



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.247

RSS-GEN, ISSUE 5, AMENDMENT 1, MARCH 2019

RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Proxim Wireless Corporation

2114 Ringwood Ave, San Jose, CA 95131, USA

FCC ID: HZB-NGPLC
IC: 1856A-NGPLC


Report Type: Original Report	Product Name: NGP LC 5 GHz radio
Report Number: RDG200805002-00A	
Report Date: 2020-12-21	
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TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
DECLARATIONS.....	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	7
BLOCK DIAGRAM OF TEST SETUP	8
SUMMARY OF TEST RESULTS.....	9
FCC §15.203, RSS-GEN CLAUSE 6.8 - ANTENNA REQUIREMENT	10
APPLICABLE STANDARD	10
ANTENNA CONNECTOR CONSTRUCTION	11
FCC §15.207 (a), RSS-GEN CLAUSE 8.8 – AC LINE CONDUCTED EMISSIONS	12
APPLICABLE STANDARD	12
EUT SETUP	12
EMI TEST RECEIVER SETUP	12
TEST PROCEDURE	13
CORRECTED AMPLITUDE & MARGIN CALCULATION	13
TEST EQUIPMENT LIST AND DETAILS.....	13
TEST DATA	14
FCC §15.209, §15.205 & §15.247(d), RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10 - SPURIOUS EMISSIONS.....	16
APPLICABLE STANDARD	16
EUT SETUP	16
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	17
TEST PROCEDURE	17
CORRECTED AMPLITUDE & MARGIN CALCULATION	17
TEST EQUIPMENT LIST AND DETAILS.....	18
TEST DATA	18
FCC §15.247(a) (2), RSS-247 CLAUSE 5.2 a) &RSS-GEN CLAUSE 6.7–6 dB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH.....	24
APPLICABLE STANDARD	24
TEST PROCEDURE	25
TEST EQUIPMENT LIST AND DETAILS.....	25
TEST DATA	26
FCC §15.247(b) , RSS-247 CLAUSE 5.4 - MAXIMUM PEAK CONDUCTED OUTPUT POWER.....	30
APPLICABLE STANDARD	30
TEST PROCEDURE	30
TEST EQUIPMENT LIST AND DETAILS.....	30
TEST DATA	30
FCC §15.247(d), RSS-247 CLAUSE 5.5 – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE	32

APPLICABLE STANDARD	32
TEST PROCEDURE	32
TEST EQUIPMENT LIST AND DETAILS.....	33
TEST DATA	33
FCC §15.247(e), RSS-247 CLAUSE 5.2 B - POWER SPECTRAL DENSITY	35
APPLICABLE STANDARD	35
TEST PROCEDURE	35
TEST EQUIPMENT LIST AND DETAILS.....	35
TEST DATA	35

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		NGP LC 5 GHz radio
Test Model:		FCC: MP-1015-CPE-US IC: MP-1025-CPE-WD
Multiple Model:		AB-CCCCD-XXX-YYY-ZZ - Refer to the DOS letter for details
Model Difference:		AB-CCCCD-XXX-YYY-ZZ - Refer to the DOS letter for details
Operation Frequency:		2402-2480MHz
Maximum Peak Output Power (Conducted):		-2.44 dBm
Modulation Type:		GFSK
Antenna Gain^Δ:		2.0 dBi
Rated Input Voltage:		DC 56.0V from PoE
PoE Adapter Information	Model:	POE31U-1AT(SC)
	Input:	AC 100-240V 50/60Hz 0.8A
	Output:	DC 56.0V 0.536A
Serial Number:		RDG200805002-RF-S1
EUT Received Date:		2020.08.07
EUT Received Status:		Good

Objective

This report is prepared on behalf of **Proxim Wireless Corporation** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, Amendment 1, March 2019 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 and 15.247 rules, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, Amendment 1, March 2019 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

FCC Part 15E NII submissions with FCC ID: HZB-NGPLC.
RSS-247 LE-LANs submissions with IC: 1856A-NGPLC

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 558074 D01 15.247 Meas Guidance v05r02, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, Amendment 1, March 2019 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 °C
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)

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, 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.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For Bluetooth LE mode, 40 channels are provided for testing:

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

EUT was tested with channel 0, 19 and 39.

EUT Exercise Software

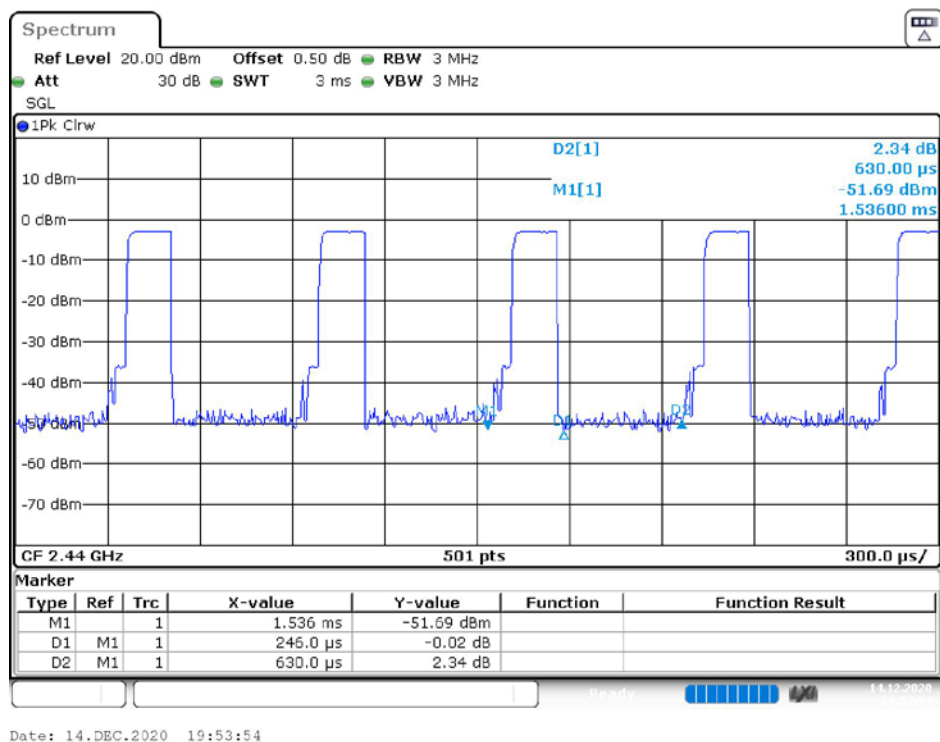
For BLE, the software “nRFgo” was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer ▲:

Channel	Frequency (MHz)	Power level
Low	2402	Default
Middle	2440	Default
High	2480	Default

The maximum duty cycle as following table:

Test mode	T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
BLE	0.246	0.630	39.05

BLE



Equipment Modifications

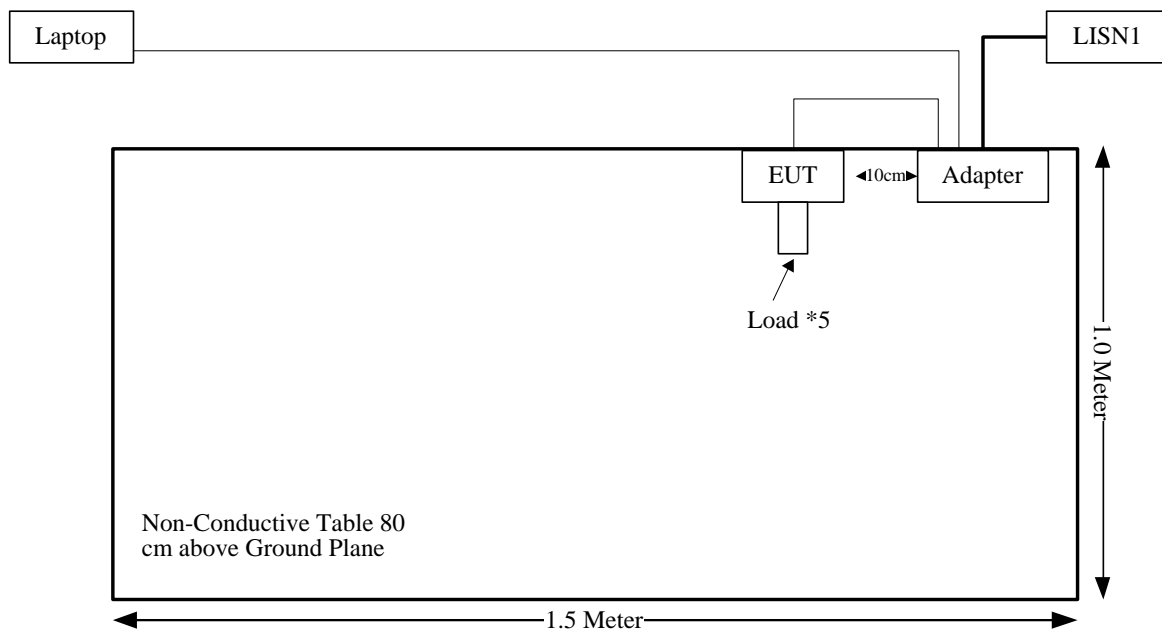
No modification was made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017
Unknown	50Ohm SMA Load	Unknown	SMA Load-1
Unknown	50Ohm SMA Load	Unknown	SMA Load-2
Unknown	50Ohm SMA Load	Unknown	SMA Load-3
Unknown	50Ohm SMA Load	Unknown	SMA Load-4
Unknown	50Ohm SMA Load	Unknown	SMA Load-5

