV	H	33.22	3.23	37.25	48.86	54.00	5.14
7440.00	45.74	PK	H	36.34	4.41	37.52	48.97	74.00	25.03
7440.00	32.06	AV	H	36.34	4.41	37.52	35.29	54.00	18.71

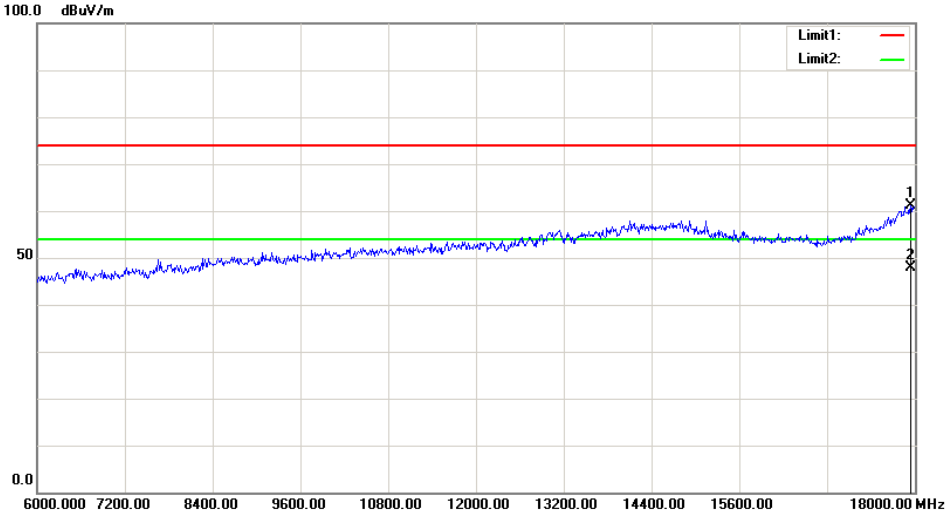
ZigBee Mode:

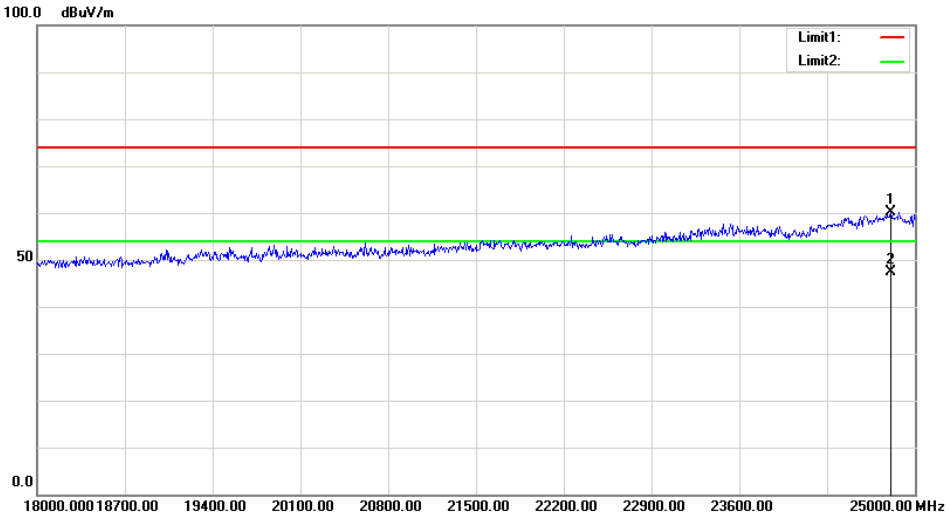
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Low Channel: 2405 MHz									
2405.00	69.65	PK	H	28.11	1.80	0.00	99.56	N/A	N/A
2405.00	67.50	AV	H	28.11	1.80	0.00	97.41	N/A	N/A
2405.00	64.05	PK	V	28.11	1.80	0.00	93.96	N/A	N/A
2405.00	62.18	AV	V	28.11	1.80	0.00	92.09	N/A	N/A
2390.00	26.20	PK	H	28.08	1.80	0.00	56.08	74.00	17.92
2390.00	13.73	AV	H	28.08	1.80	0.00	43.61	54.00	10.39
4810.00	54.36	PK	H	32.92	3.17	37.20	53.25	74.00	20.75
4810.00	46.12	AV	H	32.92	3.17	37.20	45.01	54.00	8.99
7215.00	44.51	PK	H	35.76	4.81	37.24	47.84	74.00	26.16
7215.00	32.15	AV	H	35.76	4.81	37.24	35.48	54.00	18.52
Middle Channel: 2445 MHz									
2445.00	69.20	PK	H	28.19	1.82	0.00	99.21	N/A	N/A
2445.00	67.09	AV	H	28.19	1.82	0.00	97.10	N/A	N/A
2445.00	64.30	PK	V	28.19	1.82	0.00	94.31	N/A	N/A
2445.00	62.41	AV	V	28.19	1.82	0.00	92.42	N/A	N/A
4890.00	54.67	PK	H	33.08	3.29	37.21	53.83	74.00	20.17
4890.00	47.07	AV	H	33.08	3.29	37.21	46.23	54.00	7.77
7335.00	45.47	PK	H	36.07	4.60	37.39	48.75	74.00	25.25
7335.00	31.85	AV	H	36.07	4.60	37.39	35.13	54.00	18.87
High Channel: 2480 MHz									
2480.00	69.33	PK	H	28.26	1.84	0.00	99.43	N/A	N/A
2480.00	67.11	AV	H	28.26	1.84	0.00	97.21	N/A	N/A
2480.00	63.25	PK	V	28.26	1.84	0.00	93.35	N/A	N/A
2480.00	61.09	AV	V	28.26	1.84	0.00	91.19	N/A	N/A
2483.50	30.43	PK	H	28.27	1.84	0.00	60.54	74.00	13.46
2483.50	19.26	AV	H	28.27	1.84	0.00	49.37	54.00	4.63
4960.00	56.37	PK	H	33.22	3.23	37.25	55.57	74.00	18.43
4960.00	49.75	AV	H	33.22	3.23	37.25	48.95	54.00	5.05
7440.00	45.32	PK	H	36.34	4.41	37.52	48.55	74.00	25.45
7440.00	32.08	AV	H	36.34	4.41	37.52	35.31	54.00	18.69

Worst Test plots (BLE 1M low channel was the worst case)
Horizontal:

Fundamental Test with Band Rejection Filter

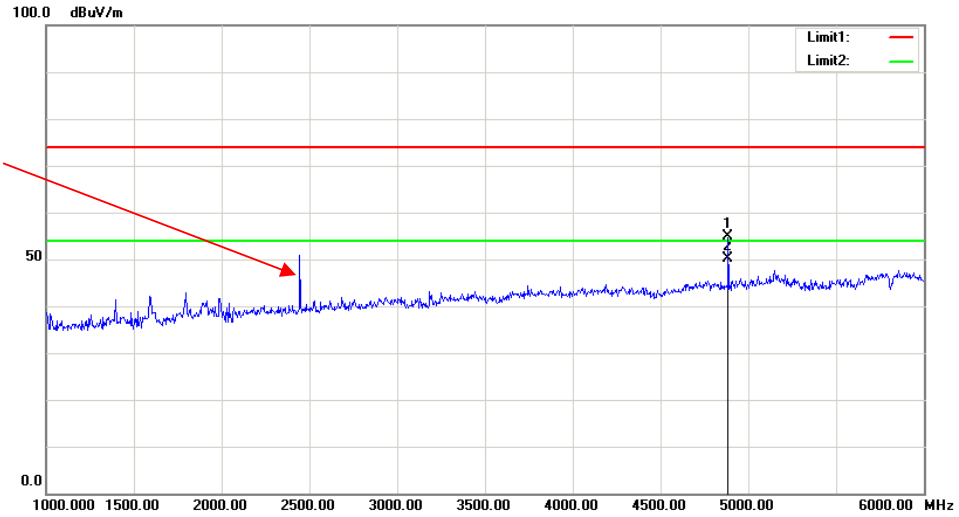


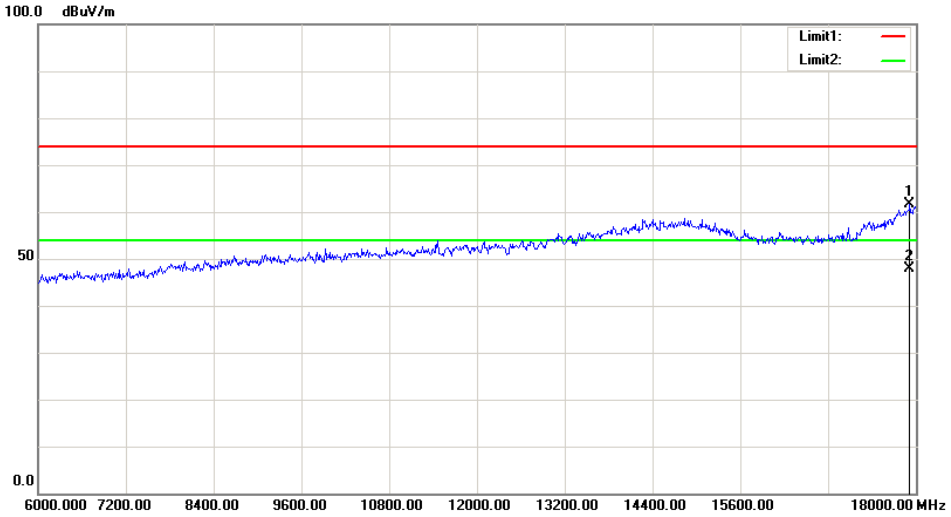


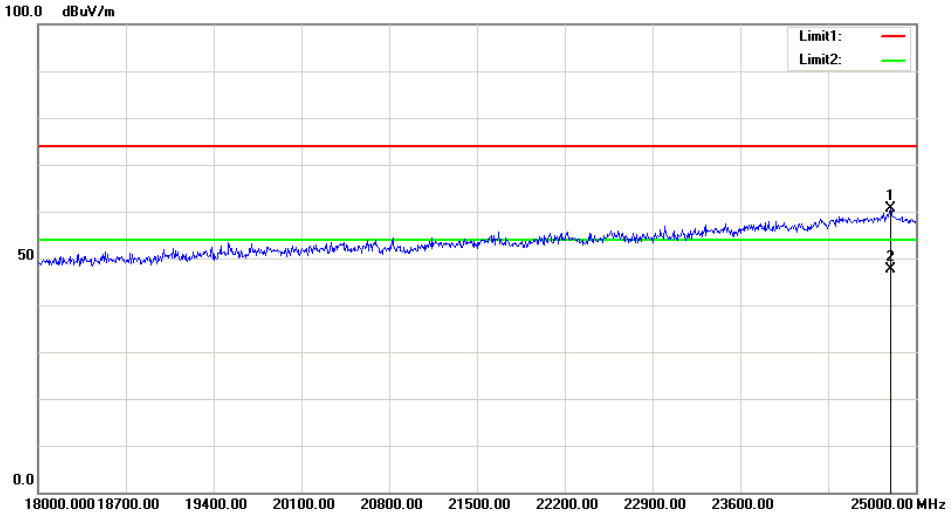


Vertical:

Fundamental Test with Band Rejection Filter

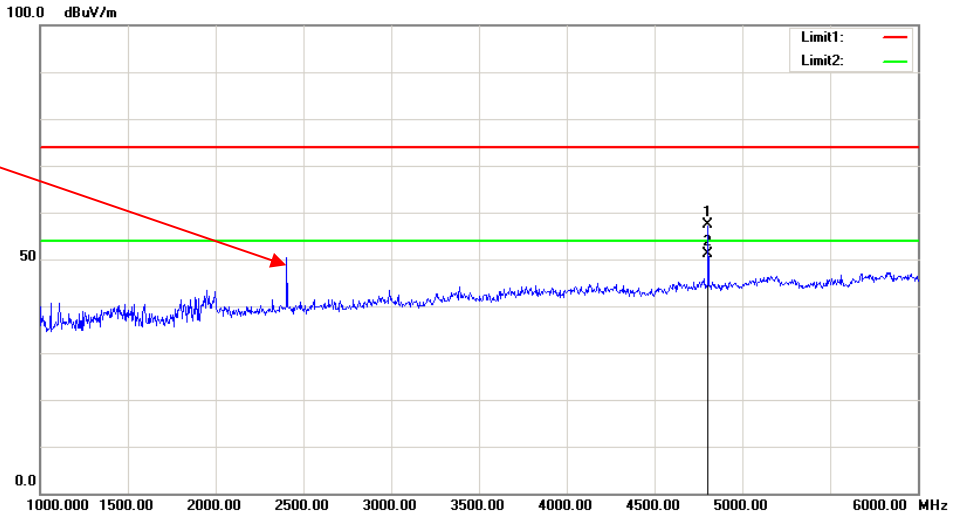


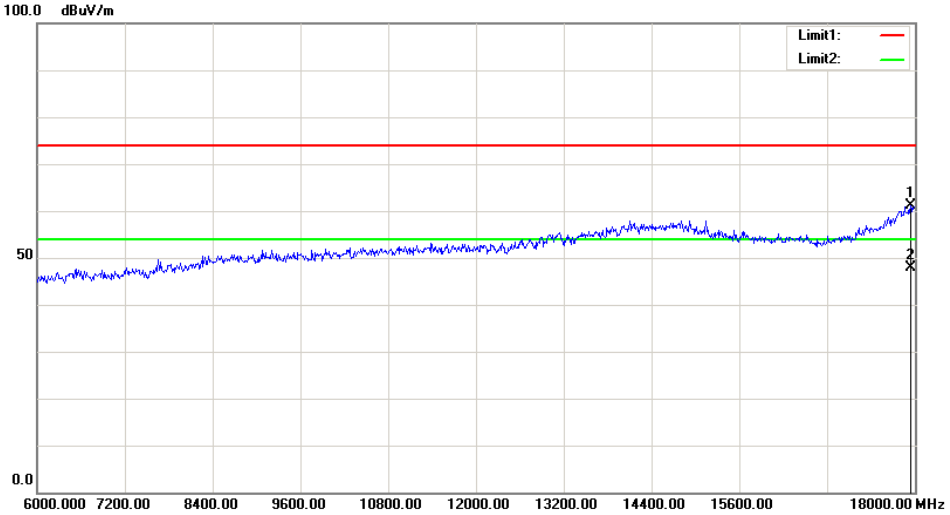


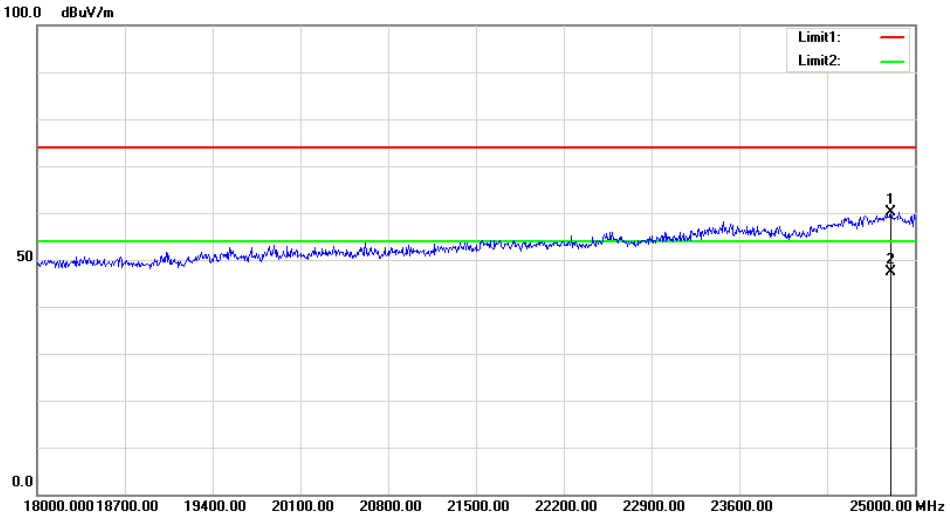


Worst Test plots(BLE_low channel 2M was the worst case)
Horizontal:

Fundamental Test with Band Rejection Filter

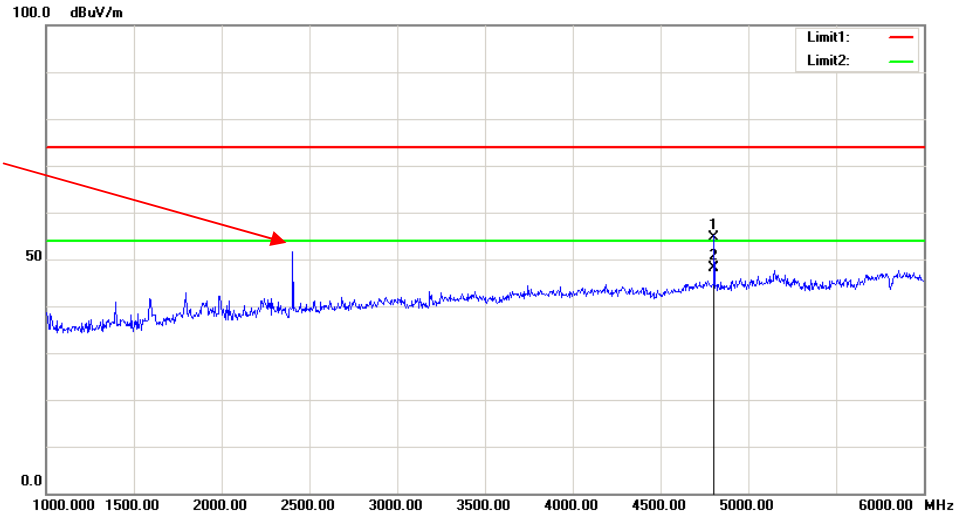


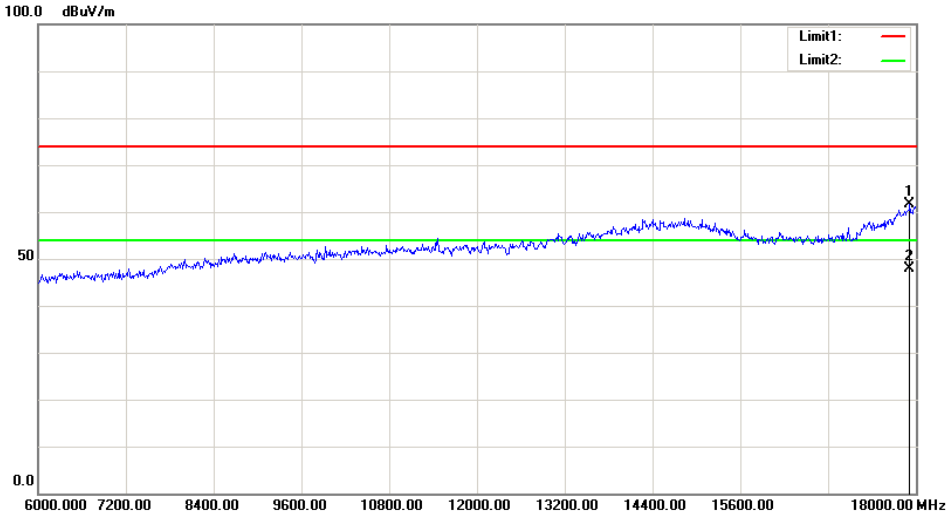


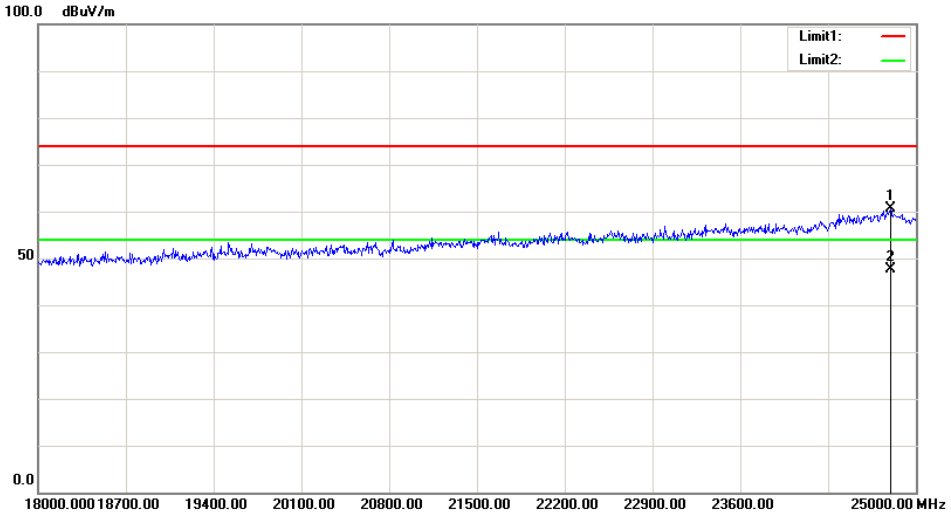


Vertical:

Fundamental Test with Band Rejection Filter

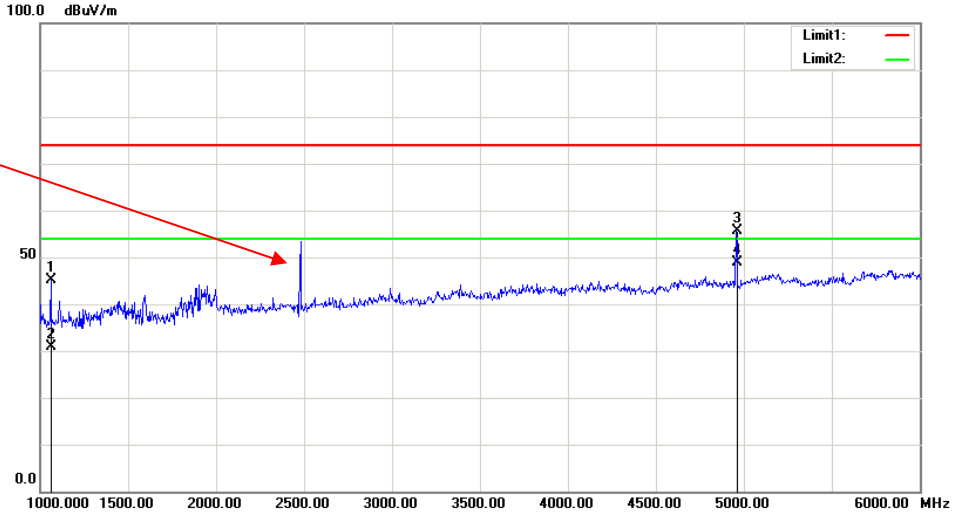


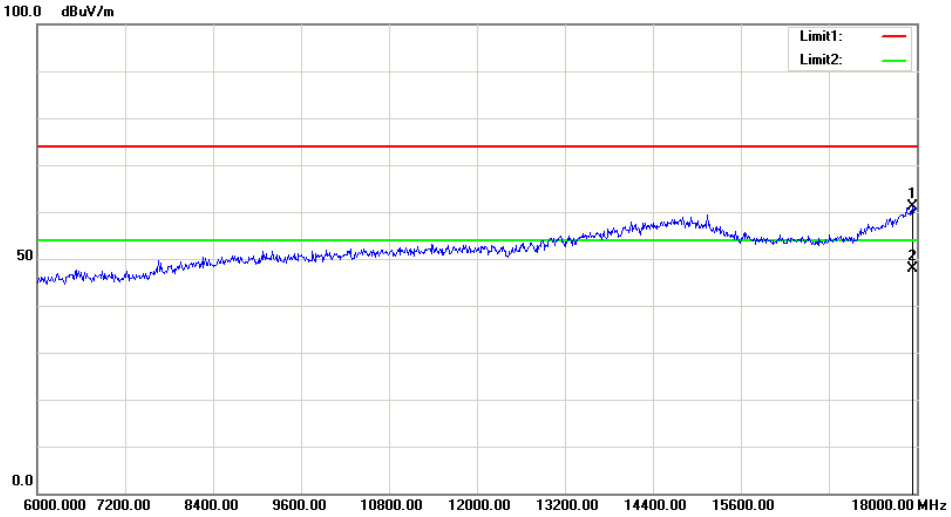


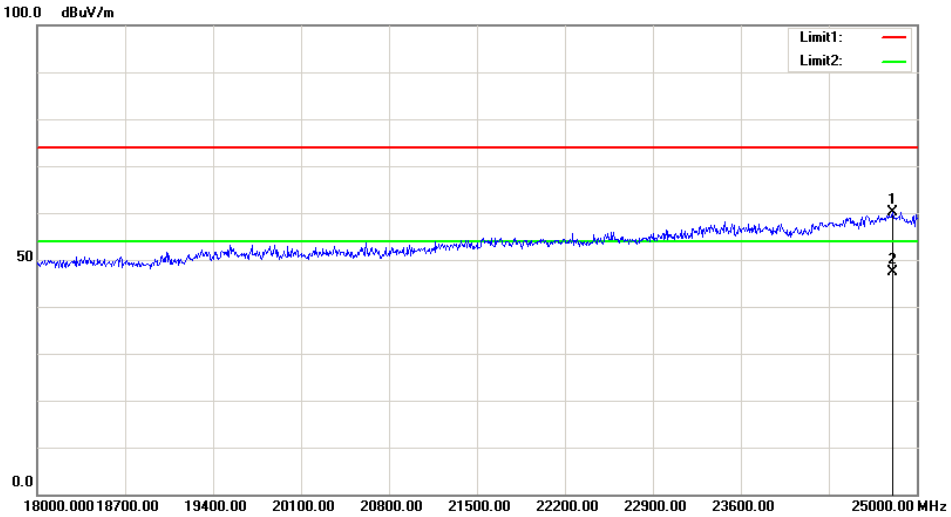


Worst Test plots(ZigBee high channel was the worst case)
Horizontal:

Fundamental Test with Band Rejection Filter

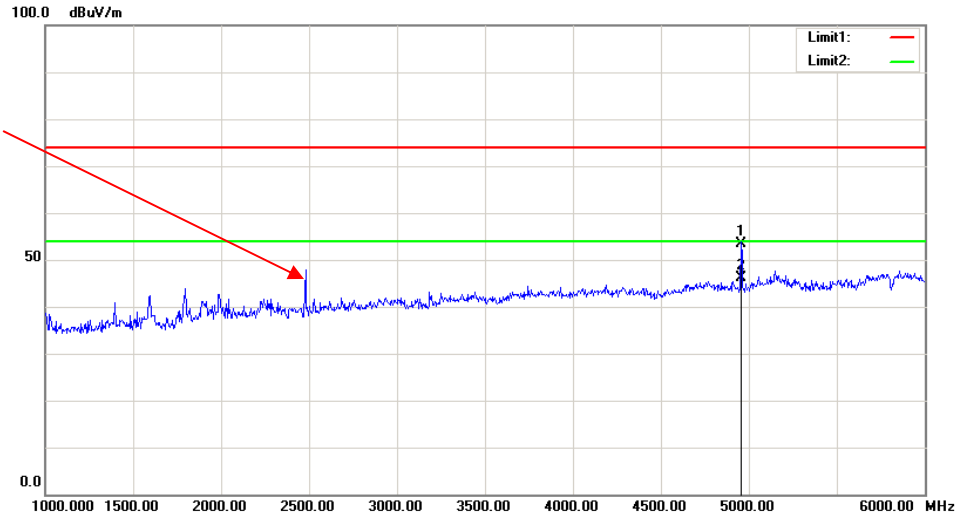


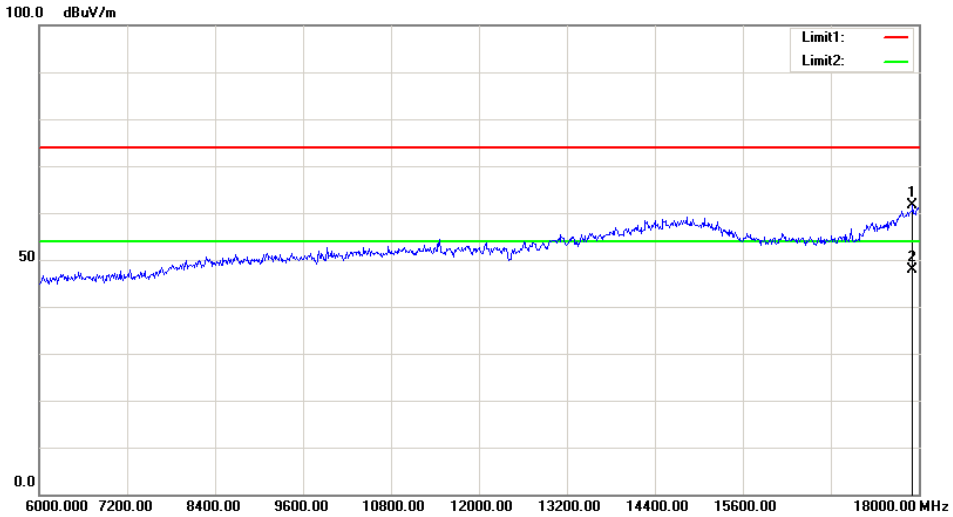


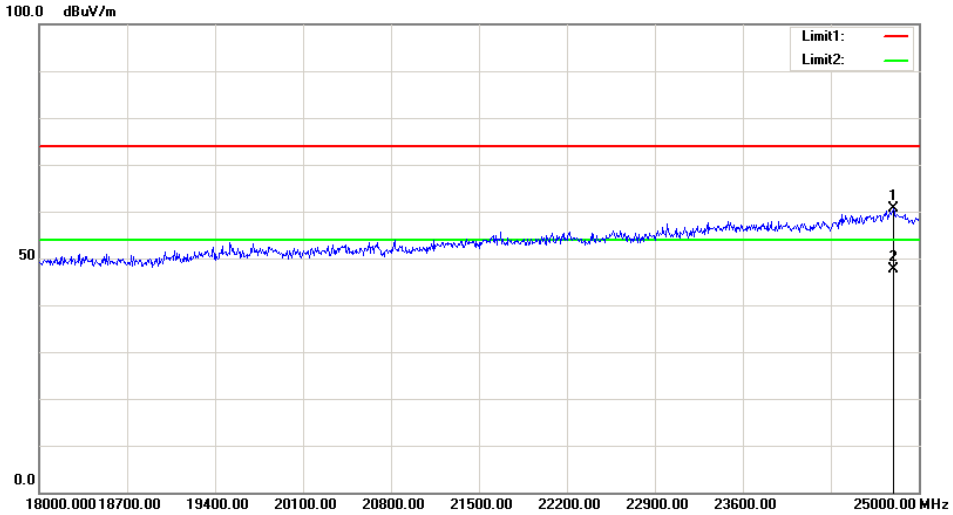


Vertical:

Fundamental Test with Band Rejection Filter







FCC §15.247(a) (2) & RSS-247 CLAUSE 5.2 a) &RSS-GEN CLAUSE 6.7–6 dB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (2)

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.

According to RSS-247 §5.2 a)

The minimum 6 dB bandwidth shall be 500 kHz.

According to RSS-Gen §6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

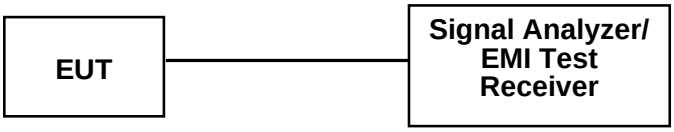
Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Test Procedure

6dB bandwidth test:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.

99% Occupied bandwidth test:
Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
Repeat above procedures until all frequencies measured were complete.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	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 Data

Environmental Conditions

Temperature:	26.7°C
Relative Humidity:	65%
ATM Pressure:	100.2 kPa

** The testing was performed by Tiago Huang on 2019-06-02*

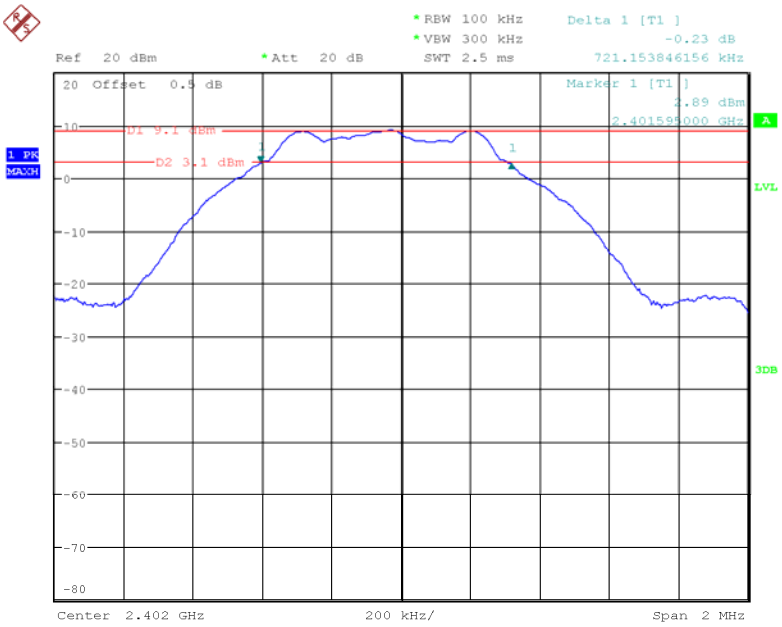
Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
BLE-1M	Low	2402	0.721	1.023	≥0.5
	Middle	2442	0.712	1.027	≥0.5
	High	2480	0.718	1.023	≥0.5
BLE-2M	Low	2402	1.187	2.047	≥0.5
	Middle	2442	1.247	2.047	≥0.5
	High	2480	1.187	2.060	≥0.5
ZigBee	Low	2405	1.458	2.233	≥0.5
	Middle	2445	1.525	2.233	≥0.5
	High	2480	1.367	2.233	≥0.5

