TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247
RSS-GEN, ISSUE 5, APRIL 2018
RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

SZ DJI Osmo Technology Co.,Ltd.

2F, Building 3, Binhai Mingzhu Industrial Park No. 291 Louming Road, Xinhu Street Guangming District, Shenzhen, China

FCC ID: 2ANDR-R181902
IC: 23060-R181902
Model: R18

Report Type:	**Product Name:**
Original Report	Ronin-SC

Report Number:	RDG190316002-00B
Report Date:	2019-04-16
Reviewed By:	Jerry Zhang EMC Manager
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:	Ronin-SC
EUT Model:	R18
Operation Frequency:	2402-2480 MHz
Maximum Output Power (Conducted):	4.75 dBm
Modulation Type:	GFSK
Rated Input Voltage:	7.2 Vdc from Ronin-SC BG18 Grip
External Dimension:	200mm(L)*58 mm(W)* 214mm(H)
Serial Number:	190316002
EUT Received Date:	2019.03.12

Objective

This report is prepared on behalf of ***SZ DJI Osmo Technology 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 of the Innovation, Science and Economic Development Canada, 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)

FCC Part 15B JAB submissions with FCC ID: 2ANDR-R181902.

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices", RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada, 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: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 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 lab has been recognized as the FCC accredited lab 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 lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0022.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.

Bluetooth LE supports 1Mbps and 2Mbps modes, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
..	…	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

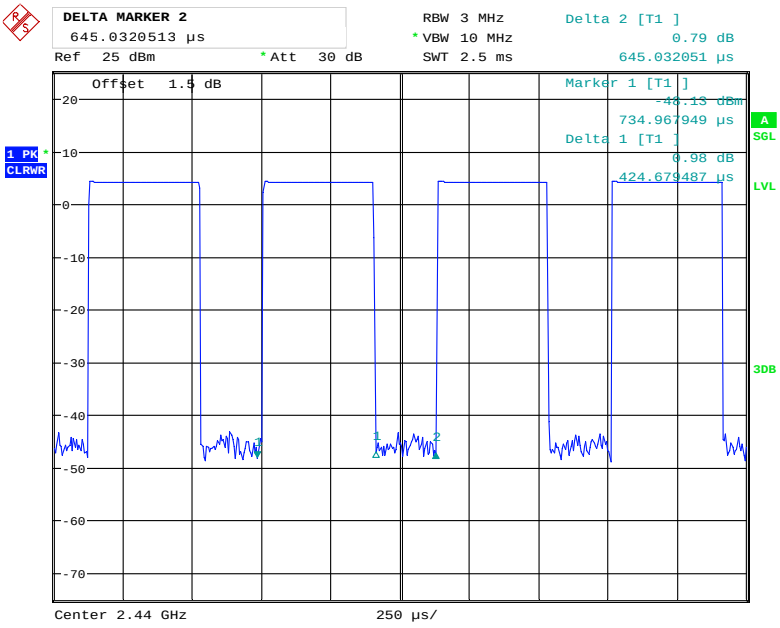
The worst condition (maximum power) was configured by software ' dtm_application.exe ' as below table:

Channel	Frequency (MHz)	Data rate	Power level
Low	2402	1Mbps	4
Middle	2440	1 Mbps	4
High	2480	1 Mbps	4
Low	2402	2 Mbps	4
Middle	2440	2 Mbps	4
High	2480	2 Mbps	4

The duty cycle as below:

Test mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
1Mbps	0.425	0.645	65.89
2Mbps	0.224	0.629	35.61

1Mbps



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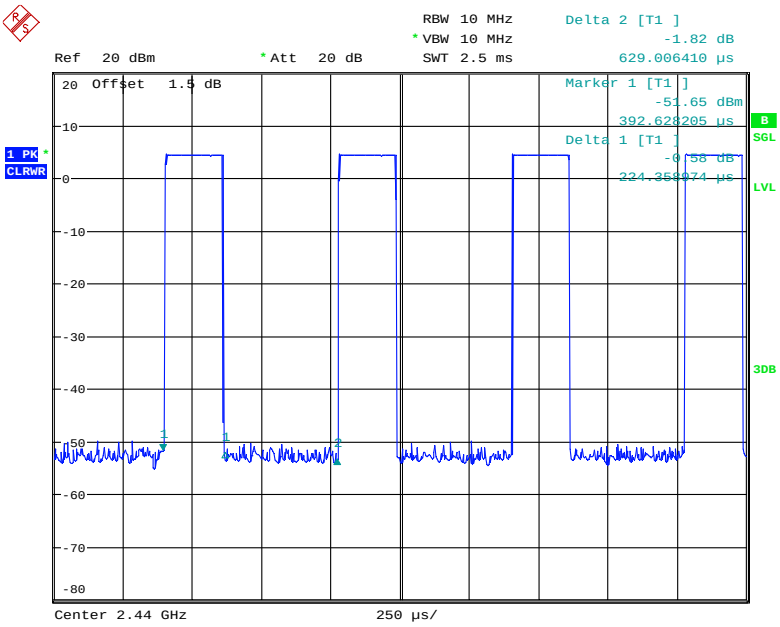
2Mbps



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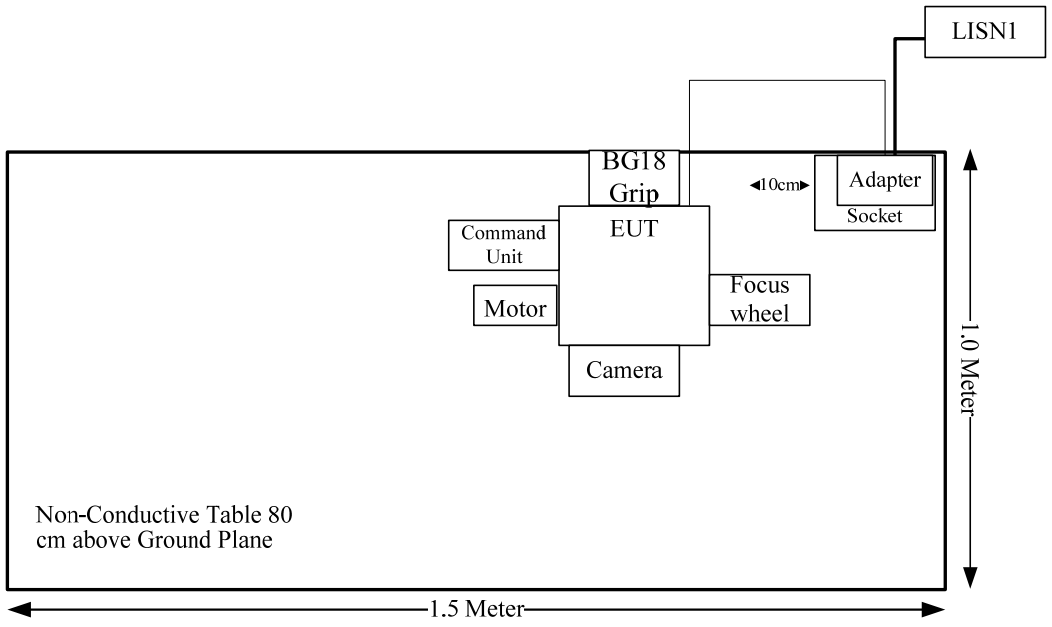
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Huawei	Adapter	HW050200C01	/
DJI	Focus Wheel	RSFW	/
DJI	Ronin-SC BG18 Grip	BG18 Grip	/
DJI	Ronin-S Command Unit	RSCMD	/
DJI	Ronin-SC Focus Motor	RSCFM	/
Cannon	Camera		/

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Control Line	Yes	No	0.3	EUT	Ronin-SC Focus Motor
USB-C Cable	Yes	No	1.2	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
RSS-102 §2.5.1	Exemption Limits for Routine Evaluation -SAR Evaluation	Compliance
FCC§15.203 RSS-GEN Clause 6.8	Antenna Requirement	Compliance
§15.207 (a) RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d) RSS-247 Clause 5.5 RSS-Gen Clause 8.10	Spurious Emissions	Compliance
§15.247 (a)(2) RSS-247 Clause 5.2 a) RSS-Gen Clause 6.7	6 dB Emission Bandwidth And 99% Occupied Bandwidth	Compliance
§15.247(b)(3) RSS-247 Clause 5.4 d)	Maximum conducted output power	Compliance
§15.247(d) RSS-247 Clause 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247 (e) RSS-247 Clause 5.2 b)	Power Spectral Density	Compliance

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The max conducted power including tune-up tolerance is 5.0 dBm (3.16 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
=3.16/5*(√2.480) = 1.0< 7.5

So the stand-alone SAR evaluation is not necessary for this extremity device(Handheld).

RSS-102 § 2.5.1 EXEMPTION LIMITS FOR ROUTINE EVALUATION – SAR EVALUATION

Applicable Standard

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Measurement Result:

The max tune-up conducted power is 5.0 dBm(3.16 mW), Antenna Gain: 2 dBi, EIRP=7 dBm(5mW)

The exemption power(P) limits for routine evaluation in 2402-2480MHz is:
(2480-2450)/(3500-2450)=(P -4)/(2-4)
=>P=3.94 mW@2480 MHz

For Limb-worn device, the limit:
=>P=3.94 mW*2.5= 9.85 mW@2480 MHz
>5 mW

So the stand-alone SAR evaluation can be exempted for this extremity device(Handheld).

FCC §15.203 ,RSS-GEN§6.8- 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.

