



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: 2AGBW9290022415X

IC: 20812-2415X

Report Type: Original Report	Product Name: LED Lamp
Report Number: RXM190528058-00B	
Report Date: 2019-06-21	
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

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "**".

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	LED Lamp
EUT Model:	9290022415
FCC ID:	2AGBW9290022415X
IC:	20812-2415X
Rated input:	AC 110-130V; 50-60 Hz
External Dimension:	132.21mm(L)*77.25mm(W)*77.25mm(H)
Serial Number:	190528058
EUT Received Date:	2019.5.31

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 v05r02, 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 °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)

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 project test data refer to RXM190528050-00B report (FCC ID: 2AGBW9290022411X, IC: 20812-2411X; Model name: 9290022411), difference was the light bulb.

And radiation above 1GHz we had checked as worst power, channel, and it was not worse than original, due to above, we don't update any radiation data above 1GHz.

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.

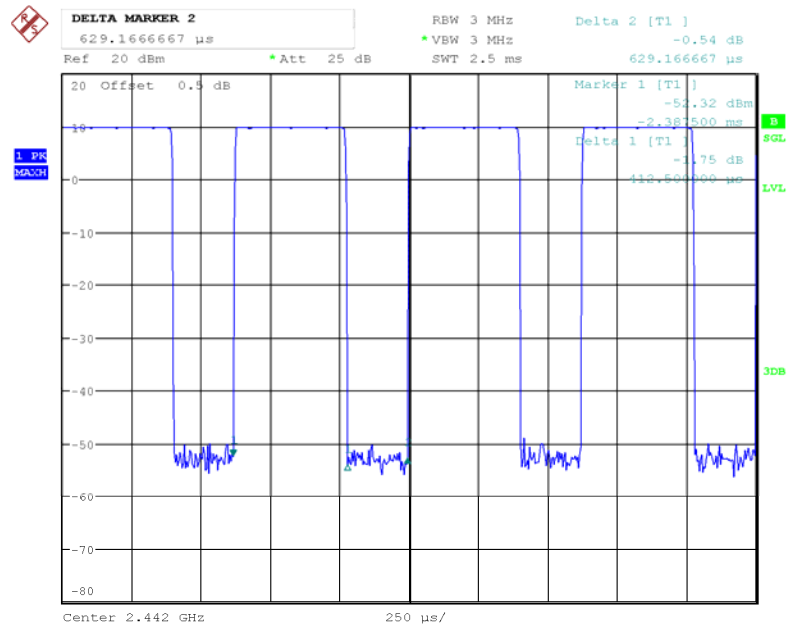
Mode	Channel	Frequency (MHz)	Power level
BLE 1M	Low	2402	10
	Middle	2442	10
	High	2480	10
BLE 2M	Low	2402	10
	Middle	2442	10
	High	2480	10
Zigbee	Low	2405	13
	Middle	2445	13
	High	2480	13

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:

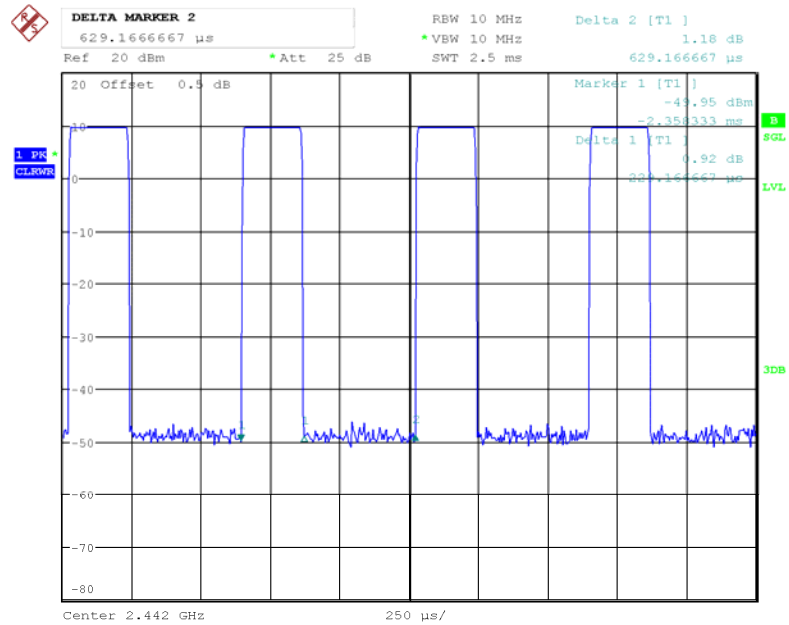
Test mode	T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
BLE 1M	0.412	0.629	65.50
BLE 2M	0.229	0.629	36.41
ZigBee	3.16	21.17	14.93