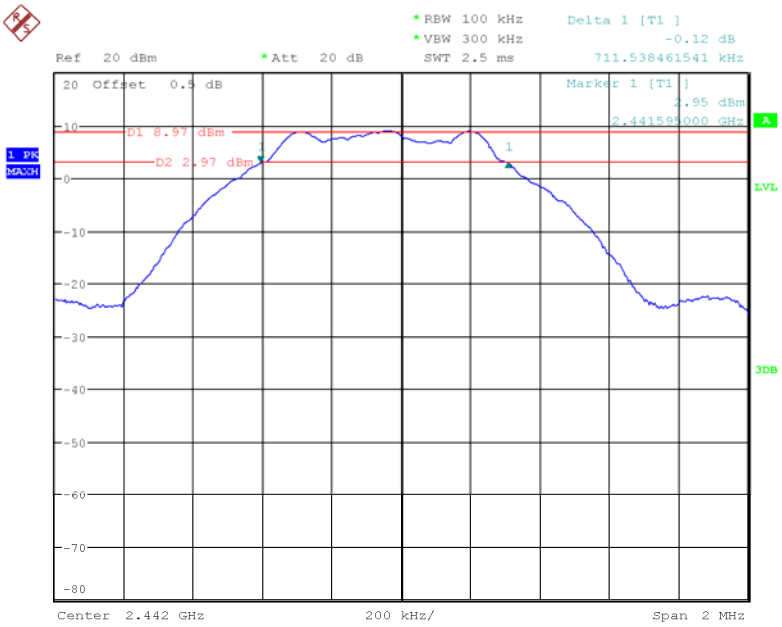
6dB bandwidth:

BLE-1M Low Channel



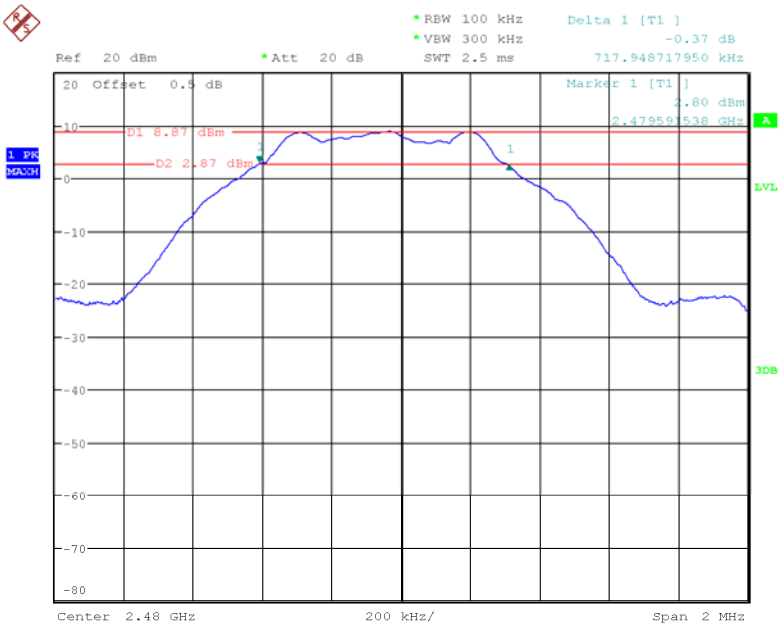
Date: 2.JUN.2019 10:30:51

BLE-1M Middle Channel



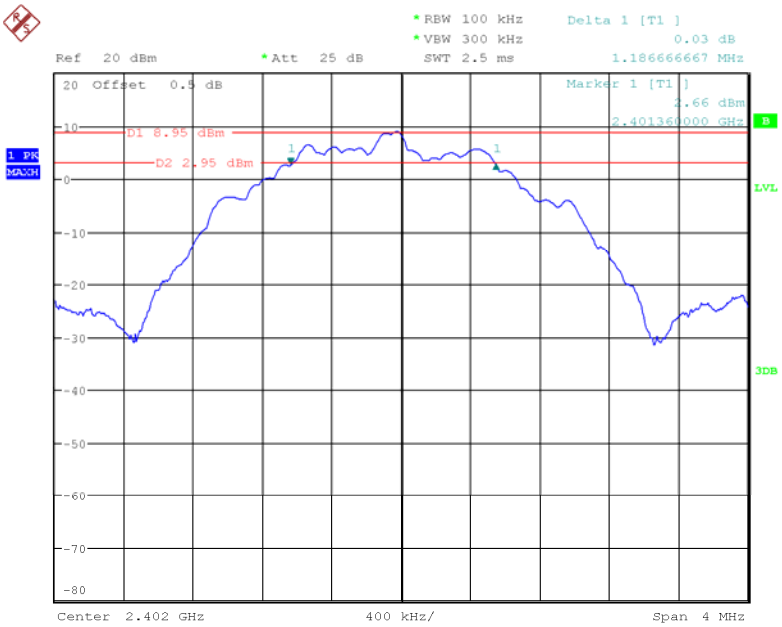
Date: 2.JUN.2019 10:36:44

BLE-1M High Channel



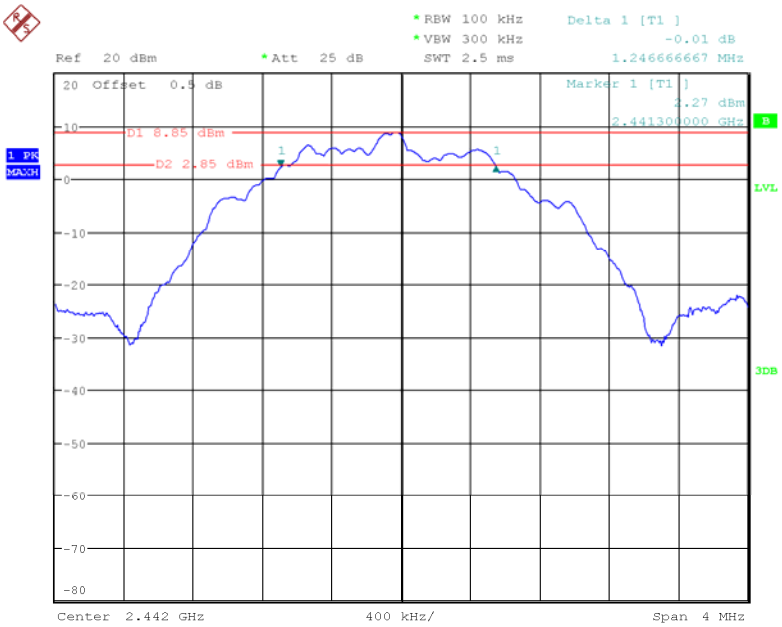
Date: 2.JUN.2019 10:44:00

BLE-2M Low Channel



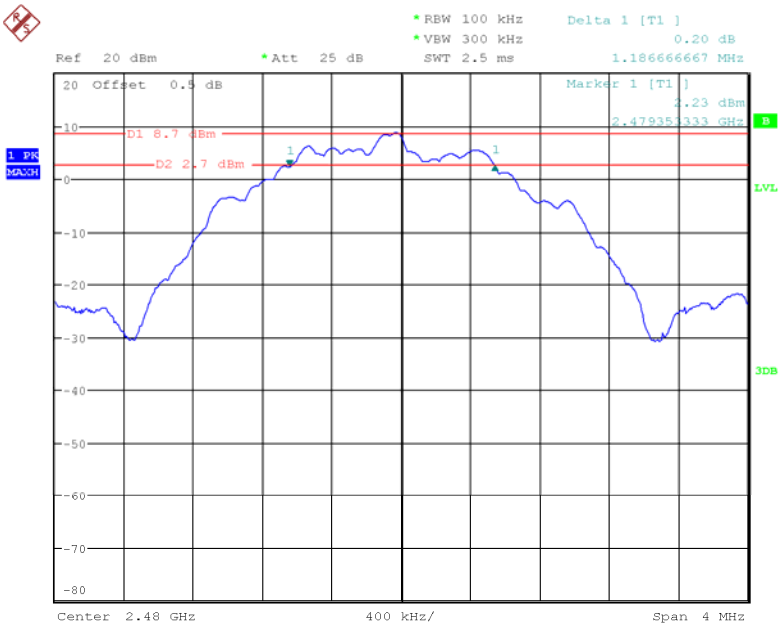
Date: 2.JUN.2019 10:53:40

BLE-2M Middle Channel



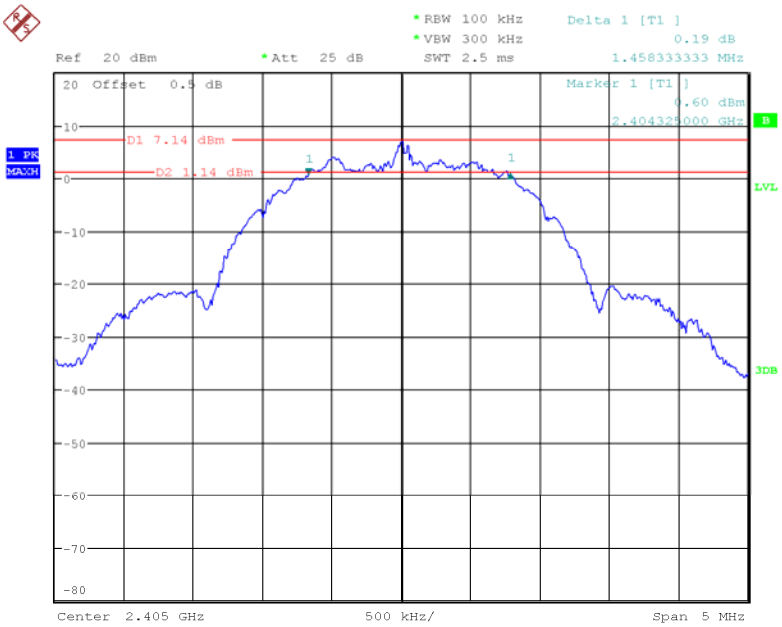
Date: 2.JUN.2019 10:56:43

BLE-2M High Channel



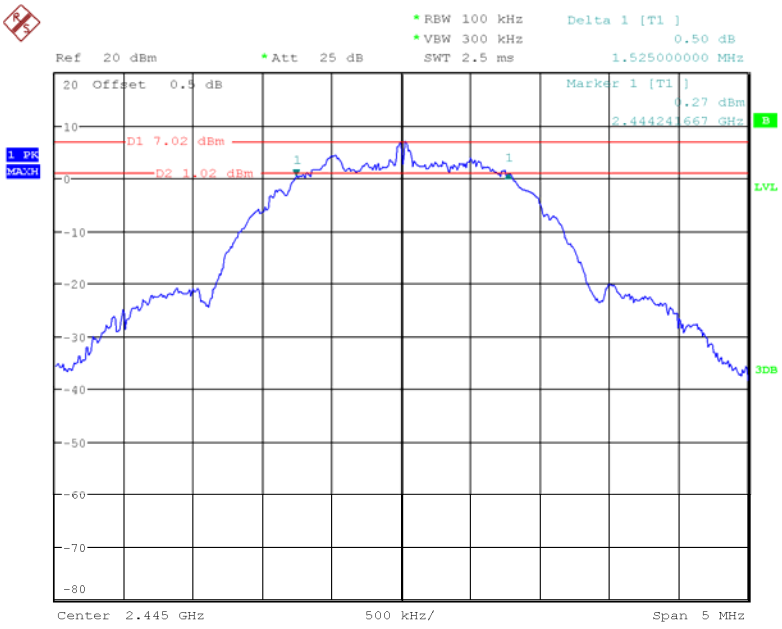
Date: 2.JUN.2019 11:07:03

ZigBee Low Channel



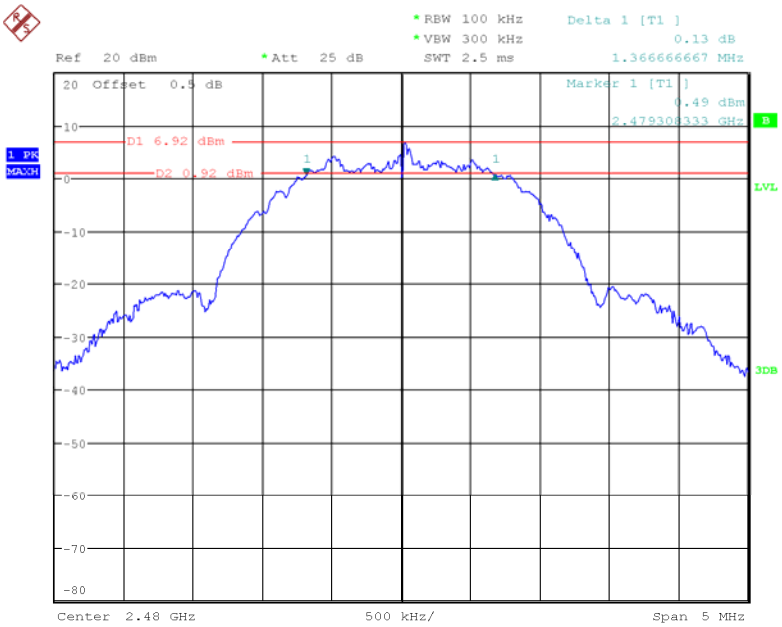
Date: 2.JUN.2019 11:29:43

ZigBee Middle Channel



Date: 2.JUN.2019 11:36:10

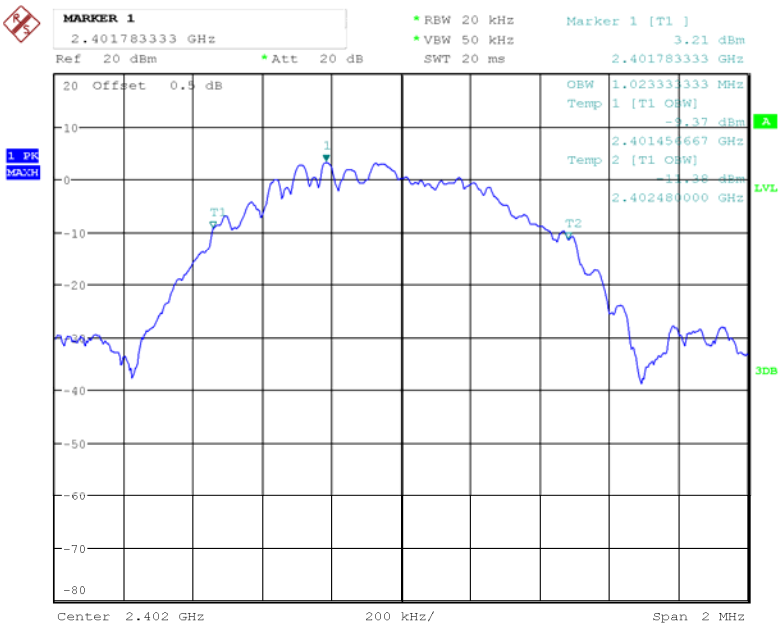
ZigBee High Channel



Date: 2.JUN.2019 11:41:34

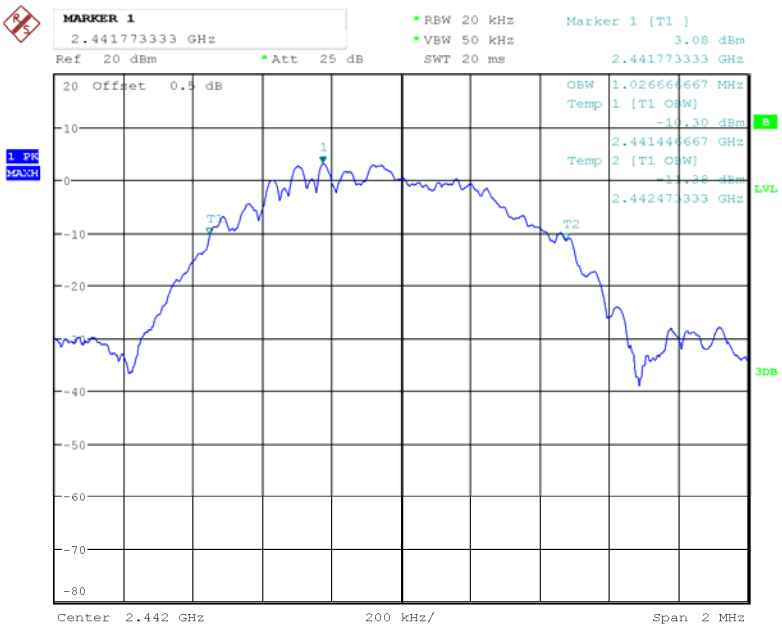
99% Occupied bandwidth:

BLE-1M Low Channel



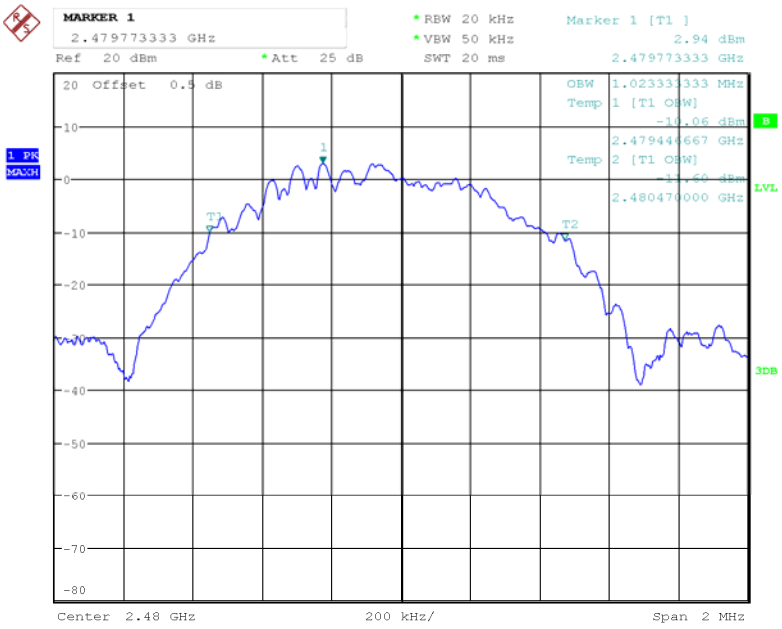
Date: 2.JUN.2019 10:29:33

BLE-1M Middle Channel



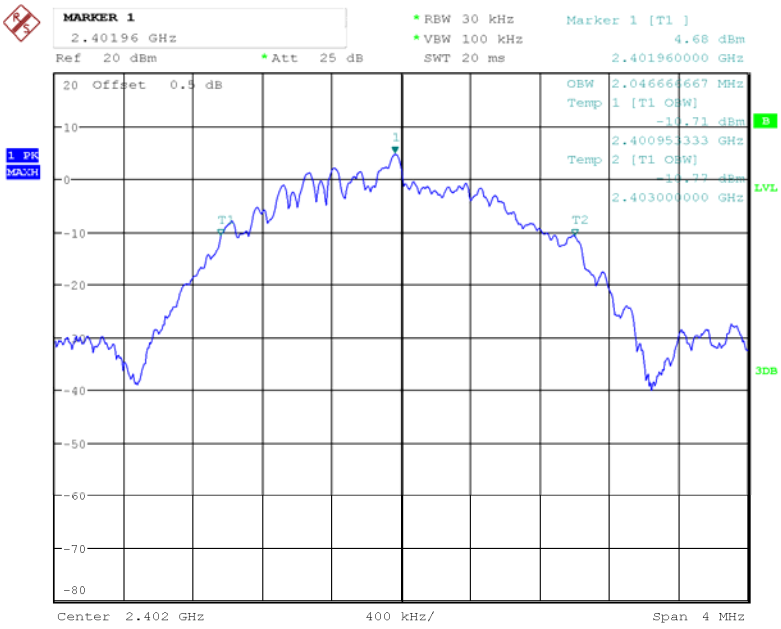
Date: 2.JUN.2019 10:39:45

BLE-1M High Channel



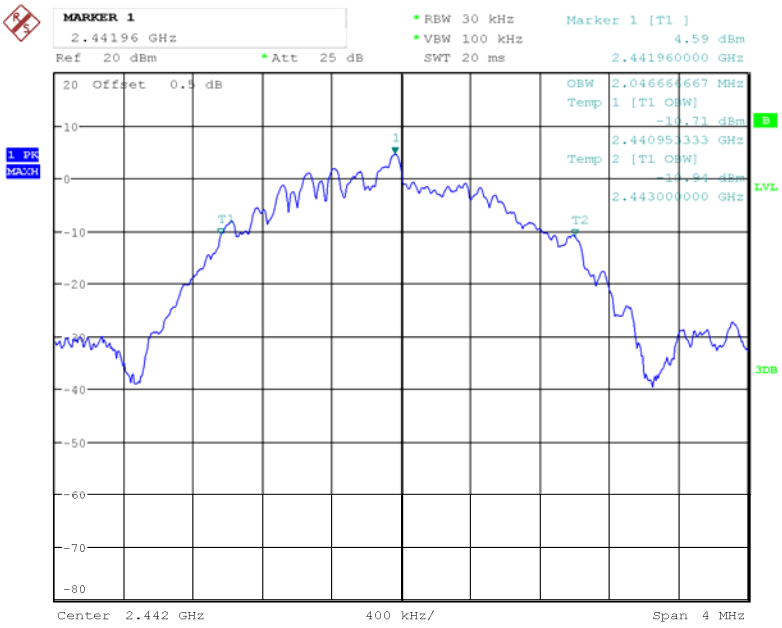
Date: 2.JUN.2019 10:45:06

BLE-2M Low Channel



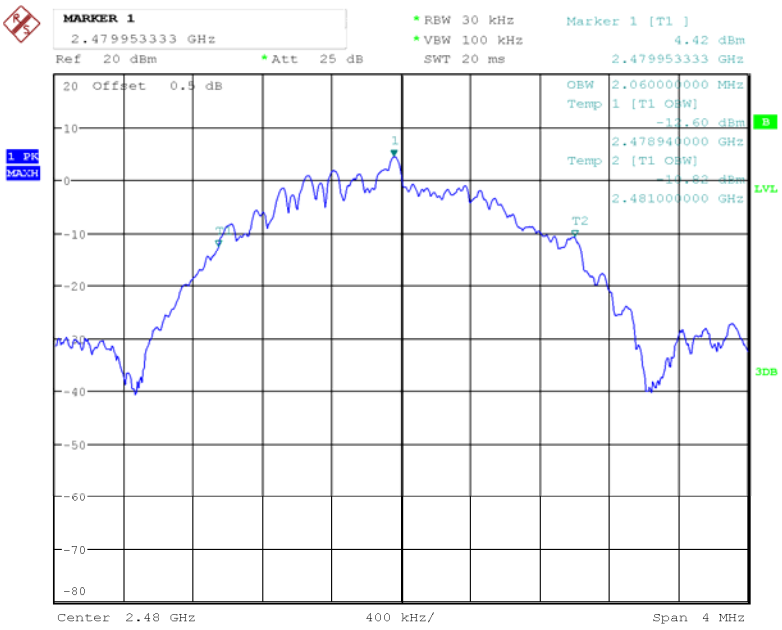
Date: 2.JUN.2019 10:52:29

BLE-2M Middle Channel



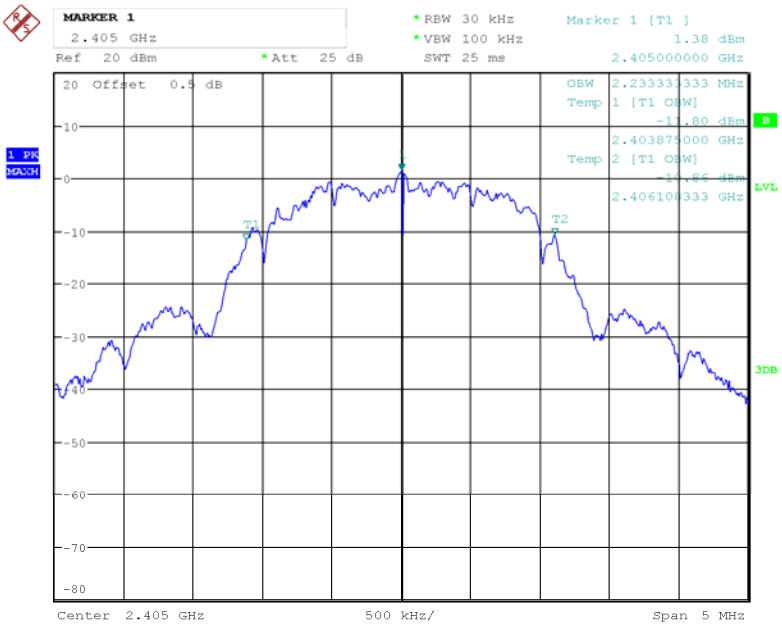
Date: 2.JUN.2019 10:59:54

BLE-2M High Channel



Date: 2.JUN.2019 11:00:53

ZigBee Low Channel



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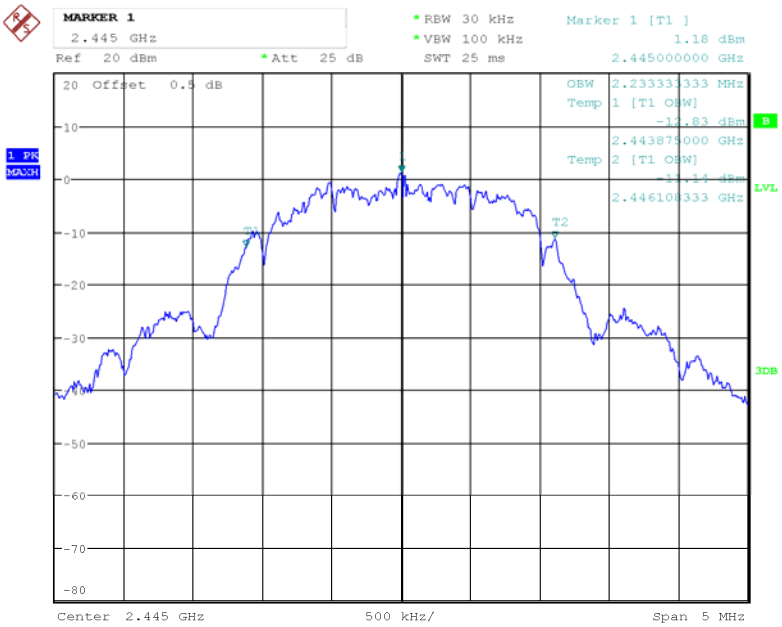
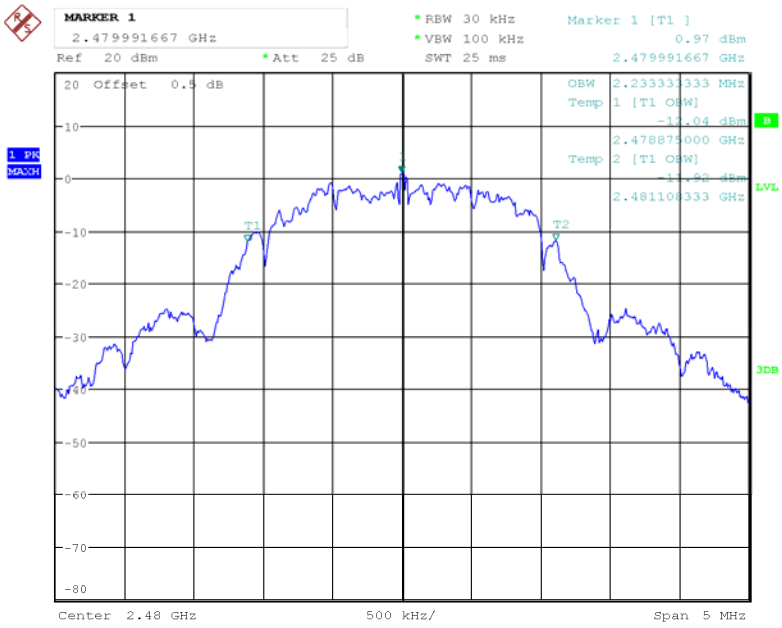
ZigBee Middle Channel



Date: 2.JUN.2019 11:37:43

ZigBee High Channel



Date: 2.JUN.2019 11:40:26

FCC §15.247(b) (3)& RSS-247 CLAUSE 5.4 d) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

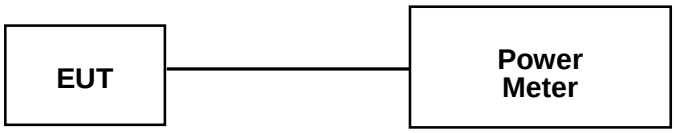
Applicable Standard

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.

According to RSS-247§5.4 d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W.
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.
4. Set the power Meter to test Peak output power, record the result as peak power.
5. Set the power meter to test average output power, record the result as average power.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
narda	Attenuator	6dB	04270	2018-09-06	2019-09-06
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2018-12-11	2019-12-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	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 Data

Environmental Conditions

Temperature:	26.7°C
Relative Humidity:	65%
ATM Pressure:	100.2 kPa

** The testing was performed by Tiago Huang on 2019-06-02*

Test Mode: Transmitting

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

BLE 1M

Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Peak Conducted Output Power Limit (dBm)
2402	9.66	30
2442	9.96	30
2480	9.80	30

BLE 2M

Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Peak Conducted Output Power Limit (dBm)
2402	9.98	30
2442	9.95	30
2480	9.79	30

ZigBee

Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Peak Conducted Output Power Limit (dBm)
2405	9.48	30
2445	9.21	30
2480	9.05	30

Note: the maximum antenna gain is -1.0 dBi.

FCC §15.247(d)& RSS-247 CLAUSE 5.5 – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

According to FCC§15.247(d):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)).

According to RSS-247 Clause 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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	FSU 26	200256	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	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 Data

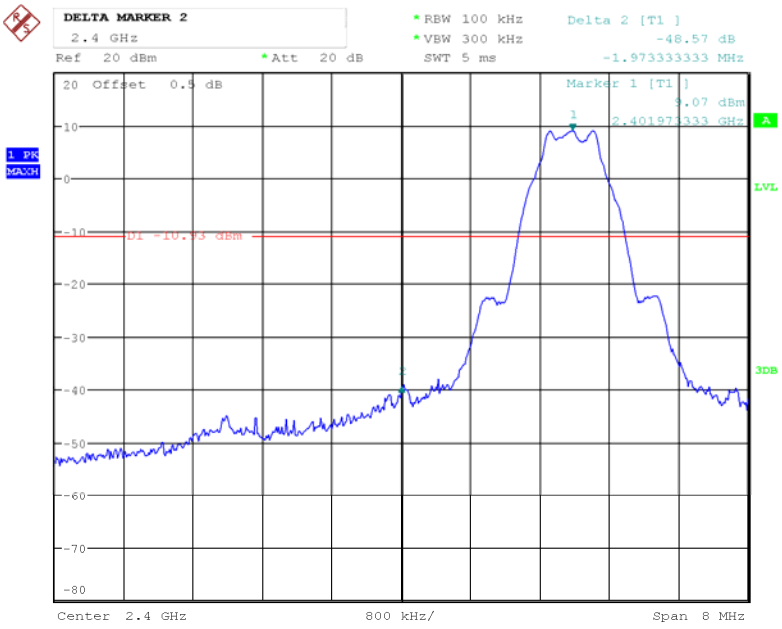
Environmental Conditions

Temperature:	26.7°C
Relative Humidity:	65%
ATM Pressure:	100.2 kPa

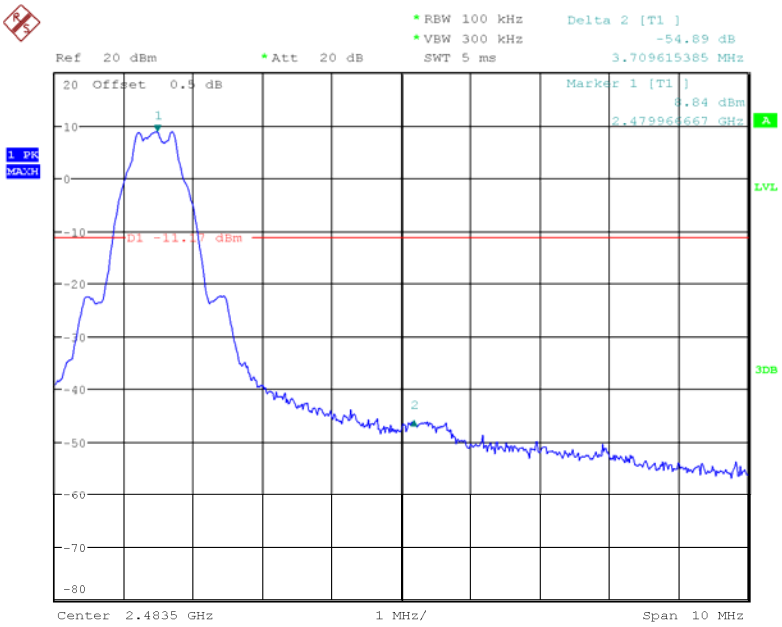
** The testing was performed by Tiago Huang on 2019-06-02*

Test mode: Transmitting
Test Result: Compliance. Please refer to following plots.