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 Connector Construction

The EUT has one internal antenna arrangement for BLE, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Connector	input impedance (Ohm)	Antenna Gain /Frequency
IFA	Thimble	50	2.0 dBi/2.4-2.5GHz

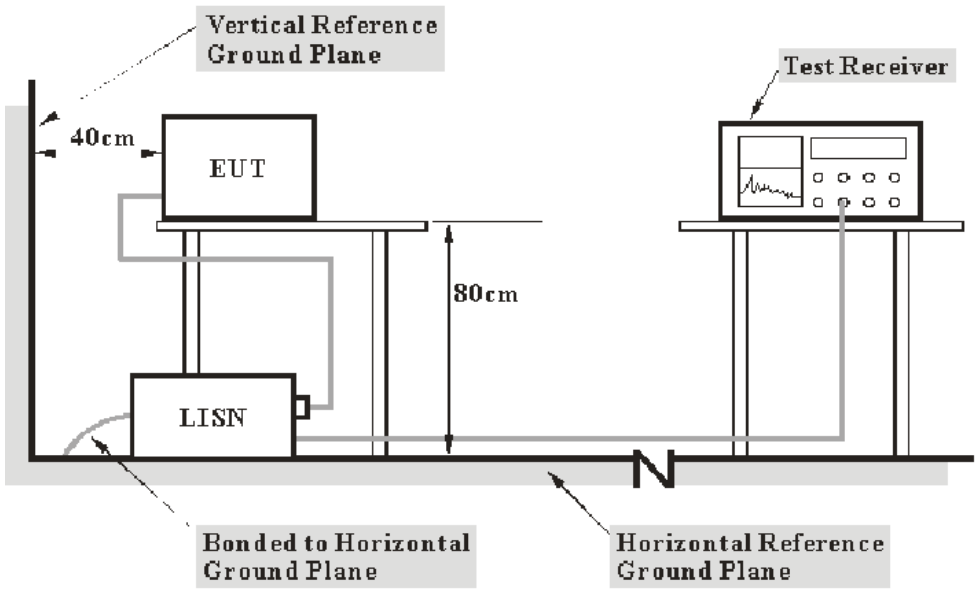
Result: Compliance.

FCC §15.207 (a),RSS-Gen §8.8– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a) and 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 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

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,
V_C: corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

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

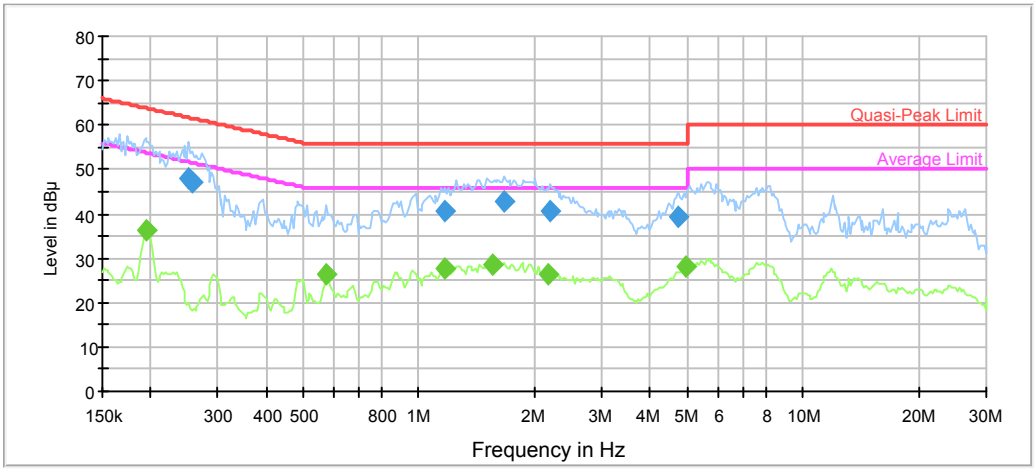
Environmental Conditions

Temperature:	26.5 °C
Relative Humidity:	58 %
ATM Pressure:	101.2 kPa

The testing was performed by Lily Xie on 2019-03-16

Test Mode: *Transmitting*

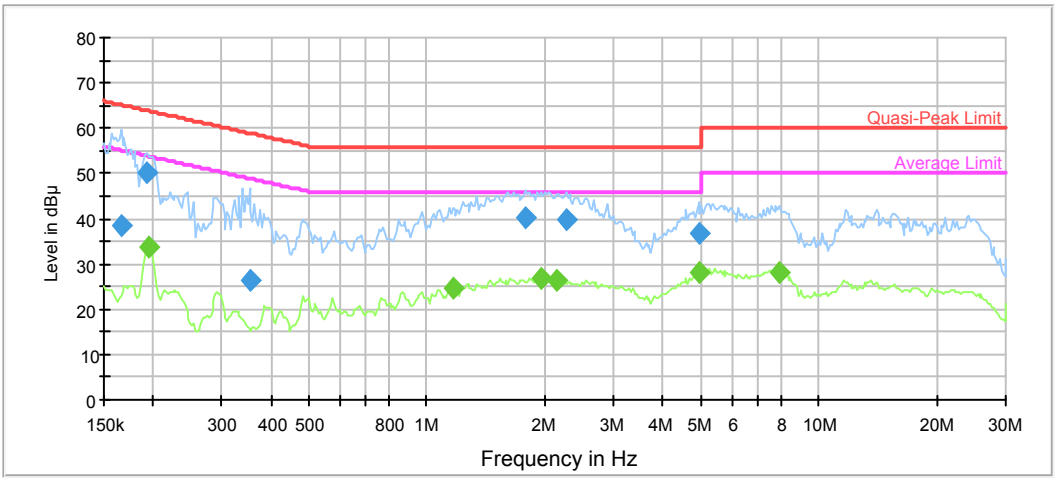
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.251654	48.2	9.000	L1	10.3	13.5	61.7
0.256712	47.0	9.000	L1	10.3	14.5	61.5
1.164916	40.7	9.000	L1	9.8	15.3	56.0
1.666725	42.7	9.000	L1	9.7	13.3	56.0
2.202229	40.8	9.000	L1	9.7	15.2	56.0
4.738144	39.2	9.000	L1	9.8	16.8	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.196231	36.2	9.000	L1	10.6	17.6	53.8
0.574747	26.4	9.000	L1	9.8	19.6	46.0
1.164916	27.7	9.000	L1	9.8	18.3	46.0
1.554585	28.6	9.000	L1	9.7	17.4	46.0
2.158836	26.2	9.000	L1	9.7	19.8	46.0
4.979837	27.9	9.000	L1	9.8	18.1	46.0

AC120V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.165693	38.3	9.000	N	10.9	26.9	65.2
0.192365	50.2	9.000	N	10.7	13.7	63.9
0.352963	26.3	9.000	N	10.0	32.6	58.9
1.786955	40.0	9.000	N	9.8	16.0	56.0
2.268959	39.7	9.000	N	9.8	16.3	56.0
4.930532	36.9	9.000	N	9.8	19.1	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.196231	33.9	9.000	N	10.6	19.9	53.8
1.164916	24.6	9.000	N	9.8	21.4	46.0
1.954366	26.7	9.000	N	9.8	19.3	46.0
2.137462	26.4	9.000	N	9.8	19.6	46.0
4.979837	28.1	9.000	N	9.8	17.9	46.0
7.949132	28.2	9.000	N	9.8	21.8	50.0

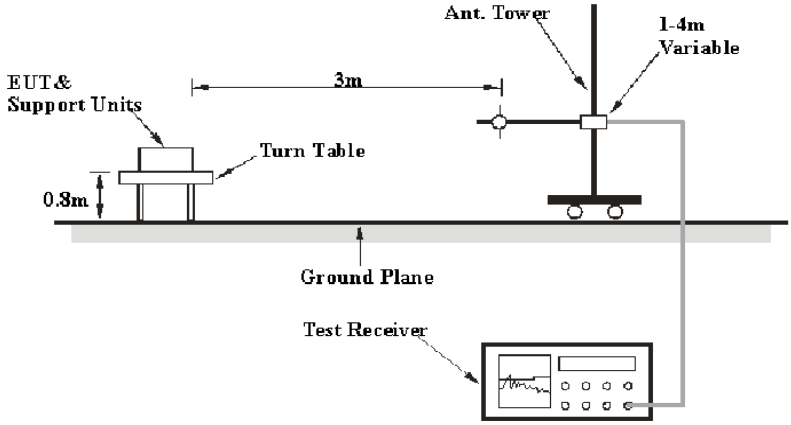
FCC §15.209, §15.205 , §15.247(d) & RSS-247 §5.5&RSS-GEN§8.10- SPURIOUS EMISSIONS

Applicable Standard

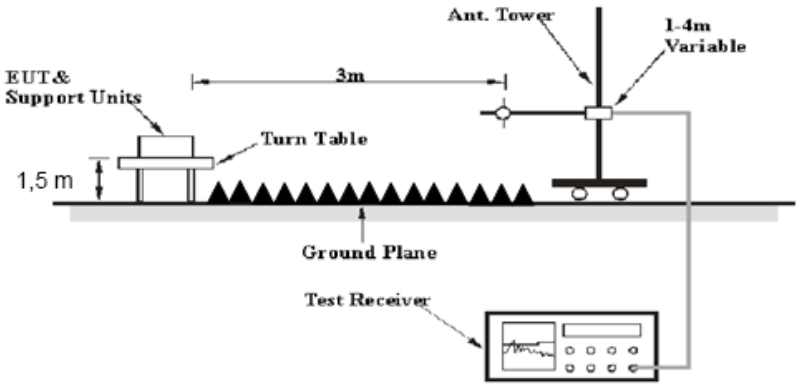
FCC §15.247 (d); §15.209; §15.205; and RSS-247 §5.5, RSS-GEN §8.10

EUT Setup

Below 1GHz:



Above 1GHz:



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

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

30-1000MHz:

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

1GHz- 25GHz:

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

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

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna 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	2018-12-10	2019-12-10
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-1400-01	2018-05-06	2019-05-06
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	2018-10-12	2021-10-12
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
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
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
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