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45 Cable	Yes	No	1.0	PoE Adapter	EUT
RJ45 Cable	Yes	No	1.0	PoE Adapter	Laptop

Block Diagram of Test Setup

SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
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, §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 and 99% Occupied Bandwidth	Compliance
FCC §15.247(b)(3); RSS-247 Clause 5.4 d)	Maximum Conducted Output Power	Compliance
FCC §15.247(d); RSS-247 Clause 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC §15.247(e) RSS-247 Clause 5.2 b)	Power Spectral Density	Compliance

FCC §15.203, RSS-GEN CLAUSE 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.
- 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 Connector Construction

The Antenna permanently attached to the unit, please refer to the EUT photos.

Manufacturer	Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range
Proxim	PCB	50	2.0 dBi/2.4-2.5GHz

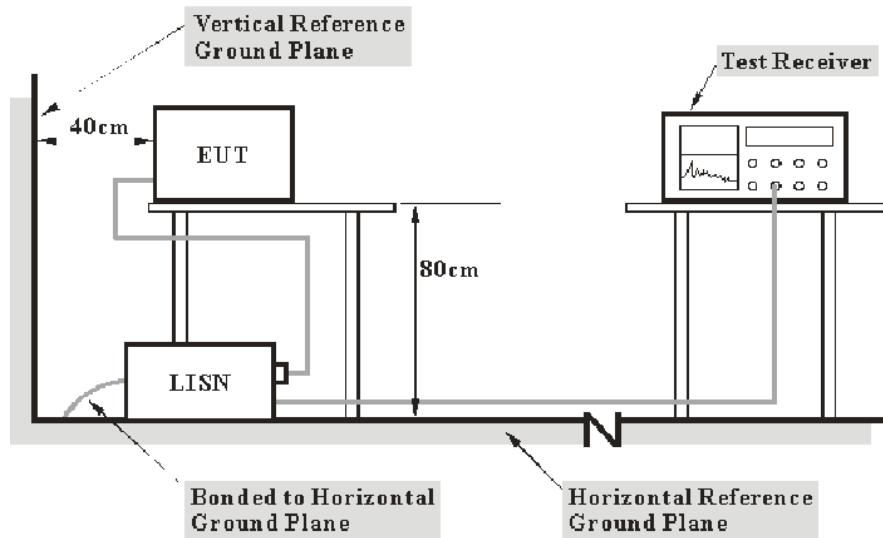
Result: Compliance.

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

Applicable Standard

FCC§15.207(a), RSS-Gen CLAUSE 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

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

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

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:

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV 216	101614	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-05-09	2021-05-09
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2019-09-05	2020-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

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

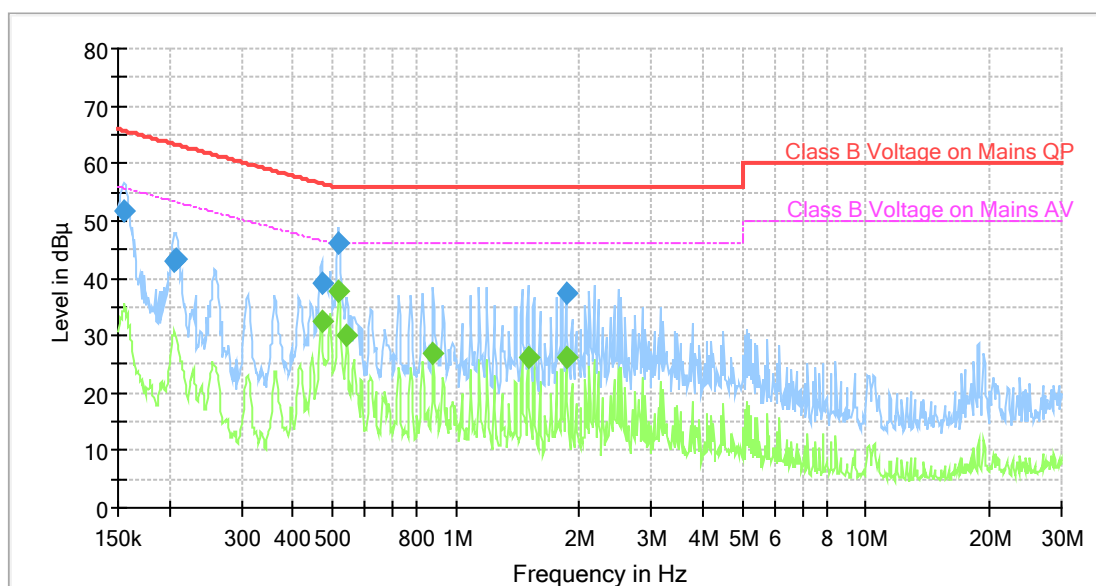
Test Data

Environmental Conditions

Temperature:	27.9°C
Relative Humidity:	62%
ATM Pressure:	99.8 kPa
Tester:	Barry Yang
Test Date:	2020-08-09

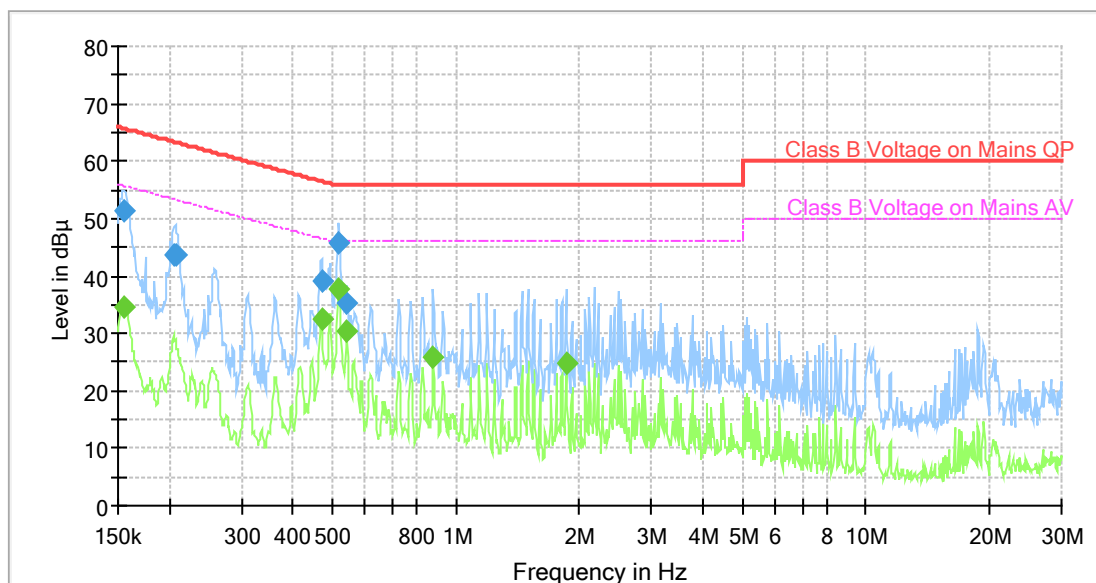
Test Mode: Transmitting

AC120 V, 60 Hz, Line:



Final Result

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.155329	51.61	---	65.71	14.10	9.000	L1	9.6
0.205378	43.07	---	63.39	20.32	9.000	L1	9.6
0.207437	43.37	---	63.31	19.94	9.000	L1	9.6
0.470023	---	32.47	46.51	14.04	9.000	L1	9.6
0.470023	38.96	---	56.51	17.55	9.000	L1	9.6
0.516743	---	37.70	46.00	8.30	9.000	L1	9.6
0.516743	46.25	---	56.00	9.75	9.000	L1	9.6
0.543169	---	29.89	46.00	16.11	9.000	L1	9.6
0.881136	---	26.75	46.00	19.25	9.000	L1	9.7
1.502491	---	26.08	46.00	19.92	9.000	L1	9.7
1.861883	---	26.25	46.00	19.75	9.000	L1	9.7
1.861883	37.21	---	56.00	18.79	9.000	L1	9.7

AC120 V, 60 Hz, Neutral:**Final_Result**

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.154557	---	34.74	55.75	21.01	9.000	N	9.6
0.155329	51.42	---	65.71	14.29	9.000	N	9.6
0.205378	43.54	---	63.39	19.85	9.000	N	9.6
0.207437	43.78	---	63.31	19.53	9.000	N	9.6
0.470023	---	32.54	46.51	13.97	9.000	N	9.6
0.470023	39.12	---	56.51	17.39	9.000	N	9.6
0.516743	---	37.85	46.00	8.15	9.000	N	9.6
0.519327	45.80	---	56.00	10.20	9.000	N	9.6
0.540467	---	30.34	46.00	15.66	9.000	N	9.6
0.540467	35.35	---	56.00	20.65	9.000	N	9.6
0.881136	---	25.78	46.00	20.22	9.000	N	9.6
1.861883	---	24.97	46.00	21.03	9.000	N	9.6

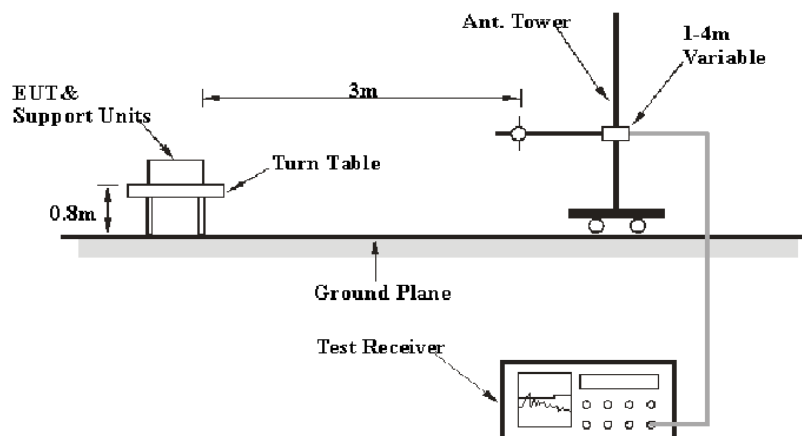
FCC §15.209, §15.205 & §15.247(d), RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10 - SPURIOUS EMISSIONS

Applicable Standard

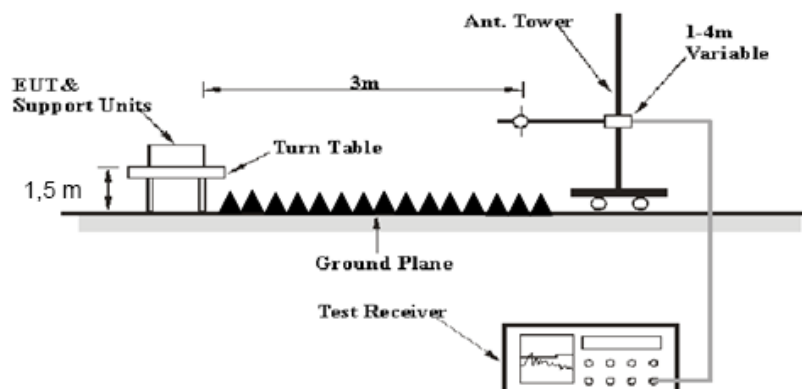
FCC §15.247 (d); §15.209; §15.205; RSS-247 §5.5, RSS-GEN §8.10.

EUT Setup

Below 1GHz:



Above 1GHz:



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

1GHz- 25GHz:

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

Note: T is minimum transmission duration

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.

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:

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

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-3	2020-07-21	2023-07-21
R&S	EMI Test Receiver	ESCI	100224	2019-09-12	2020-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2019-09-24	2020-09-24
Sonoma	Amplifier	310N	185914	2019-10-13	2020-10-13
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Radiation Above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2017-12-06	2020-12-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-07-07	2021-07-07
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2020-06-27	2021-06-27
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2020-06-27	2021-06-27
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2020-06-16	2021-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2020-06-16	2021-06-16

*** 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**

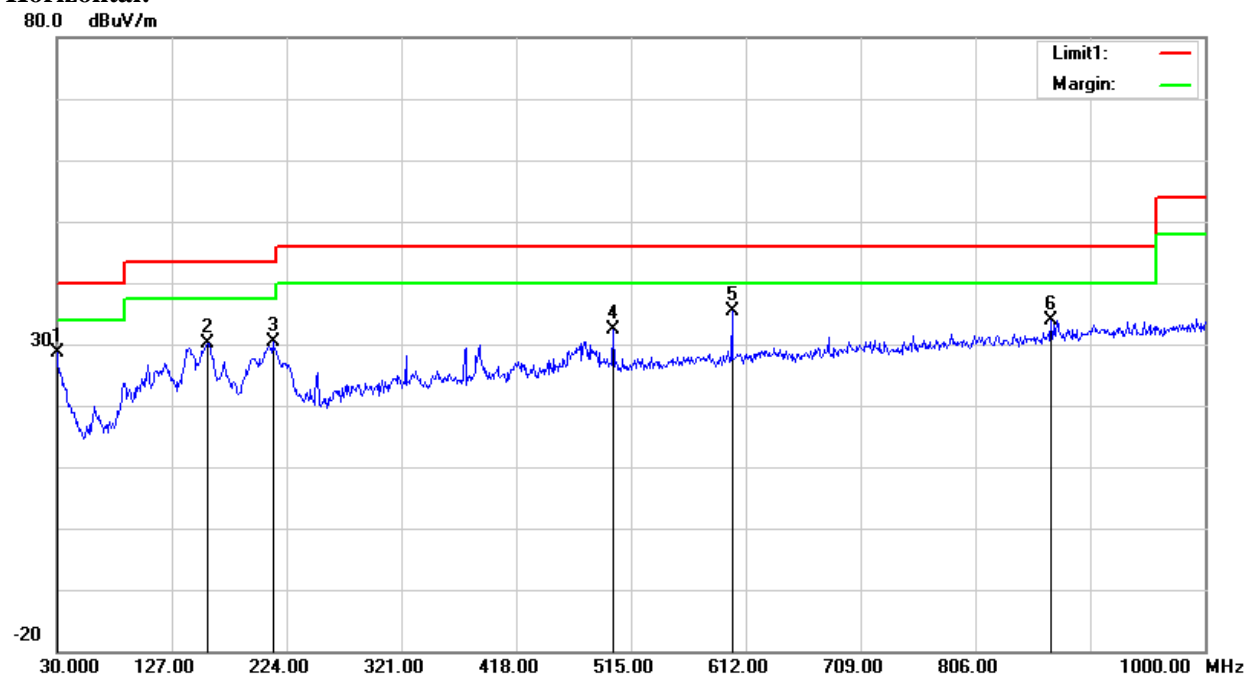
Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	28 °C	28~30 °C
Relative Humidity:	44%	32~60 %
ATM Pressure:	101 kPa	100~101.1 kPa
Tester:	Joker Chen	Carlos Jia, Felix Wang
Test Date:	2020-08-15	2020-08-13~2020-08-27

Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

1) 30MHz-1GHz(low channel was the worst)