BLE- 1M, Band Edge

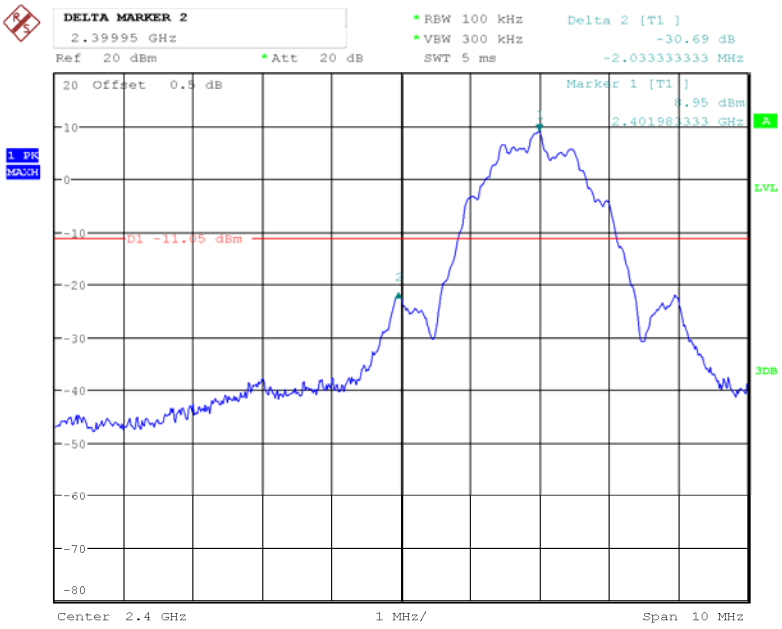


Date: 2.JUN.2019 10:32:43

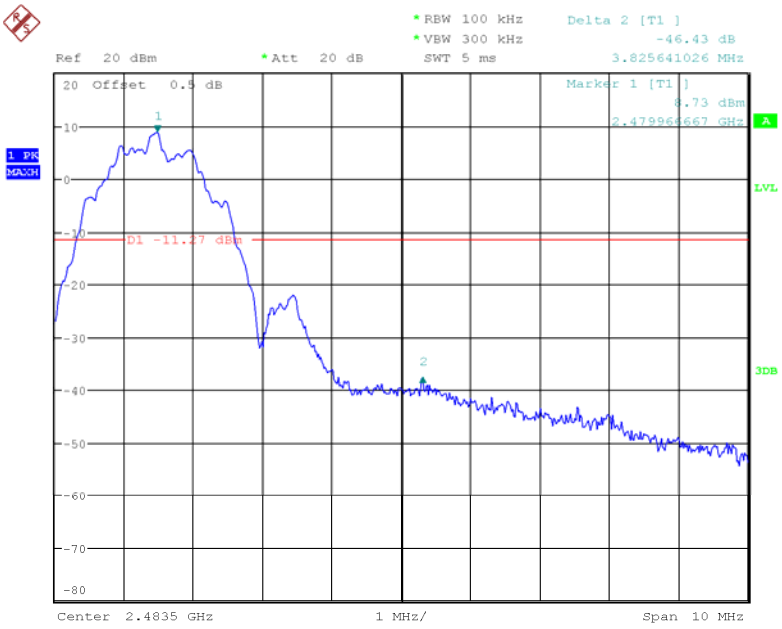


Date: 2.JUN.2019 10:47:41

BLE- 2M ,Band Edge

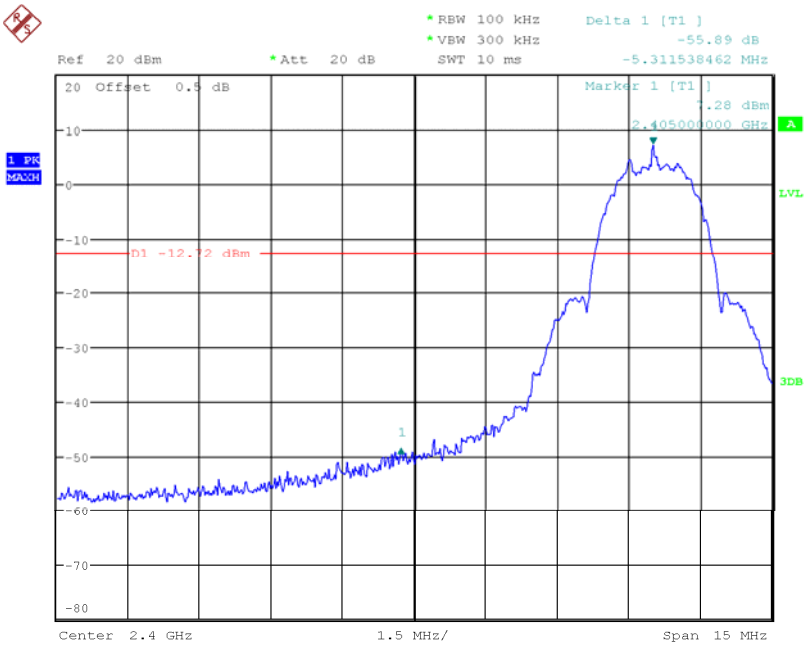


Date: 2.JUN.2019 10:51:44



Date: 2.JUN.2019 11:10:10

ZigBee, Band Edge



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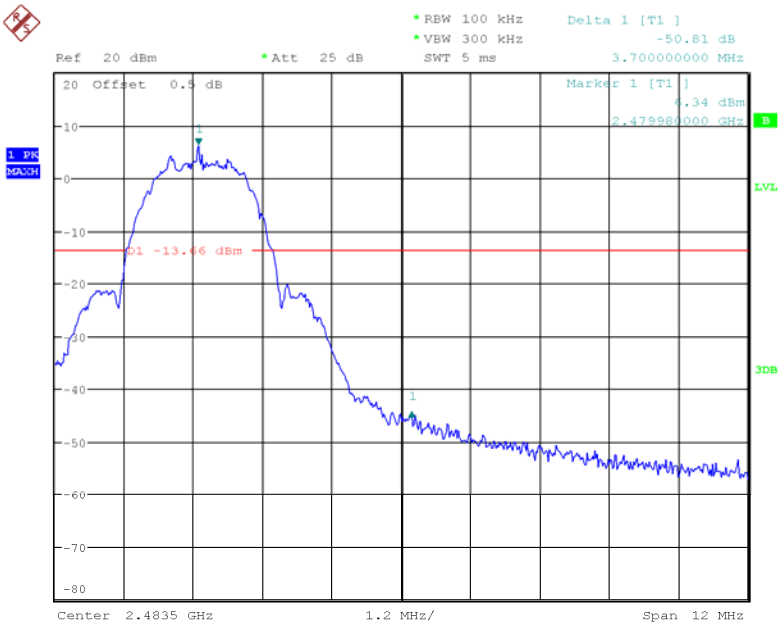

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FCC §15.247(e) & RSS-247 CLAUSE 5.2 b - POWER SPECTRAL DENSITY

Applicable Standard

According to FCC§15.247(e):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.

According to RSS-247 §5.2 b):

b) The transmitter power spectral density conducted from the transmitter 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

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 was set 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 the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	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 Data

Environmental Conditions

Temperature:	26.7°C
Relative Humidity:	65%
ATM Pressure:	100.2 kPa

** The testing was performed by Tiago Huang on 2019-06-02*

Test Mode: Transmitting

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

BLE 1M

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-5.26	≤8
Middle	2442	-5.27	≤8
High	2480	-5.56	≤8

BLE 2M

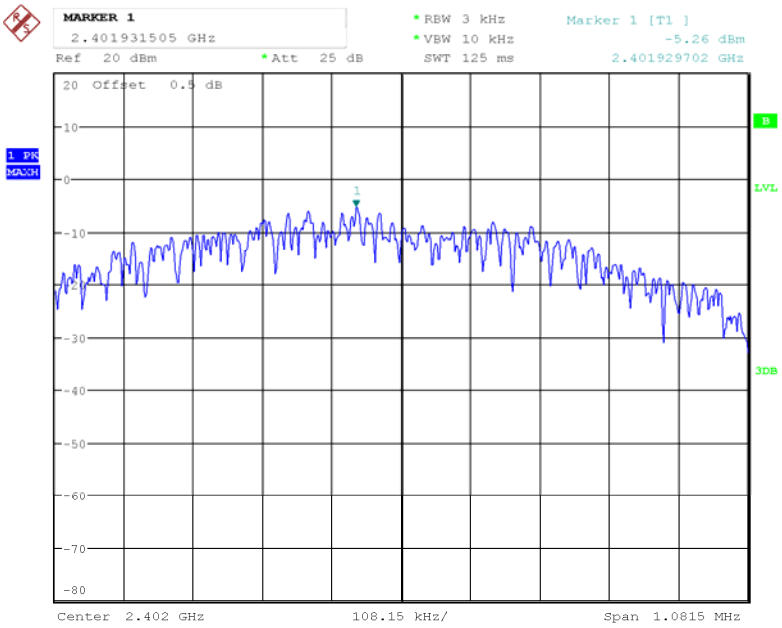
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-7.21	≤8
Middle	2442	-7.30	≤8
High	2480	-7.44	≤8

ZigBee

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2405	-4.07	≤8
Middle	2445	-4.59	≤8
High	2480	-5.19	≤8

BLE- 1M

Low Channel



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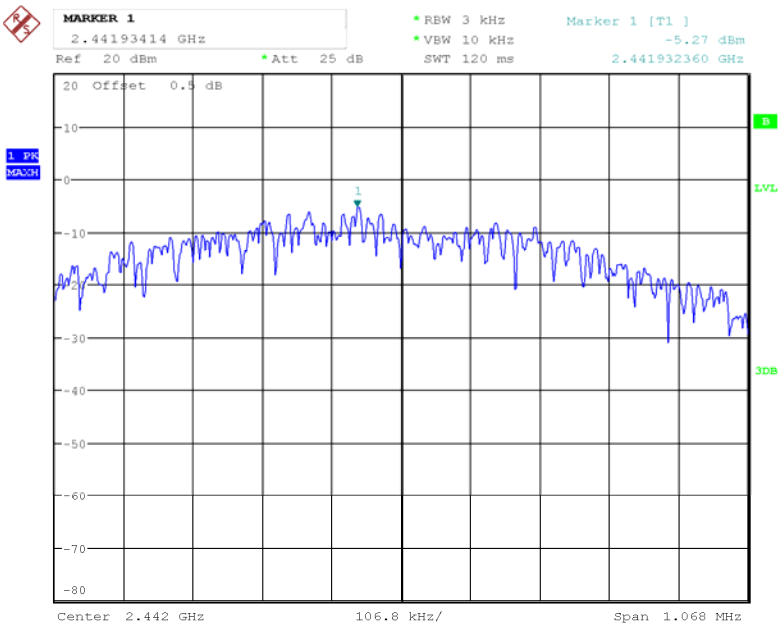
Middle Channel