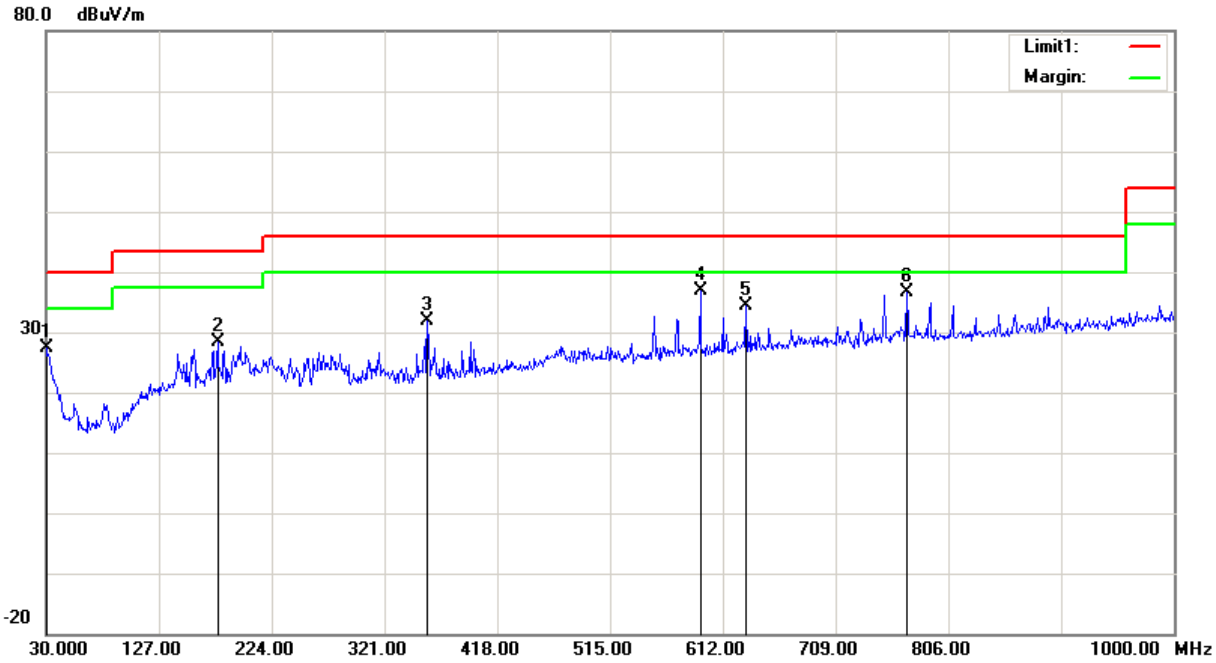
Temperature:	25.6 °C
Relative Humidity:	57%
ATM Pressure:	100.8 kPa

The testing was performed by Neil Liao on 2019-03-19

Test Mode: Transmitting

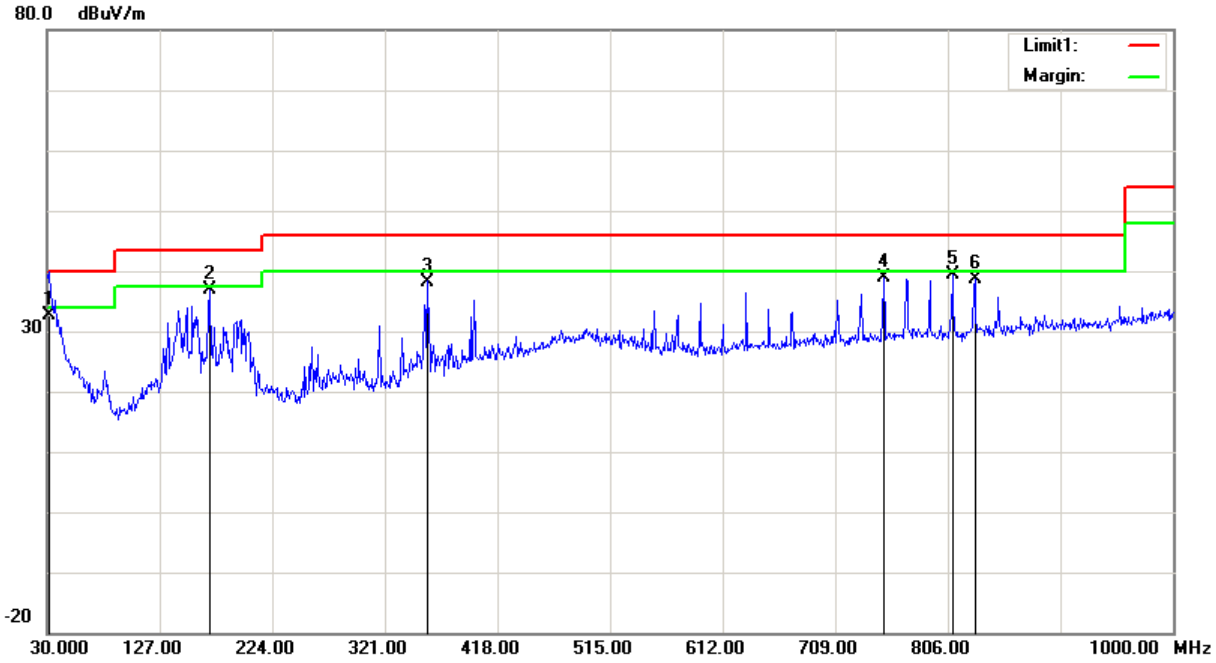
1) 30MHz-1GHz(1Mbps High Channel was the worst):

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	25.72	peak	1.72	27.44	40.00	12.56
177.4400	35.49	peak	-7.02	28.47	43.50	15.03
357.8600	34.62	peak	-2.82	31.80	46.00	14.20
592.6000	36.15	peak	0.85	37.00	46.00	9.00
631.4000	32.27	peak	2.05	34.32	46.00	11.68
770.1100	32.27	peak	4.31	36.58	46.00	9.42

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.9400	32.40	QP	0.19	32.59	40.00	7.41
169.6800	43.43	peak	-6.57	36.86	43.50	6.64
357.8600	41.07	peak	-2.82	38.25	46.00	7.75
750.7100	35.26	peak	3.66	38.92	46.00	7.08
809.8800	34.48	peak	4.80	39.28	46.00	6.72
829.2800	33.46	peak	5.05	38.51	46.00	7.49

2) 1-25GHz:

1Mbps:

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	60.64	PK	H	28.10	1.80	0.00	90.54	N/A	N/A
2402.00	59.25	AV	H	28.10	1.80	0.00	89.15	N/A	N/A
2402.00	58.85	PK	V	28.10	1.80	0.00	88.75	N/A	N/A
2402.00	58.24	AV	V	28.10	1.80	0.00	88.14	N/A	N/A
2390.00	24.88	PK	H	28.08	1.80	0.00	54.76	74.00	19.24
2390.00	14.52	AV	H	28.08	1.80	0.00	44.40	54.00	9.60
4804.00	51.95	PK	H	32.91	3.17	37.20	50.83	74.00	23.17
4804.00	45.28	AV	H	32.91	3.17	37.20	44.16	54.00	9.84
7206.00	45.92	PK	H	35.74	4.82	37.23	49.25	74.00	24.75
7206.00	32.67	AV	H	35.74	4.82	37.23	36.00	54.00	18.00
Middle Channel: 2440 MHz									
2440.00	60.59	PK	H	28.18	1.82	0.00	90.59	N/A	N/A
2440.00	60.10	AV	H	28.18	1.82	0.00	90.10	N/A	N/A
2440.00	58.33	PK	V	28.18	1.82	0.00	88.33	N/A	N/A
2440.00	57.91	AV	V	28.18	1.82	0.00	87.91	N/A	N/A
4880.00	52.16	PK	H	33.06	3.27	37.21	51.28	74.00	22.72
4880.00	45.78	AV	H	33.06	3.27	37.21	44.90	54.00	9.10
7320.00	44.74	PK	H	36.03	4.62	37.37	48.02	74.00	25.98
7320.00	32.04	AV	H	36.03	4.62	37.37	35.32	54.00	18.68
High Channel: 2480 MHz									
2480.00	60.27	PK	H	28.26	1.84	0.00	90.37	N/A	N/A
2480.00	59.65	AV	H	28.26	1.84	0.00	89.75	N/A	N/A
2480.00	59.01	PK	V	28.26	1.84	0.00	89.11	N/A	N/A
2480.00	58.43	AV	V	28.26	1.84	0.00	88.53	N/A	N/A
2483.50	25.17	PK	H	28.27	1.84	0.00	55.28	74.00	18.72
2483.50	14.81	AV	H	28.27	1.84	0.00	44.92	54.00	9.08
4960.00	55.54	PK	H	33.22	3.23	37.25	54.74	74.00	19.26
4960.00	49.75	AV	H	33.22	3.23	37.25	48.95	54.00	5.05
7440.00	45.49	PK	H	36.34	4.41	37.52	48.72	74.00	25.28
7440.00	32.74	AV	H	36.34	4.41	37.52	35.97	54.00	18.03

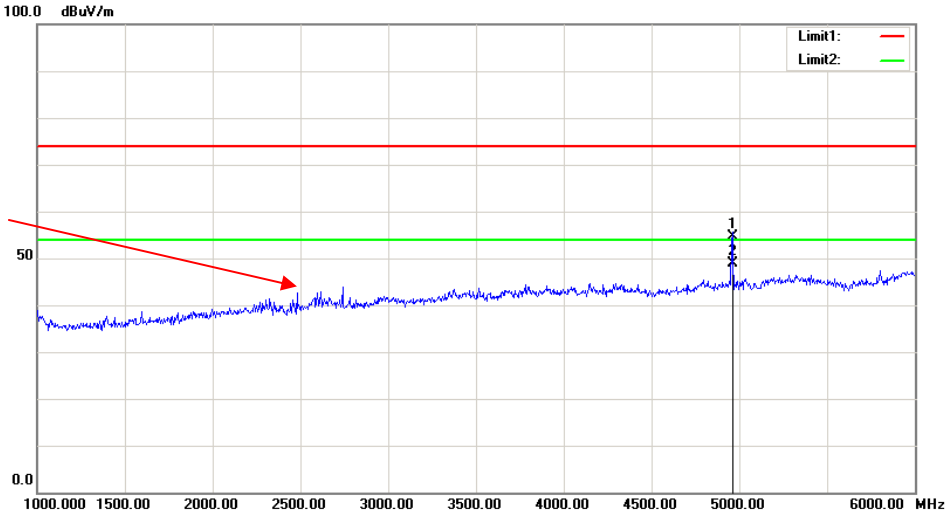
2Mbps:

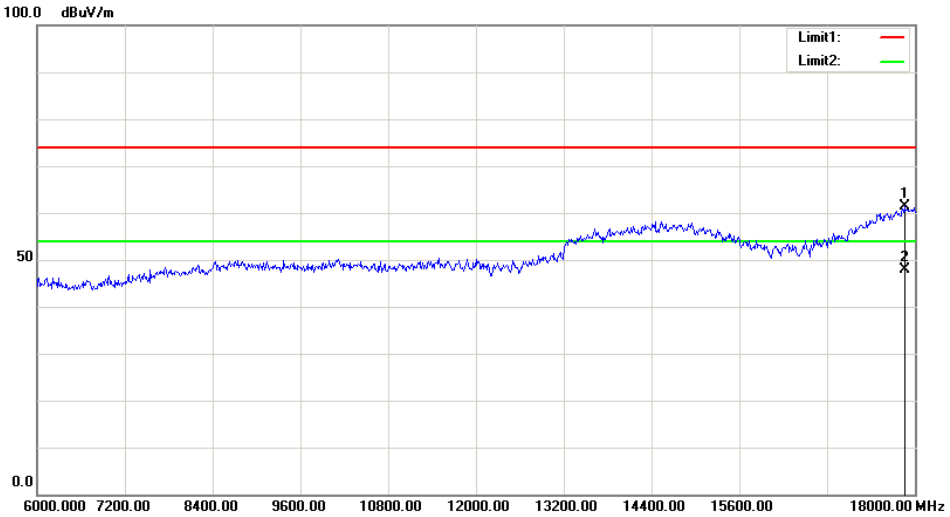
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	58.53	PK	H	28.10	1.80	0.00	88.43	N/A	N/A
2402.00	57.17	AV	H	28.10	1.80	0.00	87.07	N/A	N/A
2402.00	55.12	PK	V	28.10	1.80	0.00	85.02	N/A	N/A
2402.00	54.30	AV	V	28.10	1.80	0.00	84.20	N/A	N/A
2390.00	24.60	PK	H	28.08	1.80	0.00	54.48	74.00	19.52
2390.00	12.16	AV	H	28.08	1.80	0.00	42.04	54.00	11.96
4804.00	45.12	PK	H	32.91	3.17	37.20	44.00	74.00	30.00
4804.00	34.36	AV	H	32.91	3.17	37.20	33.24	54.00	20.76
7206.00	45.51	PK	H	35.74	4.82	37.23	48.84	74.00	25.16
7206.00	34.49	AV	H	35.74	4.82	37.23	37.82	54.00	16.18
Middle Channel: 2440 MHz									
2440.00	57.94	PK	H	28.18	1.82	0.00	87.94	N/A	N/A
2440.00	56.46	AV	H	28.18	1.82	0.00	86.46	N/A	N/A
2440.00	55.10	PK	V	28.18	1.82	0.00	85.10	N/A	N/A
2440.00	53.86	AV	V	28.18	1.82	0.00	83.86	N/A	N/A
4880.00	46.22	PK	H	33.06	3.27	37.21	45.34	74.00	28.66
4880.00	34.57	AV	H	33.06	3.27	37.21	33.69	54.00	20.31
7320.00	46.08	PK	H	36.03	4.62	37.37	49.36	74.00	24.64
7320.00	34.26	AV	H	36.03	4.62	37.37	37.54	54.00	16.46
High Channel: 2480 MHz									
2480.00	54.66	PK	H	28.26	1.84	0.00	84.76	N/A	N/A
2480.00	53.49	AV	H	28.26	1.84	0.00	83.59	N/A	N/A
2480.00	53.98	PK	V	28.26	1.84	0.00	84.08	N/A	N/A
2480.00	52.37	AV	V	28.26	1.84	0.00	82.47	N/A	N/A
2483.50	28.08	PK	H	28.27	1.84	0.00	58.19	74.00	15.81
2483.50	17.46	AV	H	28.27	1.84	0.00	47.57	54.00	6.43
4960.00	46.61	PK	H	33.22	3.23	37.25	45.81	74.00	28.19
4960.00	35.70	AV	H	33.22	3.23	37.25	34.90	54.00	19.10
7440.00	45.57	PK	H	36.34	4.41	37.52	48.80	74.00	25.20
7440.00	34.68	AV	H	36.34	4.41	37.52	37.91	54.00	16.09

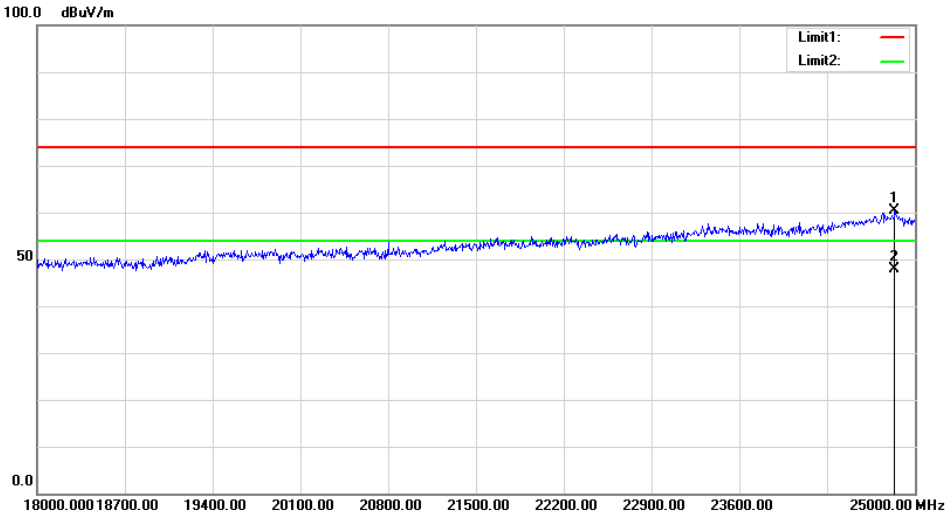
Worst plots (1Mbps high channel**)**

Horizontal

Fundamental Test with Band Rejection Filter

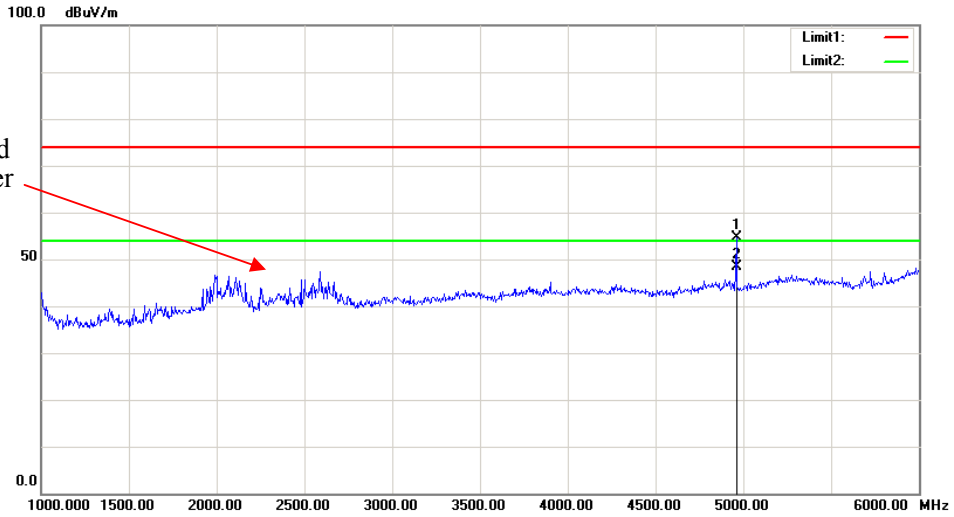


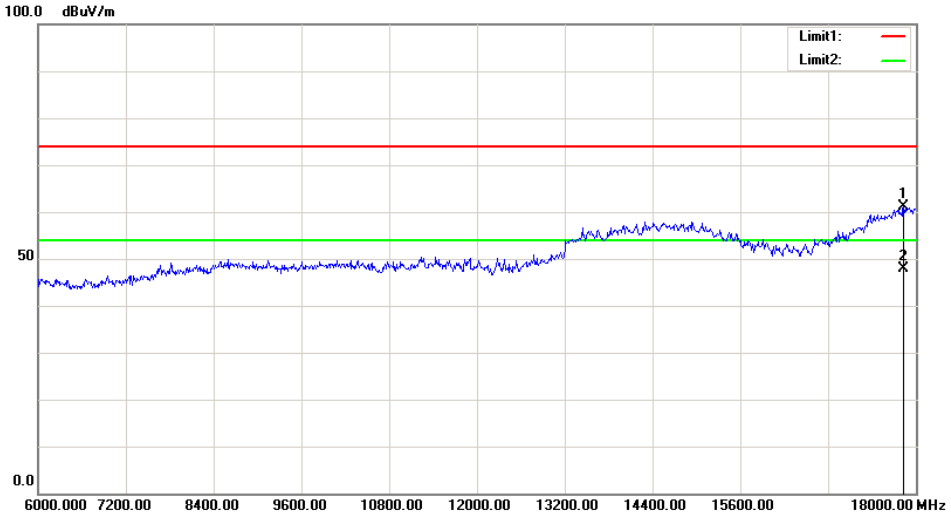


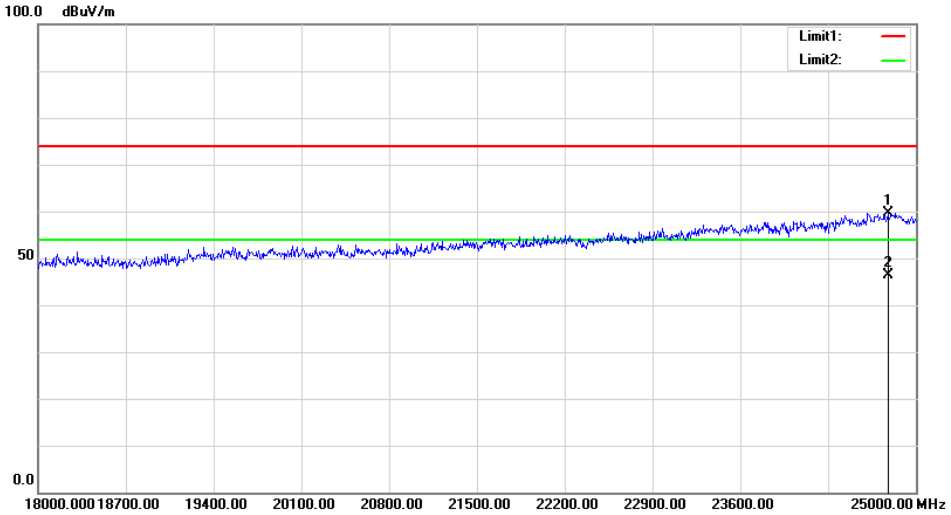


Vertical

Fundamental Test with Band Rejection Filter







FCC §15.247(a) (2)& RSS-247 §5.2 a) &RSS-247 §5.2 a) &RSS-GEN§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 kH

According to RSS-247 §5.2 a)

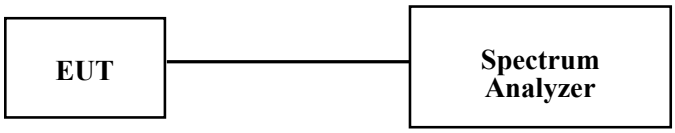
The minimum 6 dB bandwidth shall be 500 kHz.