BLE-1M



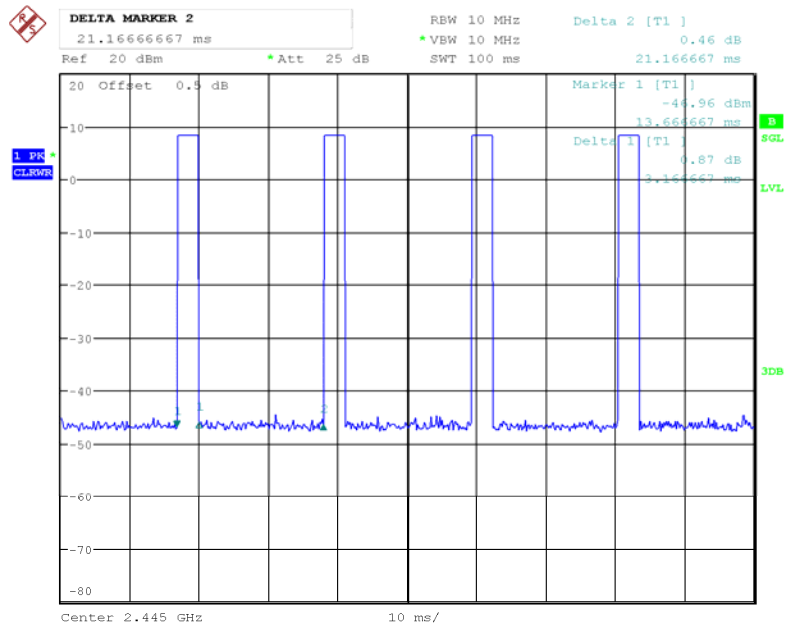
Date: 2.JUN.2019 10:38:53

BLE-2M



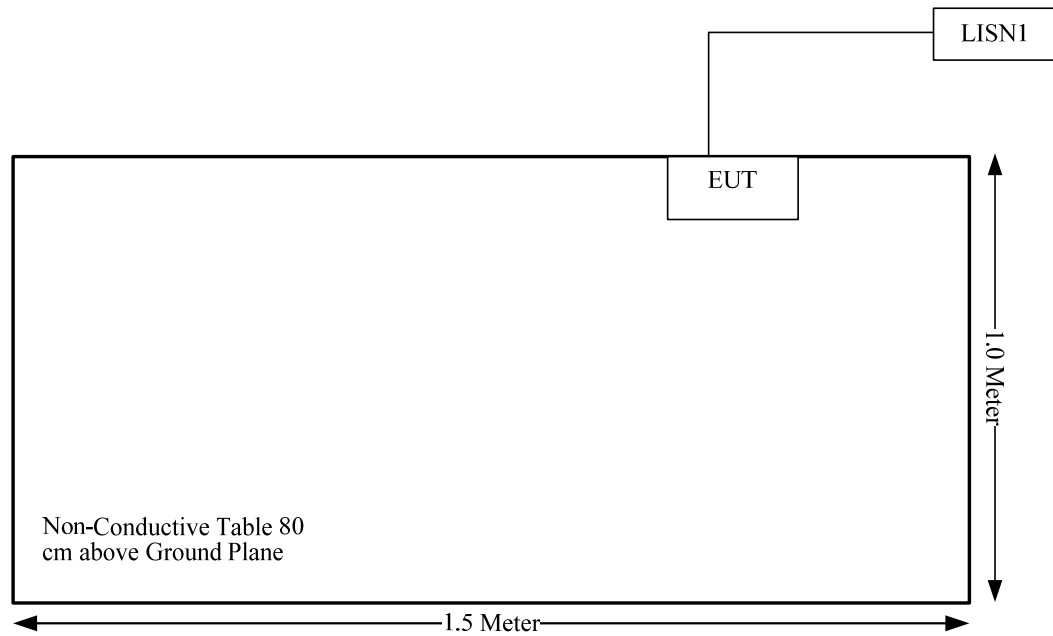
Date: 2.JUN.2019 10:58:36

ZigBee



Date: 2.JUN.2019 11:38:59

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible 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 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*

Compliance*: The EUT is identical with the product which the Model named 9290022411 and FCC ID: 2AGBW9290022411X; IC: 20812-2411X , the difference is the light bulb. So all the conducted data and radiation above 1GHz please referred to FCC ID: 2AGBW9290022411X and IC: 20812-2411X, report No.: RXM190528050-00B.

FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

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

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

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

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

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/cm²);

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.i.p. is 9dBm (0.0079W)

Exemption from Routine Evaluation Limit is:

$$1.31 \times 10^{-2} f^{0.6834} = 1.31 \times 10^{-2} \times 2402^{0.6834} = 2.68 > 0.0079W$$

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

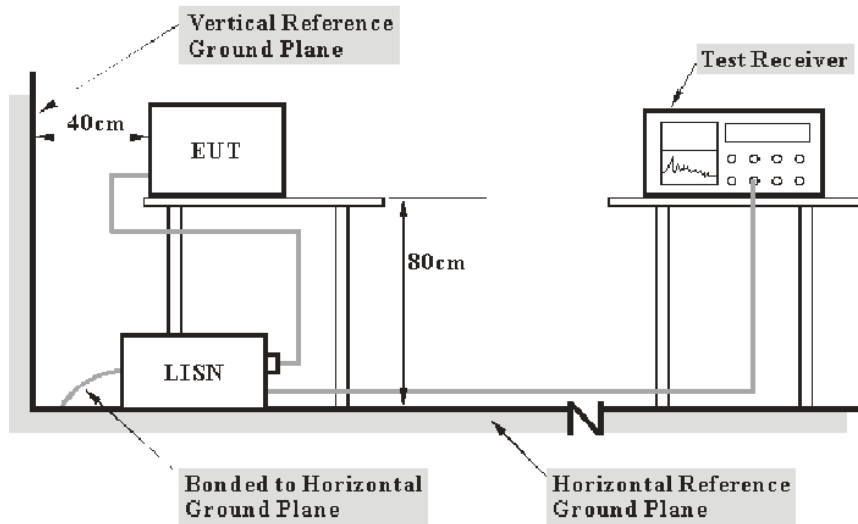
Result: Compliance.

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.

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:

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

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

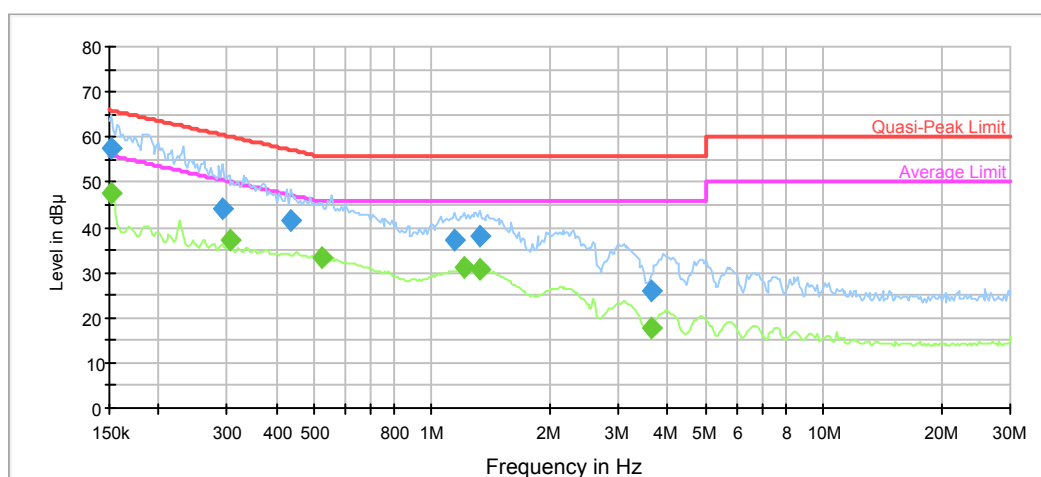
Temperature:	27.4°C
Relative Humidity:	50 %
ATM Pressure:	100.2kPa