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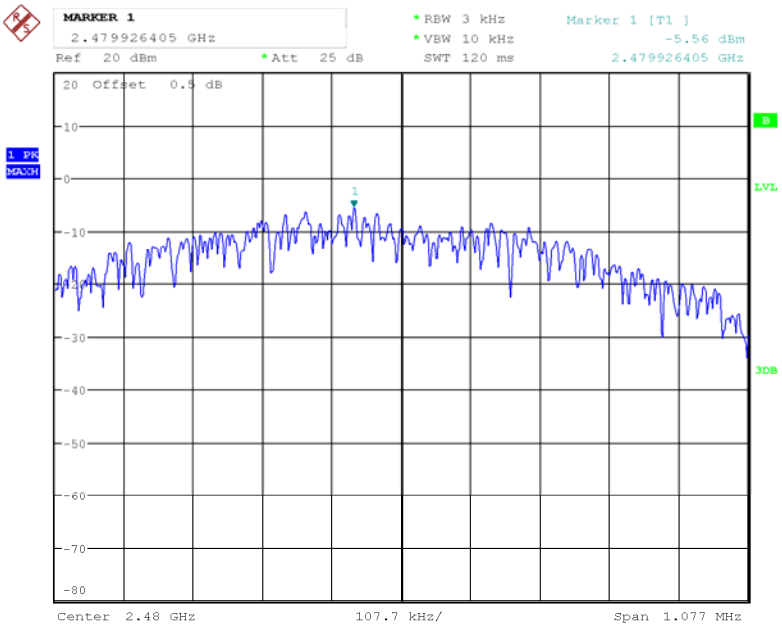
High Channel



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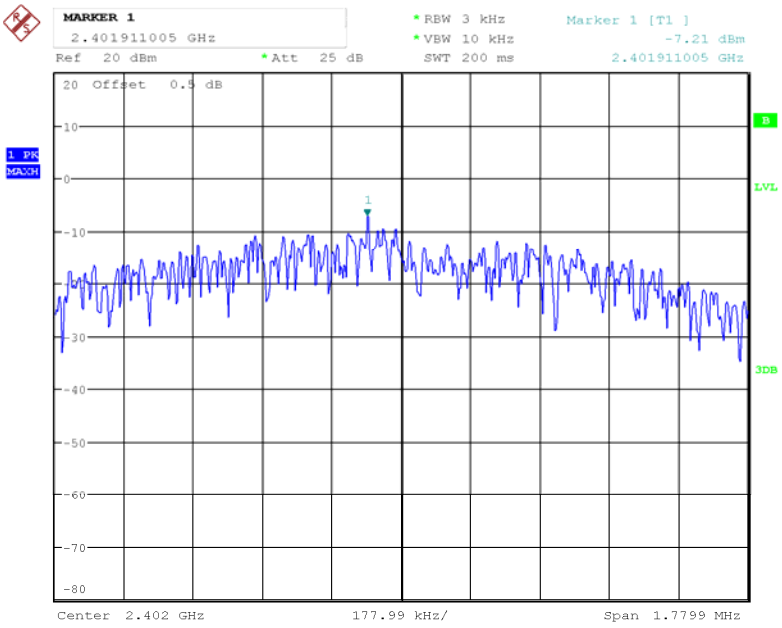
BLE- 2M

Low Channel



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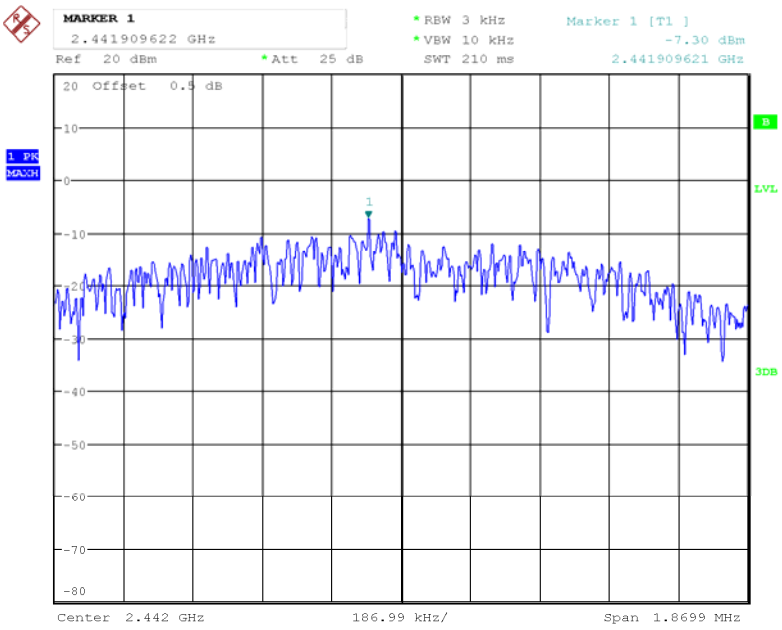
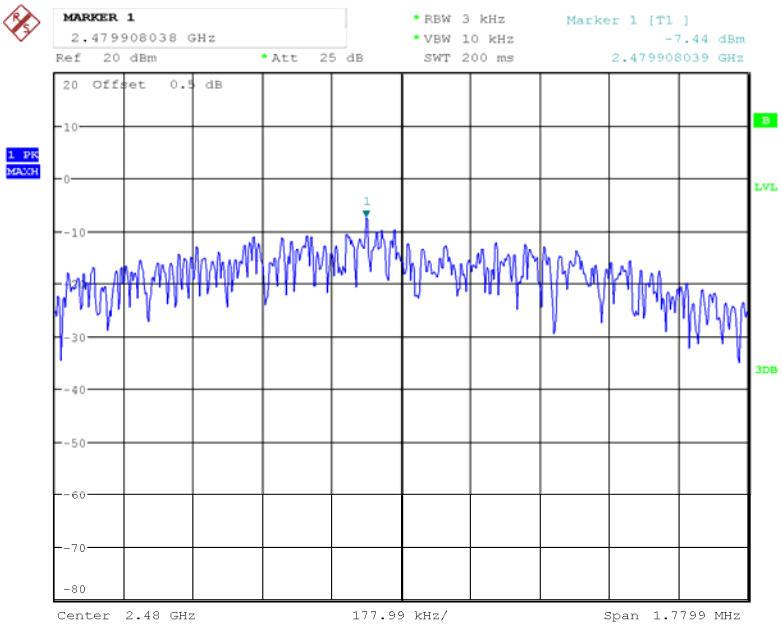
Middle Channel



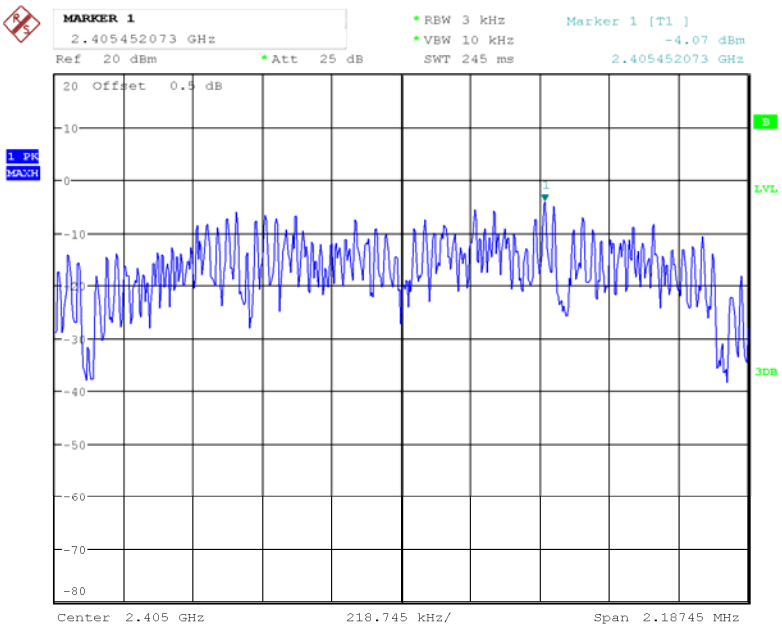
Date: 2.JUN.2019 10:57:25

High Channel



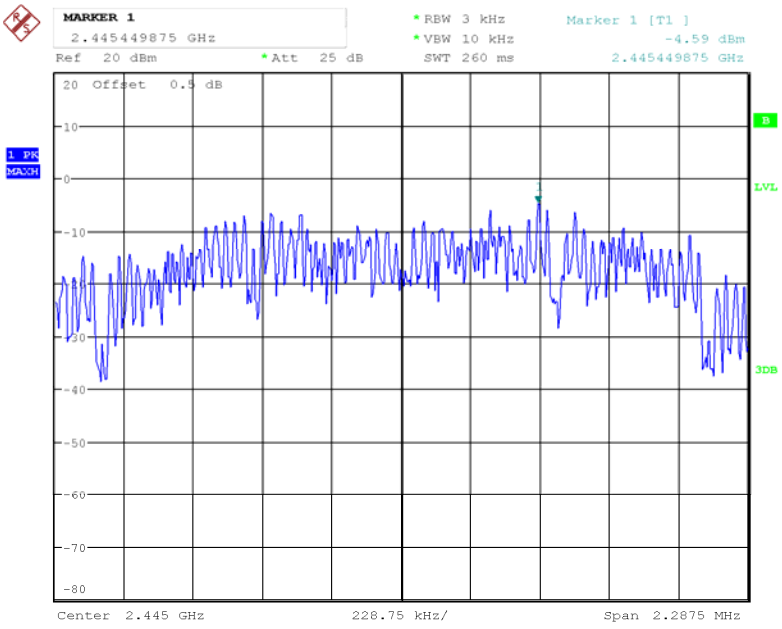
Date: 2.JUN.2019 11:08:05

ZigBee,Low Channel



Date: 2.JUN.2019 11:31:08

ZigBee,Middle Channel



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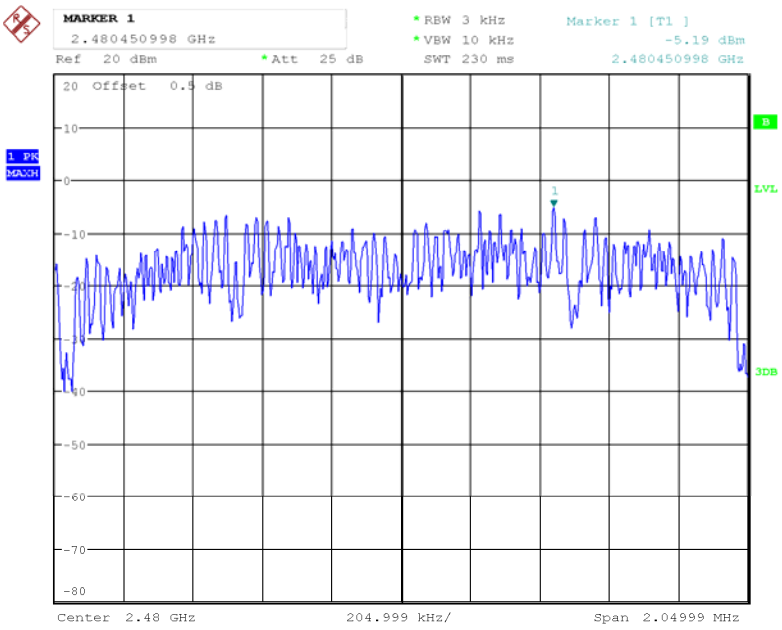
ZigBee,High Channel



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