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.

Test Procedure

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.
h) Measure the 99% bandwidth use OBW test function.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-01-04	2020-01-04
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:	25.8~26.7 °C
Relative Humidity:	46~56 %
ATM Pressure:	100.7~101.1 kPa

The testing was performed by ELena Lei from 2019-03-13 to 2019-04-06.

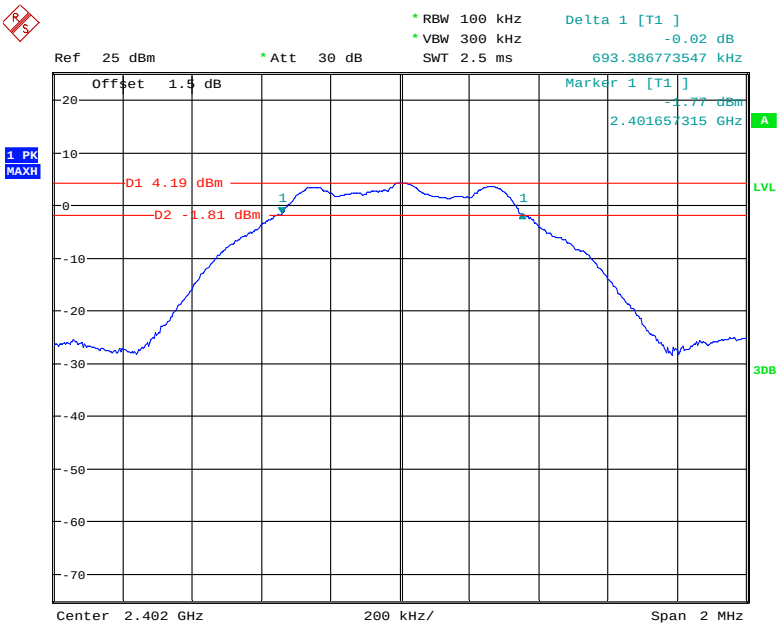
Test Mode: Transmitting

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)
1Mbps	Low	2402	0.693	1.044	≥0.5
	Middle	2440	0.693	1.048	≥0.5
	High	2480	0.693	1.048	≥0.5
2Mbps	Low	2402	1.179	2.053	≥0.5
	Middle	2440	1.173	2.051	≥0.5
	High	2480	1.167	2.051	≥0.5

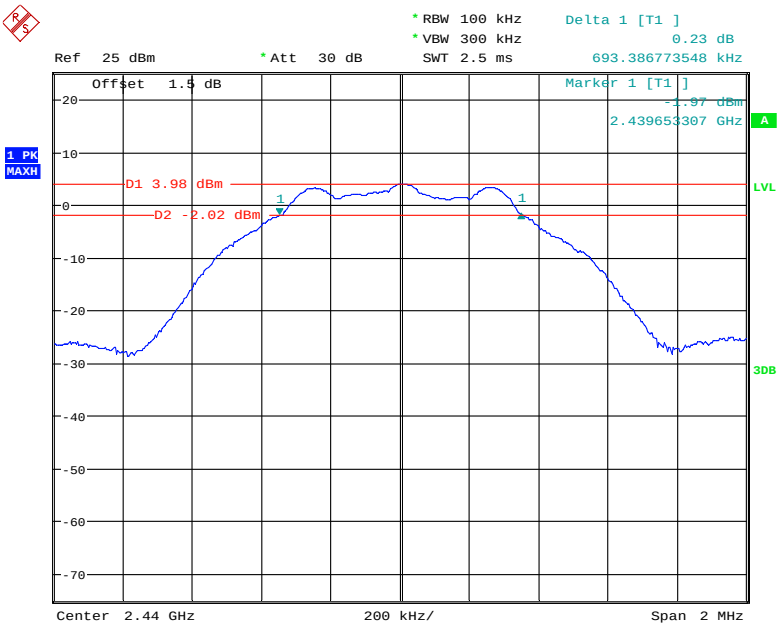
1Mbps, 6dB Bandwidth:

BLE, Low Channel



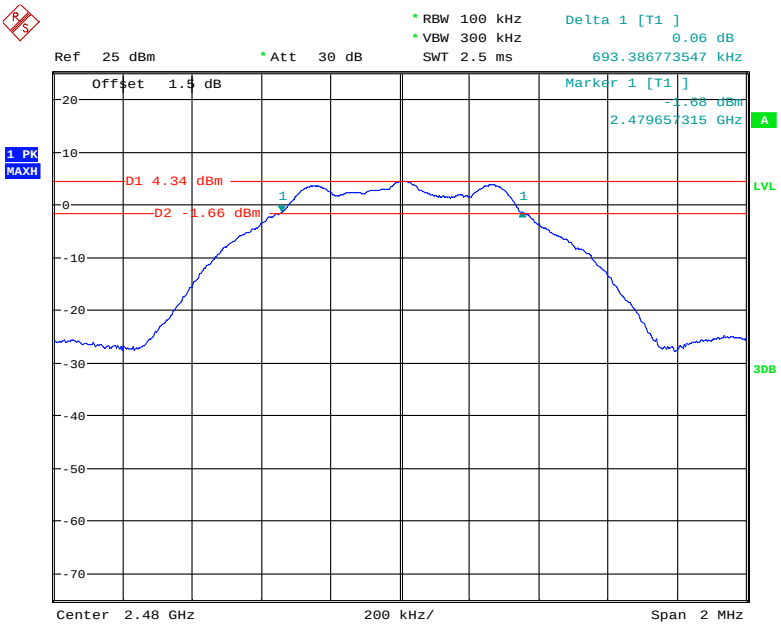
Date: 13.MAR.2019 15:22:25

BLE, Middle Channel



Date: 13.MAR.2019 15:30:10

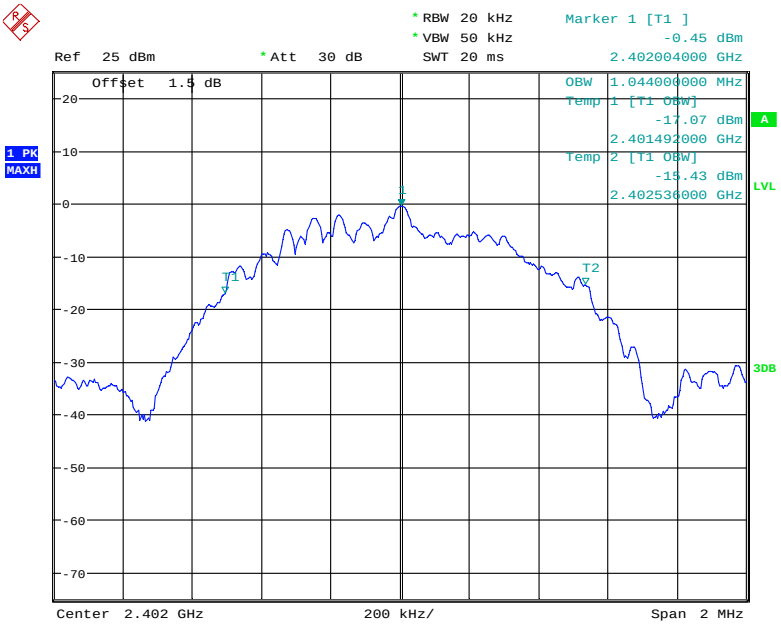
BLE, High Channel



Date: 13.MAR.2019 15:27:53

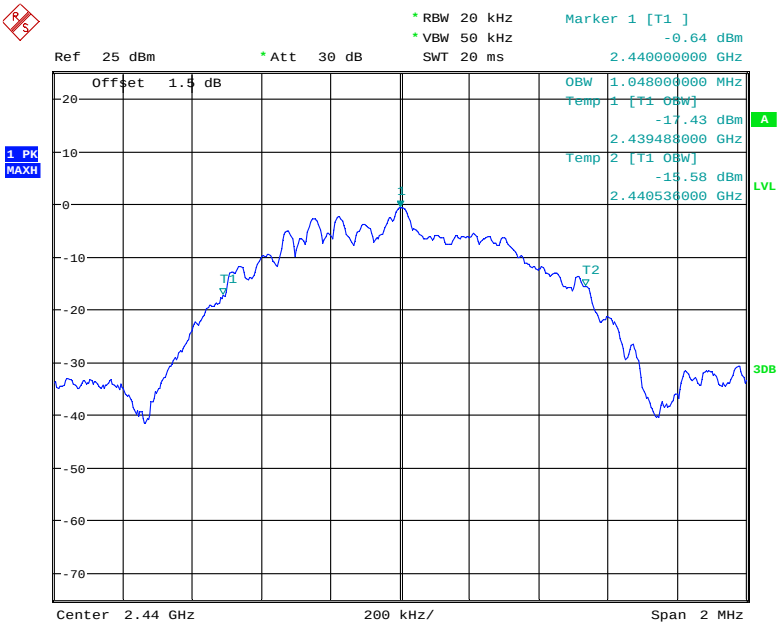
99% Occupied Bandwidth:

BLE, Low Channel



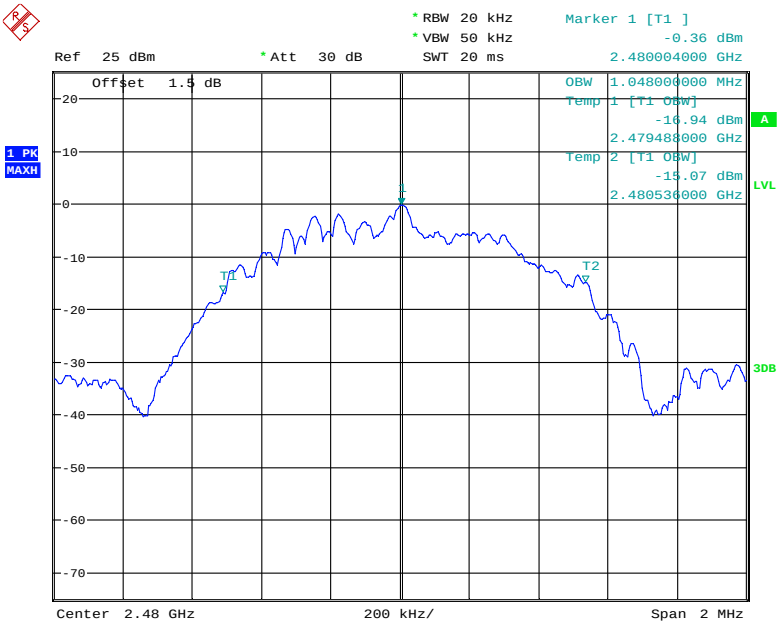
Date: 13.MAR.2019 15:22:41

BLE, Middle Channel



Date: 13.MAR.2019 15:30:25

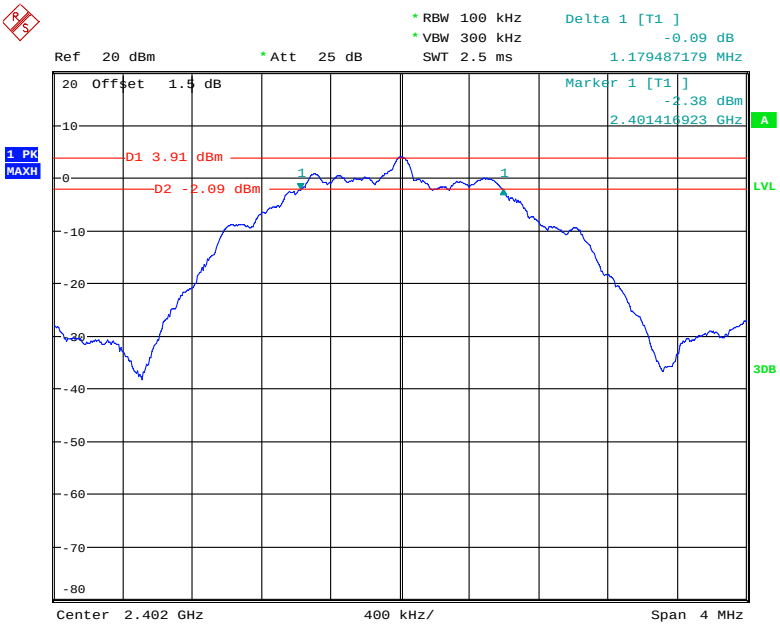
BLE, High Channel



Date: 13.MAR.2019 15:28:08

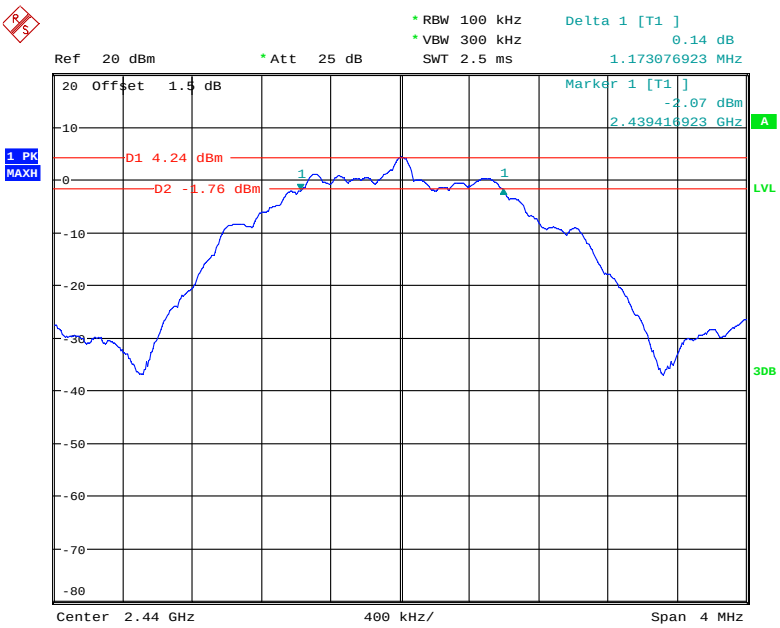
2Mbps, 6dB Bandwidth:

BLE, Low Channel



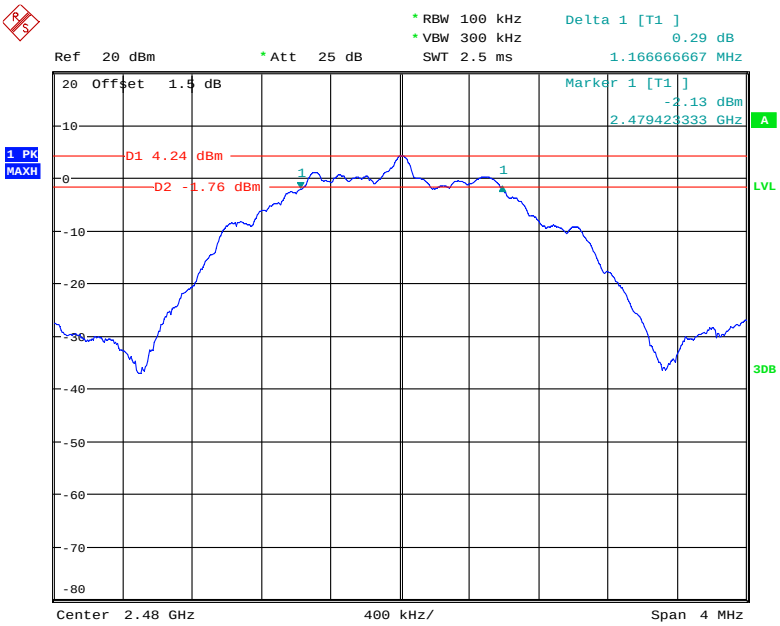
Date: 6.APR.2019 14:59:43

BLE, Middle Channel



Date: 6.APR.2019 15:16:57

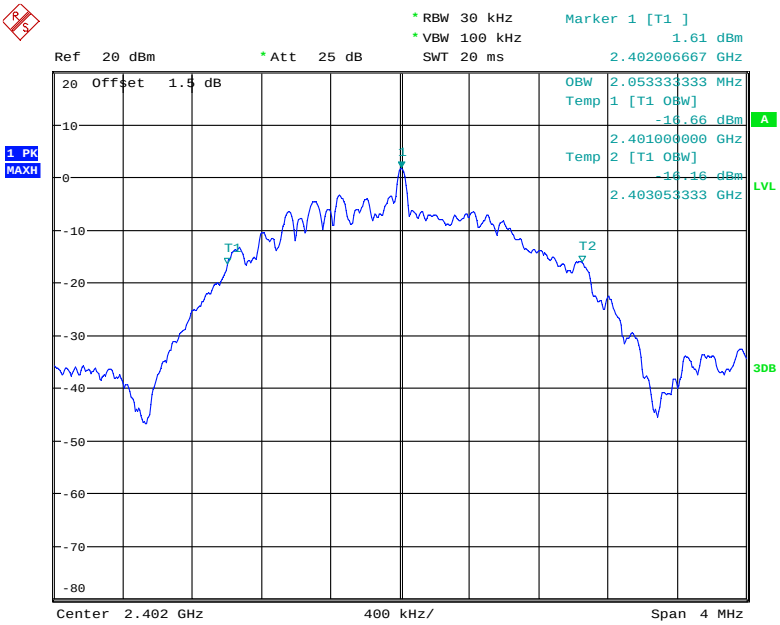
BLE, High Channel



Date: 6.APR.2019 15:25:32

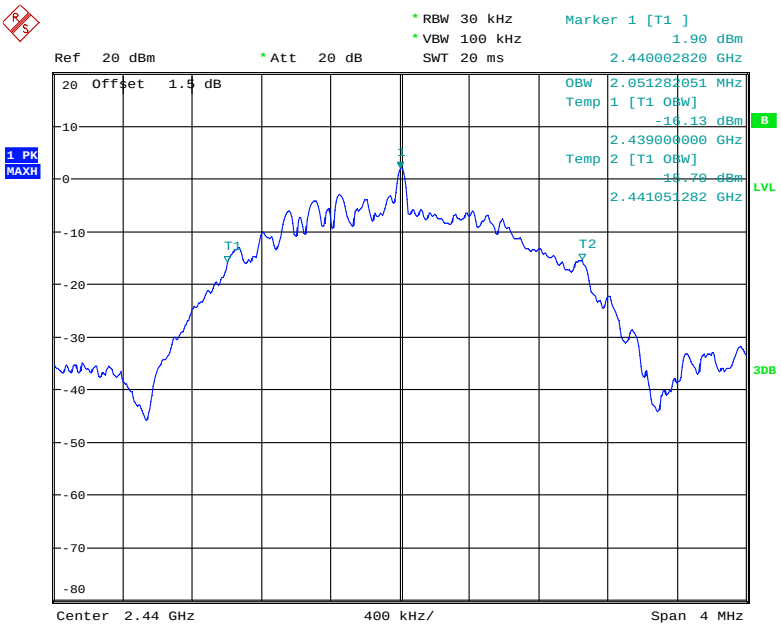
99% Occupied Bandwidth:

BLE, Low Channel



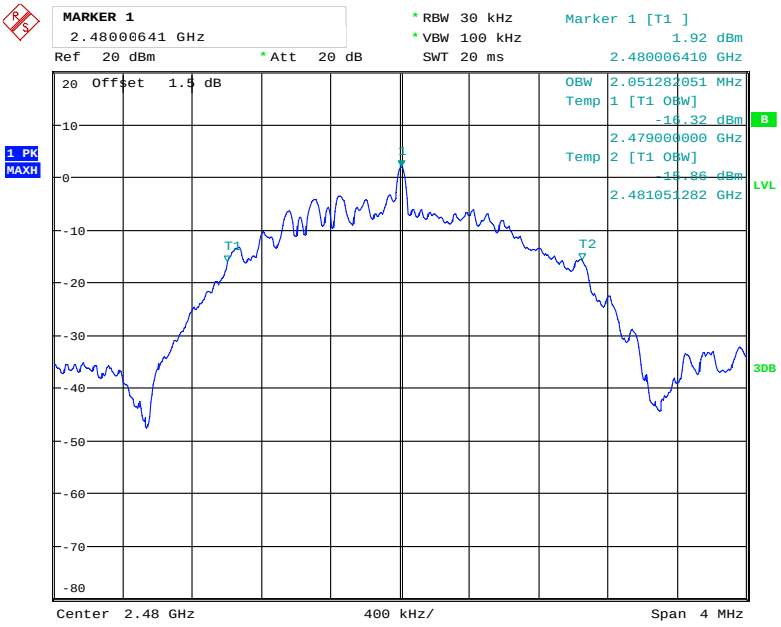
Date: 6.APR.2019 14:58:10

BLE, Middle Channel



Date: 6.APR.2019 15:21:50

BLE, High Channel



Date: 6.APR.2019 15:27:41

FCC §15.247(b) (3)&RSS-247 §5.4 d) - 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.

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2018-12-10	2019-12-10
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:	25.8 °C
Relative Humidity:	46 %
ATM Pressure:	101.1 kPa

The testing was performed by ELena Lei from 2019-03-13

Test Mode: Transmitting

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

Test Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
1Mbps	Low	2402	4.58	30
	Middle	2440	4.39	30
	High	2480	4.75	30
2Mbps	Low	2402	3.96	30
	Middle	2440	3.92	30
	High	2480	4.63	30

FCC §15.247(d)&RSS-247 §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 §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	2019-01-04	2020-01-04
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:	25.8~26.7 °C
Relative Humidity:	46~56 %
ATM Pressure:	100.7~101.1 kPa

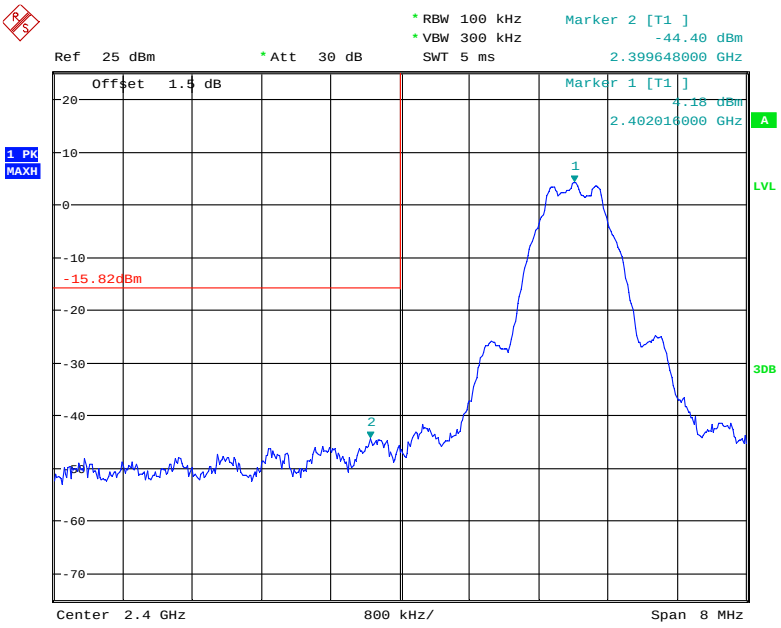
The testing was performed by ELena Lei from 2019-03-13 to 2019-04-06.

Test mode: Transmitting

Test Result: Compliance. *Please refer to following plots.*

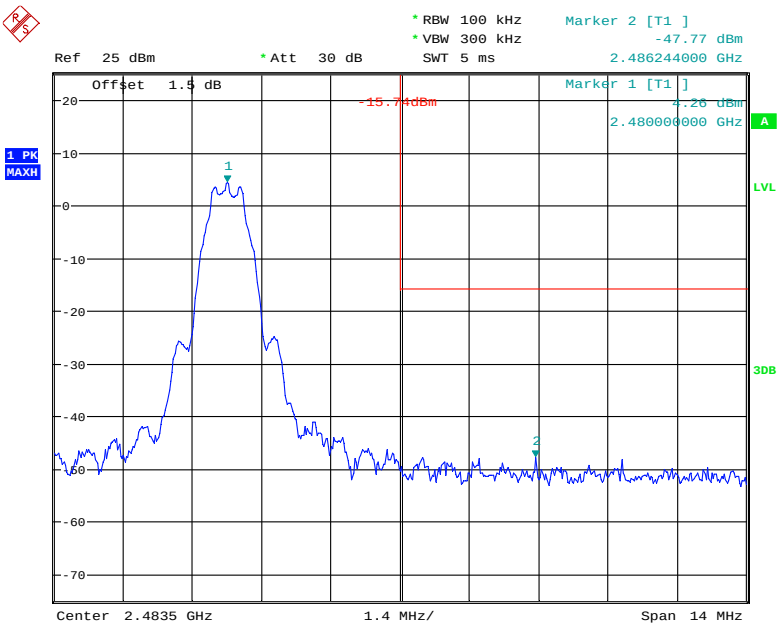
1Mbps:

BLE, Band Edge, Left Side



Date: 13.MAR.2019 15:24:27

BLE, Band Edge, Right Side



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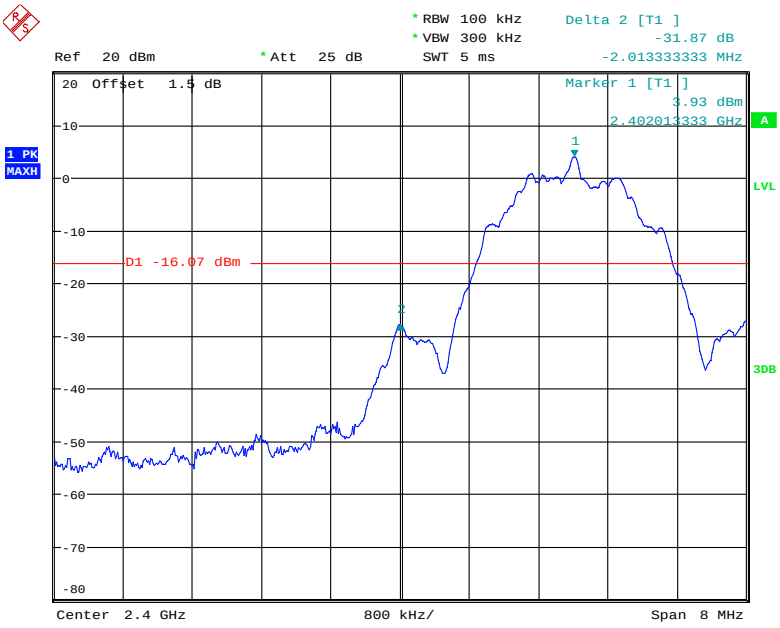
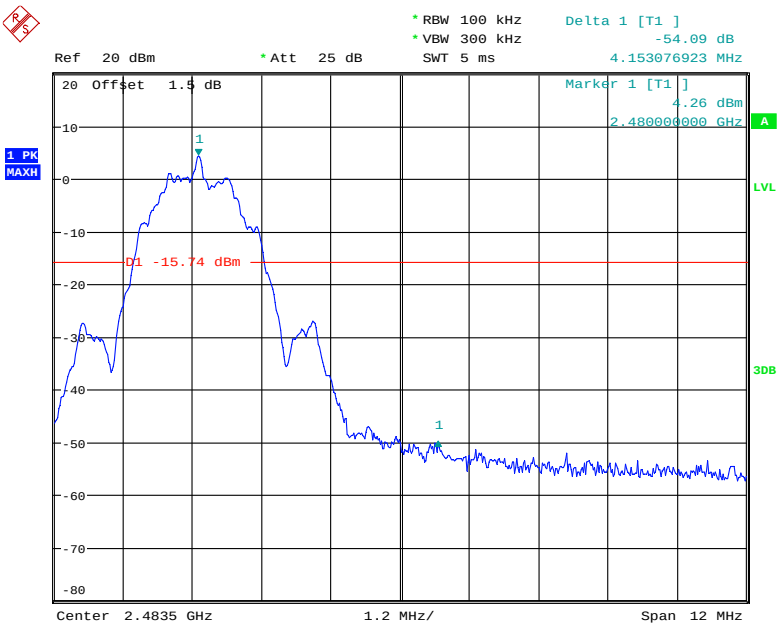
2Mbps:

BLE, Band Edge, Left Side



Date: 6.APR.2019 15:05:49

BLE, Band Edge, Right Side



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FCC §15.247(e) &RSS-247 §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

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-01-04	2020-01-04
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:	25.8~26.7 °C
Relative Humidity:	46~56 %
ATM Pressure:	100.7~101.1 kPa

The testing was performed by ELena Lei from 2019-03-13 to 2019-04-06.