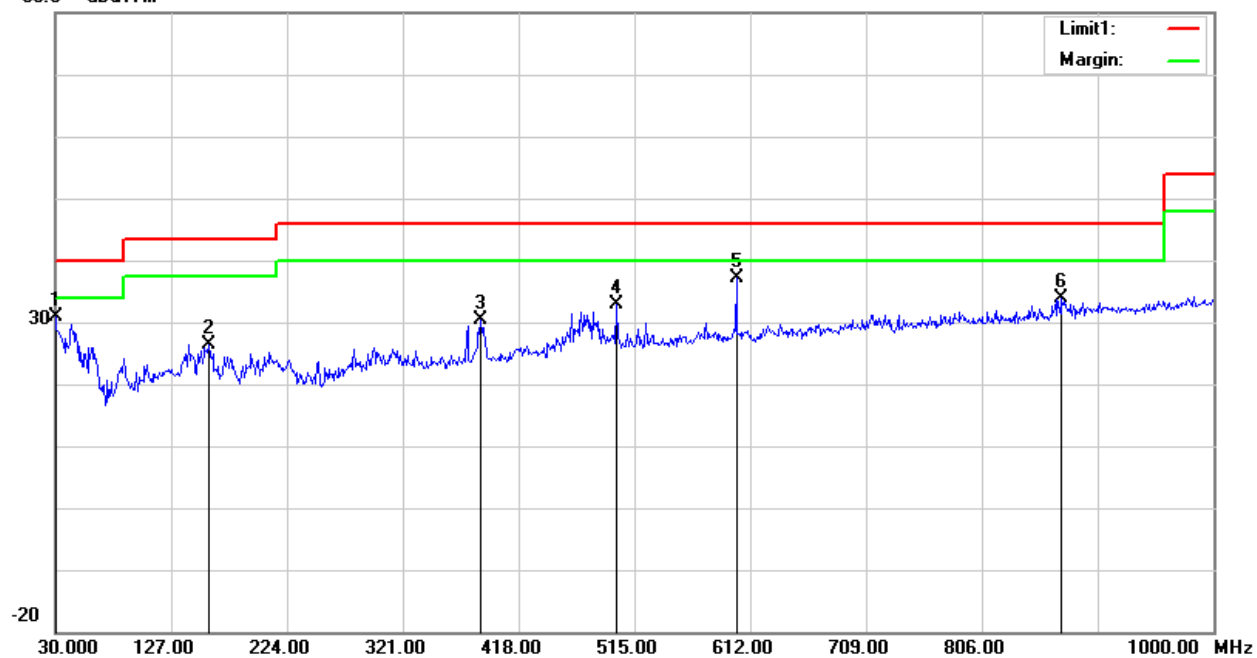
Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	27.09	peak	1.46	28.55	40.00	11.45
157.0700	36.17	peak	-5.96	30.21	43.50	13.29
212.3600	37.80	peak	-7.32	30.48	43.50	13.02
499.4800	32.87	peak	-0.39	32.48	46.00	13.52
600.3600	34.71	peak	0.76	35.47	46.00	10.53
870.0200	29.14	peak	4.79	33.93	46.00	12.07

Vertical:

80.0 dBuV/m



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	29.51	peak	1.46	30.97	40.00	9.03
158.0400	32.26	peak	-5.93	26.33	43.50	17.17
385.9900	32.71	peak	-2.43	30.28	46.00	15.72
500.4500	33.23	peak	-0.39	32.84	46.00	13.16
600.3600	36.37	peak	0.76	37.13	46.00	8.87
872.9300	29.03	peak	4.82	33.85	46.00	12.15

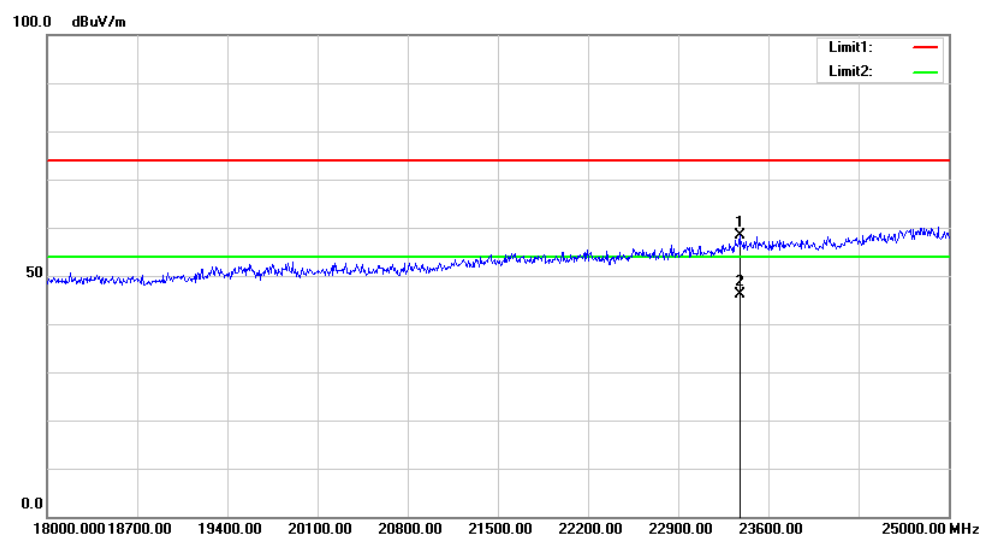
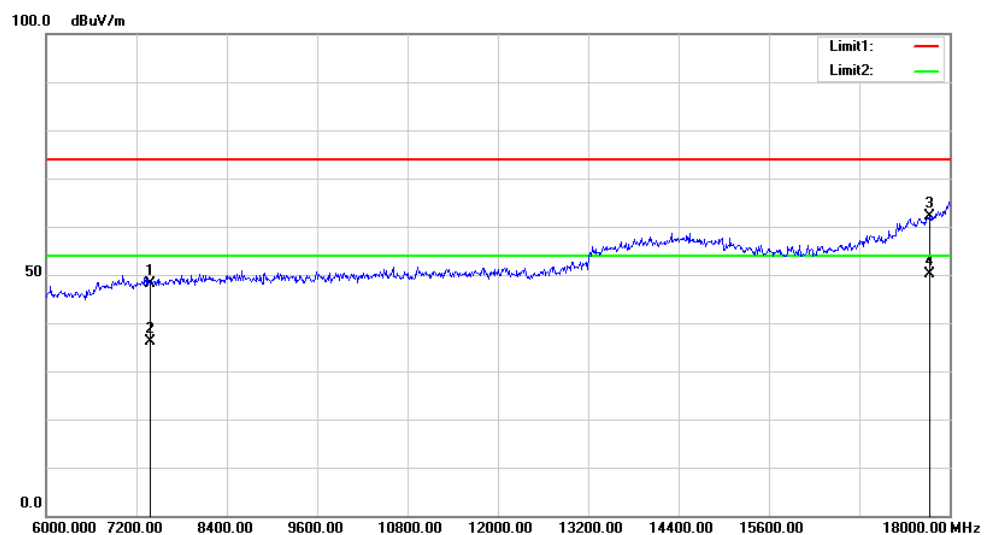
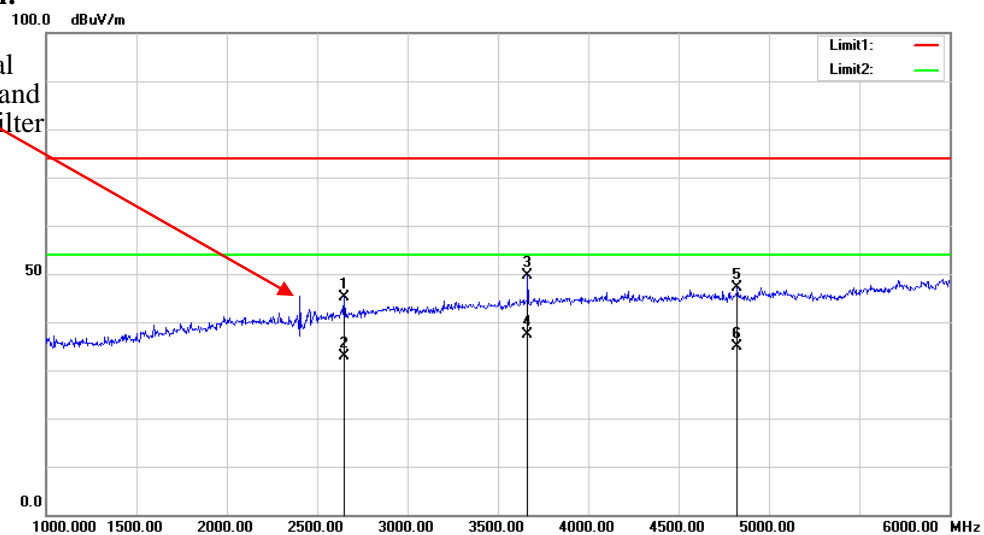
2) 1-25GHz:

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									
2390.00	29.95	PK	H	28.08	1.80	0.00	59.83	74.00	14.17
2390.00	20.02	AV	H	28.08	1.80	0.00	49.90	54.00	4.10
4804.00	41.20	PK	H	32.91	3.17	25.60	51.68	74.00	22.32
4804.00	36.54	AV	H	32.91	3.17	25.60	47.02	54.00	6.98
7206.00	37.05	PK	H	35.74	4.82	25.60	52.01	74.00	21.99
7206.00	29.63	AV	H	35.74	4.82	25.60	44.59	54.00	9.41
Middle Channel: 2440 MHz									
4880.00	40.36	PK	H	33.06	3.27	25.66	51.03	74.00	22.97
4880.00	35.82	AV	H	33.06	3.27	25.66	46.49	54.00	7.51
7320.00	37.08	PK	H	36.03	4.62	25.72	52.01	74.00	21.99
7320.00	29.73	AV	H	36.03	4.62	25.72	44.66	54.00	9.34
High Channel: 2480 MHz									
2483.50	28.32	PK	H	28.27	1.84	0.00	58.43	74.00	15.57
2483.50	16.54	AV	H	28.27	1.84	0.00	46.65	54.00	7.35
4960.00	38.04	PK	H	33.22	3.23	25.63	48.86	74.00	25.14
4960.00	30.70	AV	H	33.22	3.23	25.63	41.52	54.00	12.48
7440.00	36.38	PK	H	36.34	4.41	25.85	51.28	74.00	22.72
7440.00	25.21	AV	H	36.34	4.41	25.85	40.11	54.00	13.89

Test plots(Low channel was the worst)

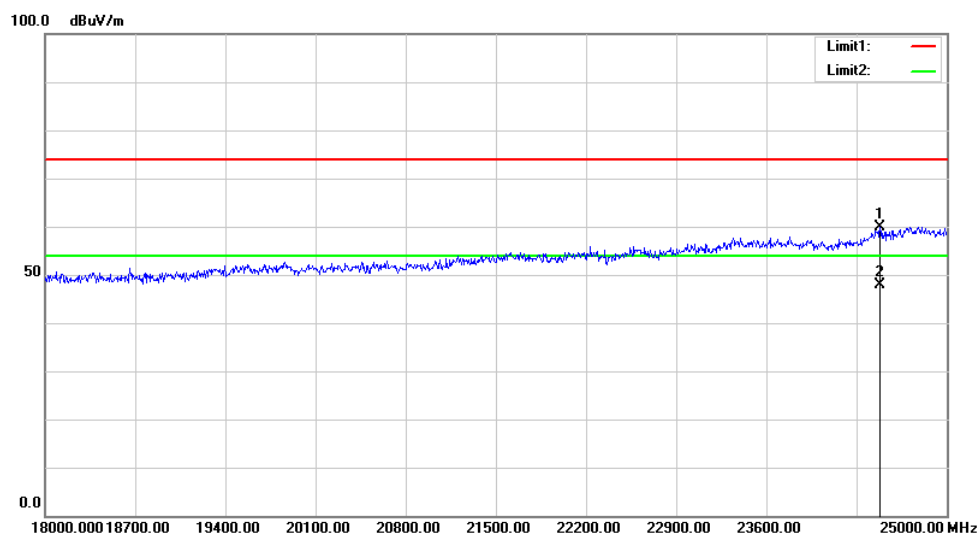
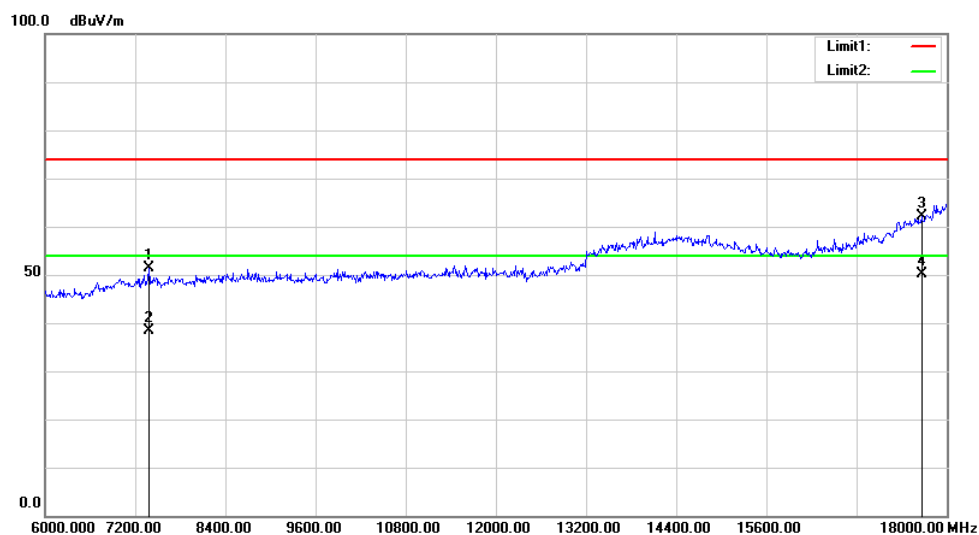
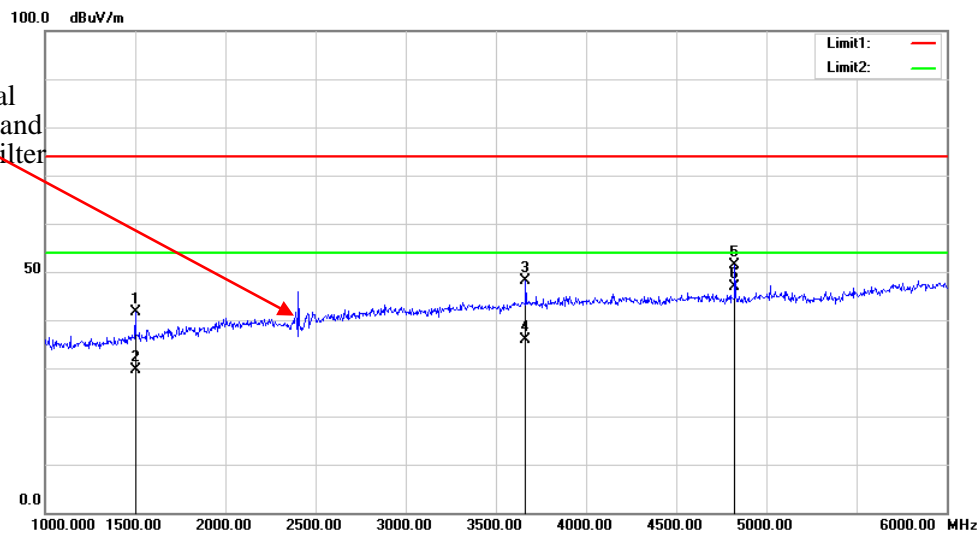
Horizontal:

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:

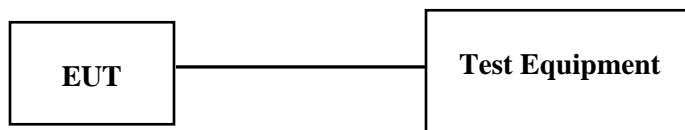
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid 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

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- 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) Test 99% Occupied bandwidth use the function 99% OBW of the test equipment.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2020-07-07	2021-07-07
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010013	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	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).