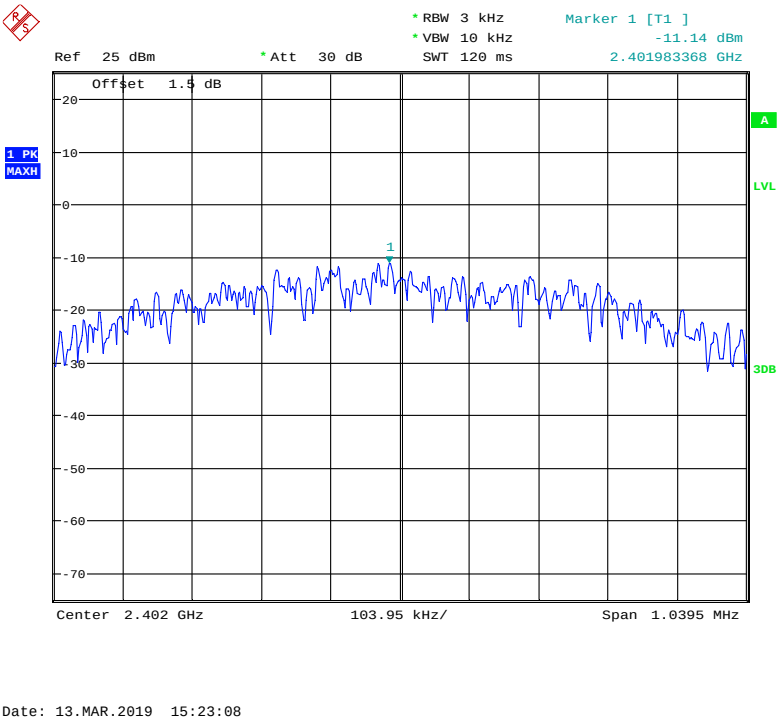
Test Mode: Transmitting

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

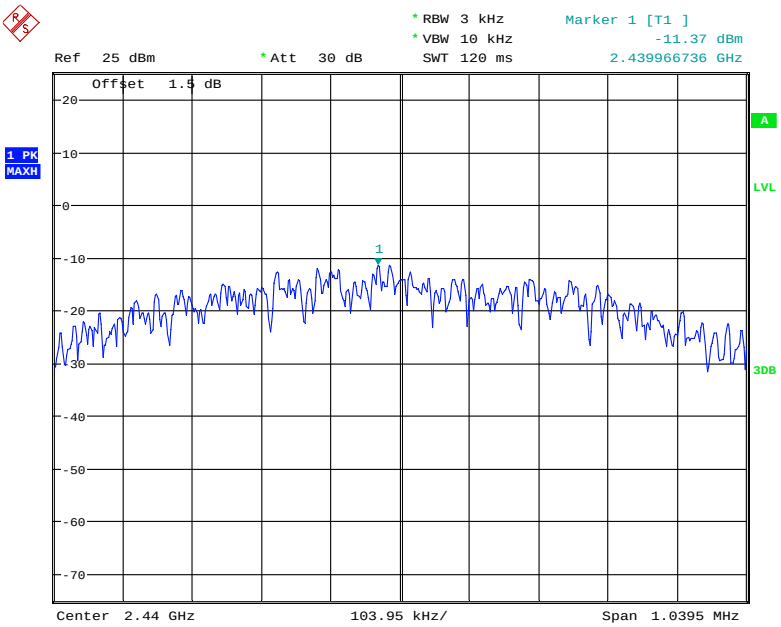
Test Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
1Mbps	Low	2402	-11.14	≤8
	Middle	2440	-11.37	≤8
	High	2480	-11.23	≤8
2Mbps	Low	2402	-13.94	≤8
	Middle	2440	-13.67	≤8
	High	2480	-13.76	≤8

1Mbps:

BLE, Low Channel



BLE, Middle Channel



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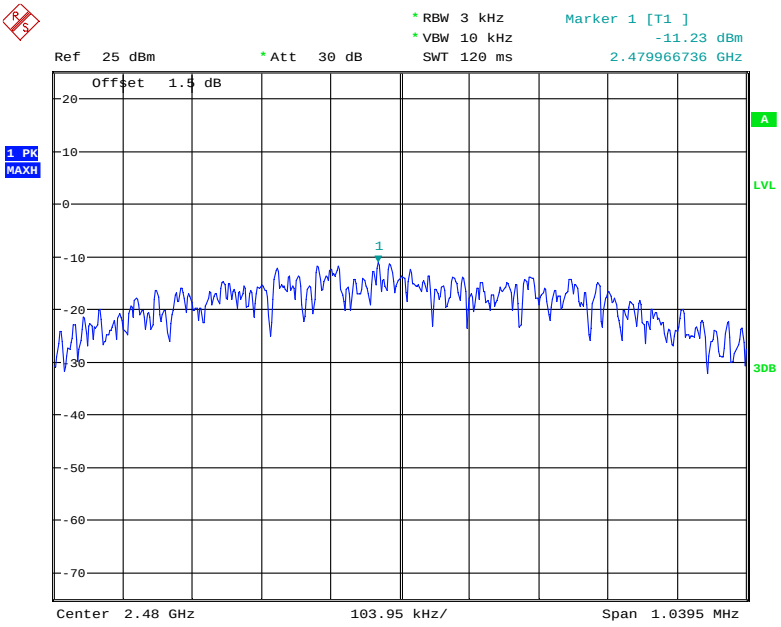
BLE, High Channel



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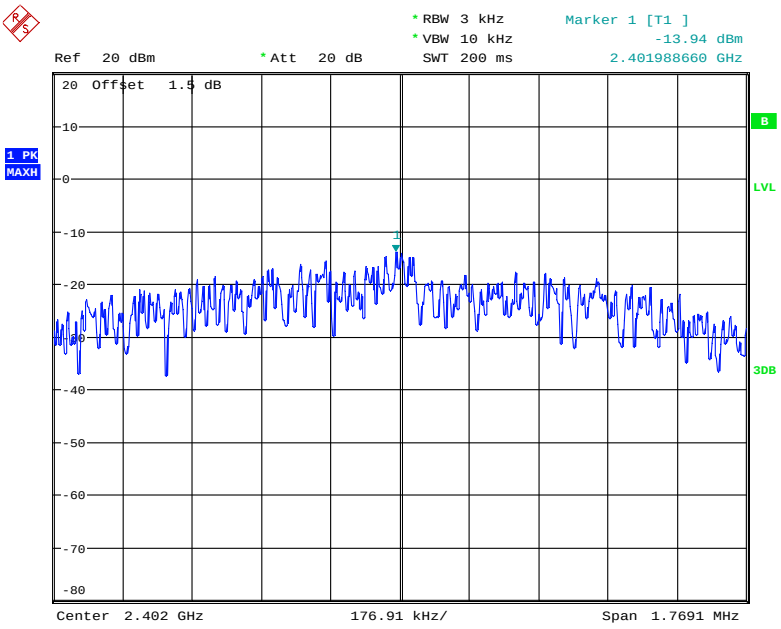
2Mbps:

BLE, Low Channel



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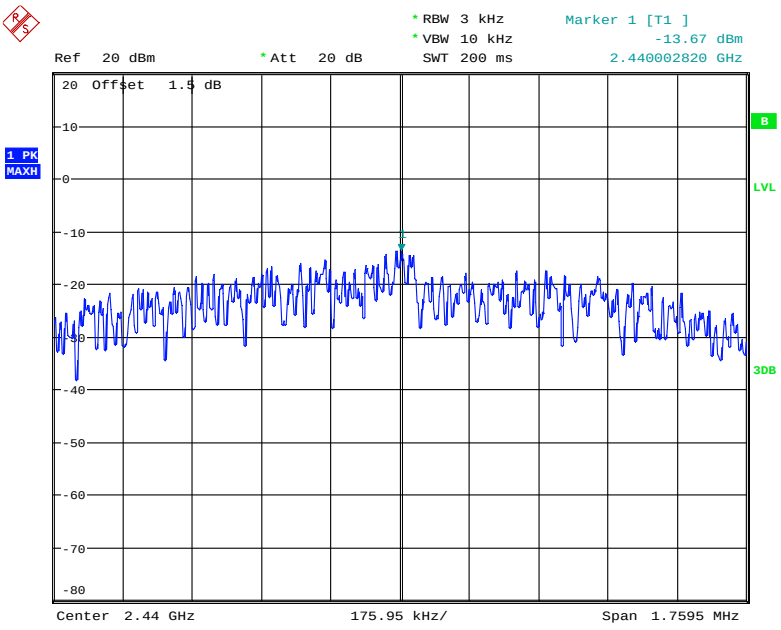
BLE, Middle Channel



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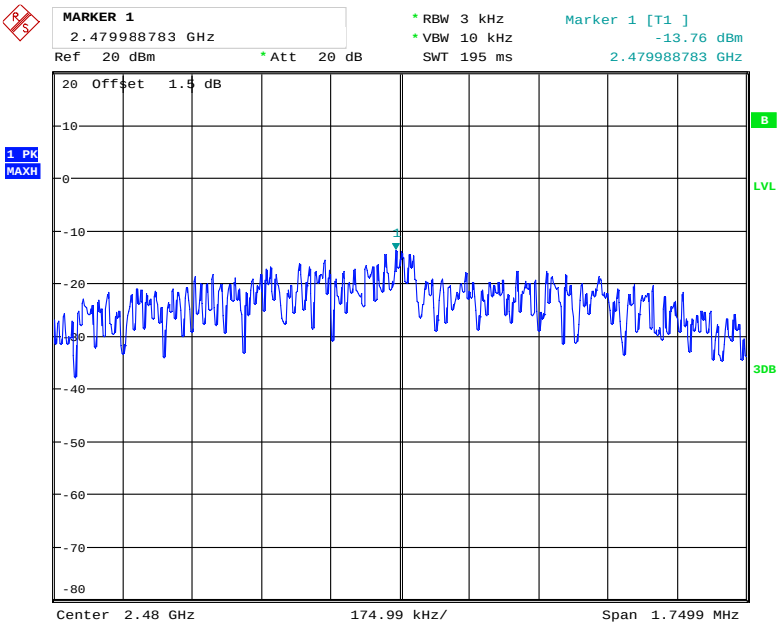
BLE, High Channel



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