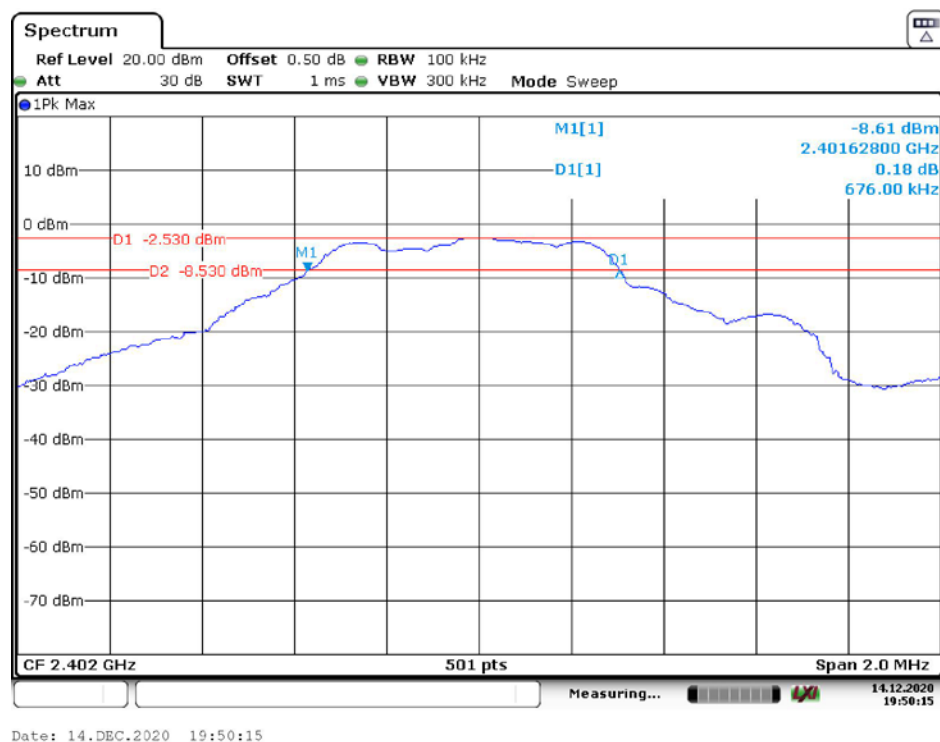
Test Data**Environmental Conditions**

Temperature:	24.6 °C
Relative Humidity:	47 %
ATM Pressure:	101.1kPa
Tester:	Chris Mo
Test Date:	2020-12-14

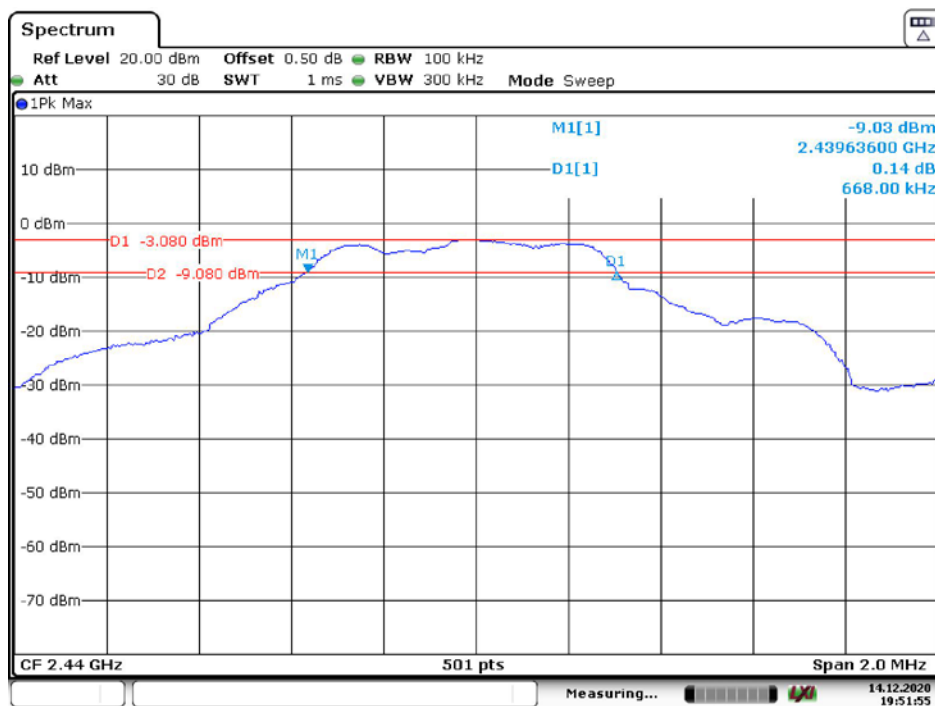
Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
BLE	Low	2402	0.676	1.118	≥ 0.5
	Middle	2440	0.668	1.130	≥ 0.5
	High	2480	0.680	1.042	≥ 0.5

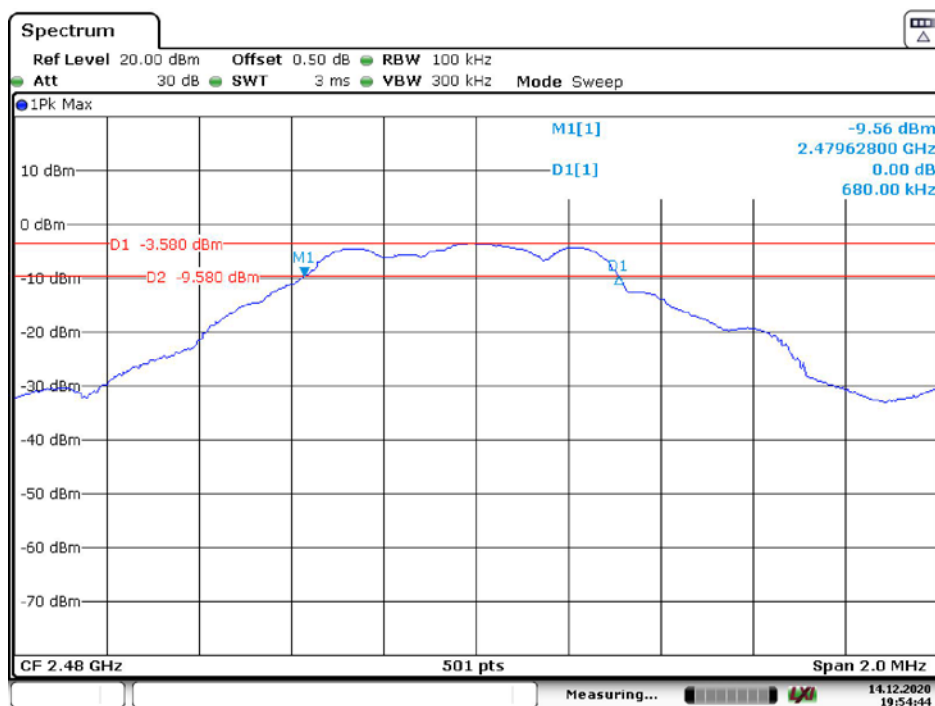
6 dB Bandwidth:**BLE Low Channel**

BLE Middle Channel



Date: 14.DEC.2020 19:51:55

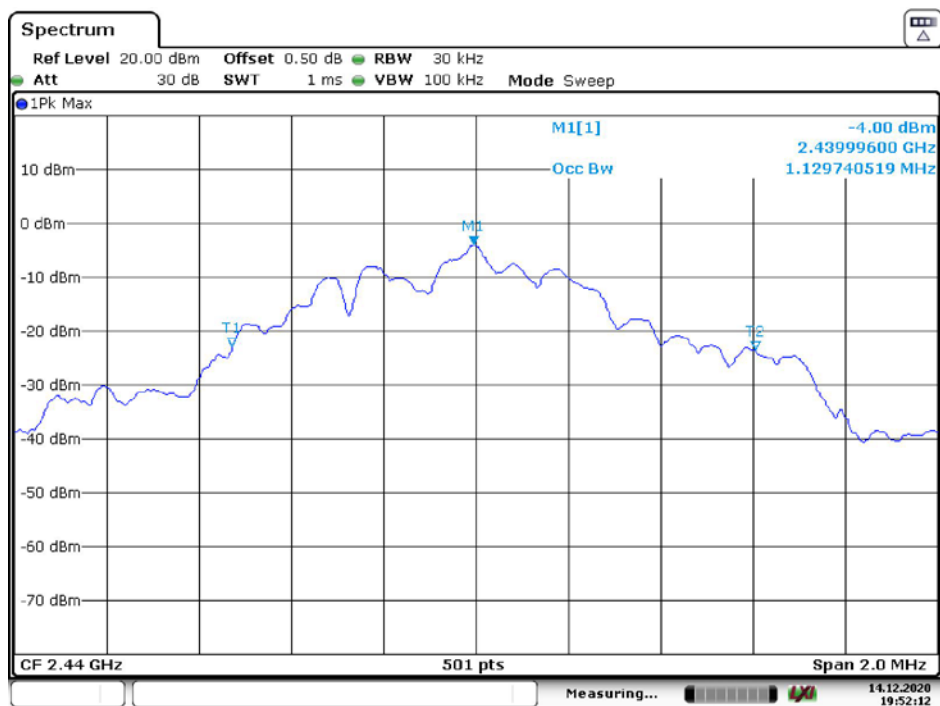
BLE High Channel



Date: 14.DEC.2020 19:54:44

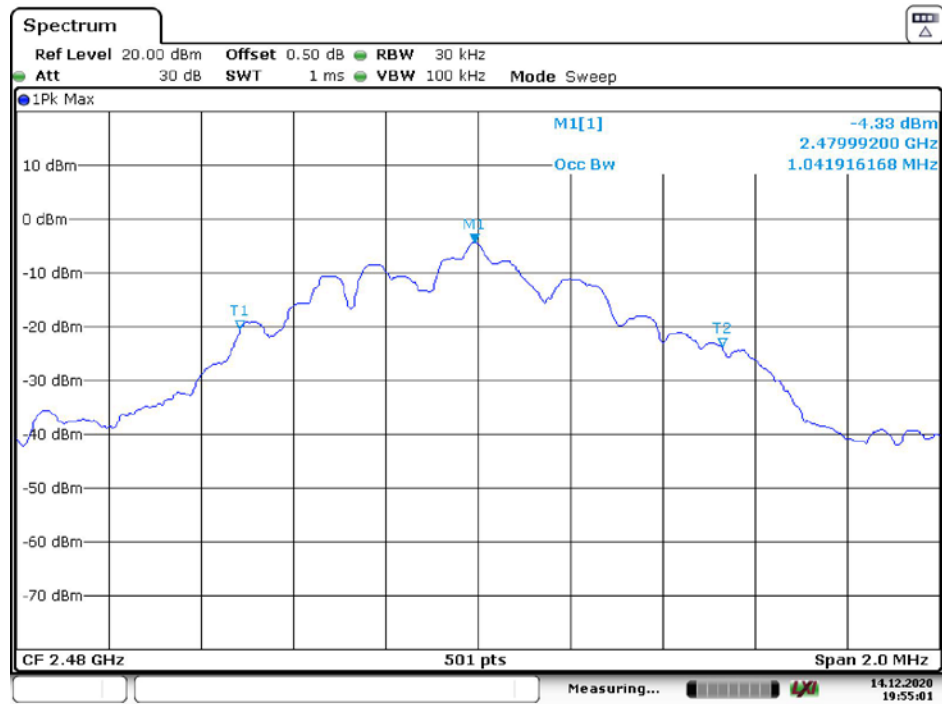
99% occupied Bandwidth**BLE Low Channel**

Date: 14.DEC.2020 19:50:33

BLE Middle Channel

Date: 14.DEC.2020 19:52:12

BLE High Channel



Date: 14.DEC.2020 19:55:01

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

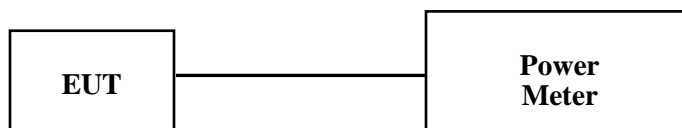
Applicable Standard

According to FCC §15.247(b) and (c)

According to RSS-247§5.4

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
Agilent	USB Wideband Power Sensor	U2021XA	MY5425009	2020-09-12	2021-09-12
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	OE01203239	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201048	Each time	N/A
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010013	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	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:	24.6 °C
Relative Humidity:	47 %
ATM Pressure:	101.1kPa
Tester:	Chris Mo
Test Date:	2020-12-14

Test Mode: Transmitting

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

Channel	Frequency (MHz)	Maximum Conducted Peak Output Power (dBm)	Limit (dBm)
Low	2402	-2.44	30
Middle	2440	-3.07	
High	2480	-3.46	

Note: The data above was tested in conducted mode and the antenna gain is 2.0 dBi, so it meets the EIRP limit of RSS-247.

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	FSV40	101474	2020-07-07	2021-07-07
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010013	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	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).

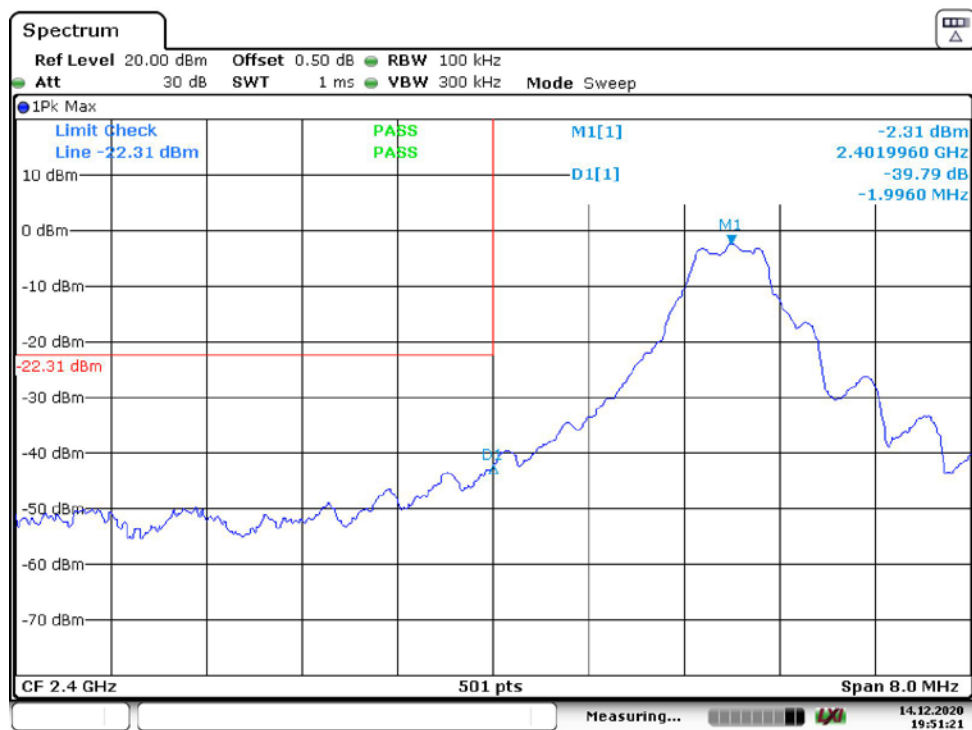
Test Data**Environmental Conditions**

Temperature:	24.6 °C
Relative Humidity:	47 %
ATM Pressure:	101.1kPa
Tester:	Chris Mo
Test Date:	2020-12-14

Test mode: Transmitting

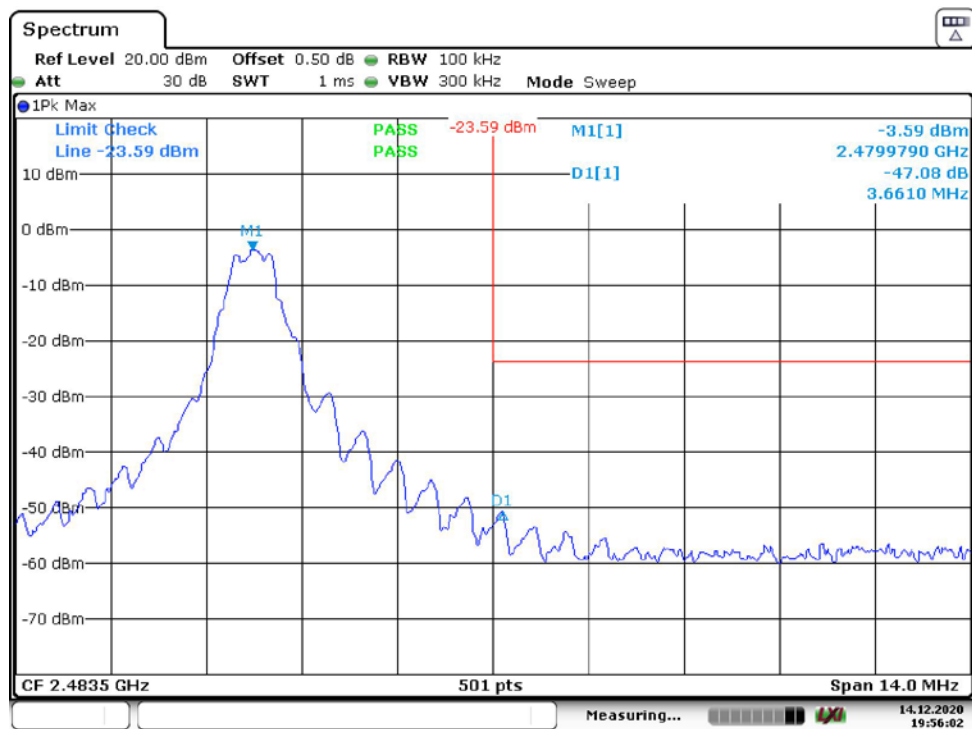
Test Result: Compliant. Please refer to following plots.

BLE Band Edge, Left Side



Date: 14.DEC.2020 19:51:21

BLE Band Edge, Right Side



Date: 14.DEC.2020 19:56:02

FCC §15.247(e), RSS-247 CLAUSE 5.2 B - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

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	FSV40	101474	2020-07-07	2021-07-07
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010013	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201048	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

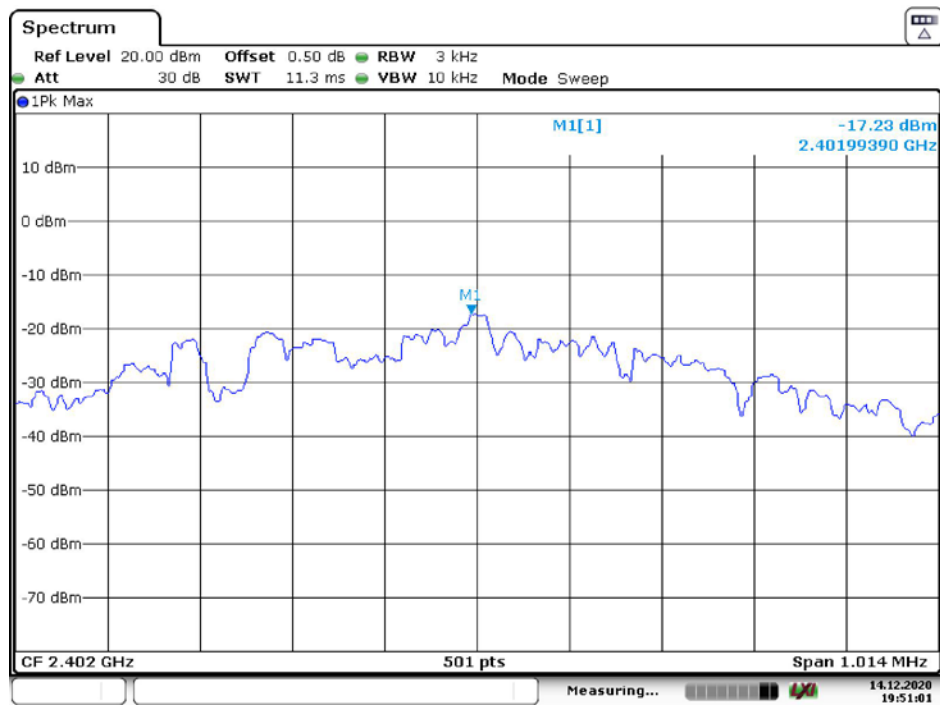
Temperature:	24.6 °C
Relative Humidity:	47 %
ATM Pressure:	101.1kPa
Tester:	Chris Mo
Test Date:	2020-12-14

Test Mode: Transmitting

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

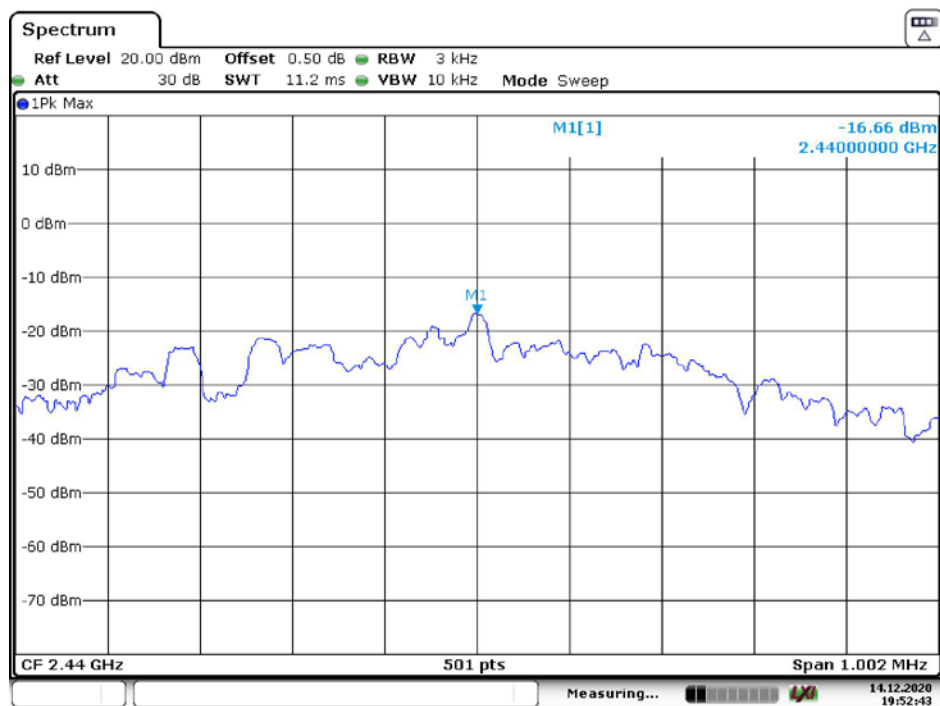
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-17.23	8
Middle	2440	-16.66	
High	2480	-16.72	

Power Spectral Density, BLE Low Channel



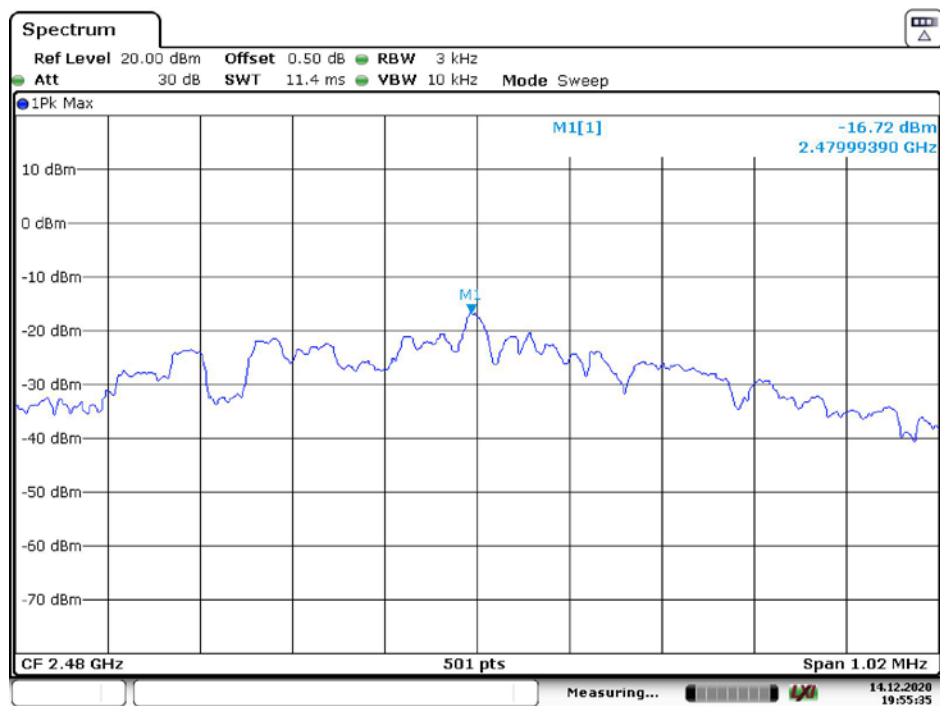
Date: 14.DEC.2020 19:51:01

Power Spectral Density, BLE Middle Channel



Date: 14.DEC.2020 19:52:44

Power Spectral Density, BLE High Channel



Date: 14.DEC.2020 19:55:36

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