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

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

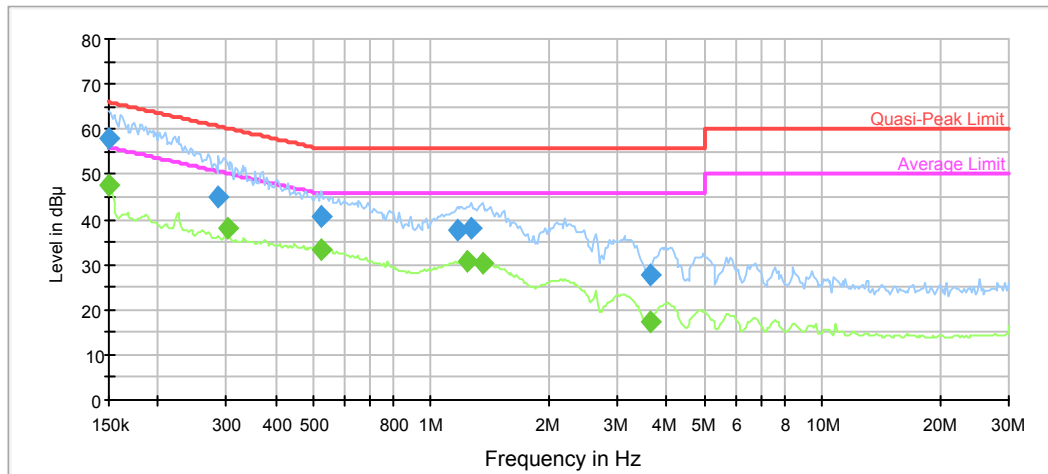
AC120 V, 60 Hz, Line:

Mode: BLE 1M Low channel



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.151500	57.3	9.000	L1	11.2	8.6	65.9	Compliance
0.292162	44.1	9.000	L1	10.2	16.4	60.5	Compliance
0.434989	41.3	9.000	L1	9.9	15.9	57.2	Compliance
1.141962	37.2	9.000	L1	9.8	18.8	56.0	Compliance
1.325783	38.1	9.000	L1	9.8	17.9	56.0	Compliance
3.621856	26.0	9.000	L1	9.8	30.0	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.151500	47.6	9.000	L1	11.2	8.3	55.9	Compliance
0.304025	37.4	9.000	L1	10.1	12.7	50.1	Compliance
0.525514	33.4	9.000	L1	9.9	12.6	46.0	Compliance
1.212216	31.0	9.000	L1	9.8	15.0	46.0	Compliance
1.325783	30.8	9.000	L1	9.8	15.2	46.0	Compliance
3.621856	17.8	9.000	L1	9.8	28.2	46.0	Compliance

AC120 V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.150000	57.8	9.000	N	11.2	8.2	66.0	Compliance
0.286405	44.9	9.000	N	10.2	15.7	60.6	Compliance
0.525514	40.5	9.000	N	9.9	15.5	56.0	Compliance
1.164916	37.5	9.000	N	9.8	18.5	56.0	Compliance
1.261437	38.2	9.000	N	9.8	17.8	56.0	Compliance
3.621856	27.7	9.000	N	9.8	28.3	56.0	Compliance

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.150000	47.5	9.000	N	11.2	8.5	56.0	Compliance
0.301015	37.9	9.000	N	10.1	12.3	50.2	Compliance
0.525514	33.2	9.000	N	9.9	12.8	46.0	Compliance
1.236582	30.6	9.000	N	9.8	15.4	46.0	Compliance
1.352431	30.1	9.000	N	9.8	15.9	46.0	Compliance
3.621856	17.5	9.000	N	9.8	28.5	46.0	Compliance

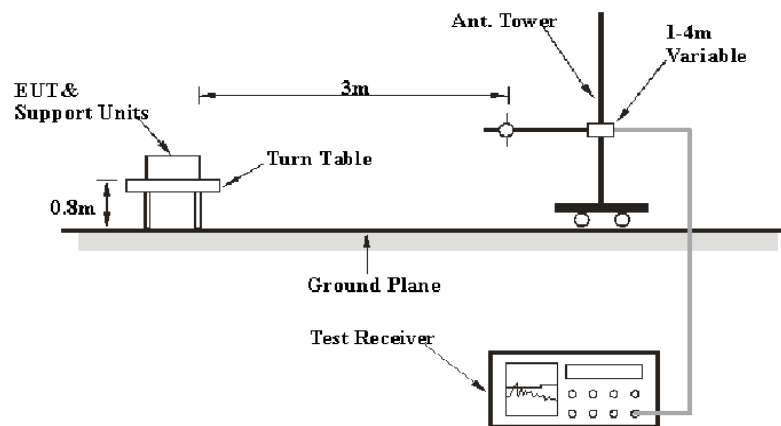
FCC §15.209, §15.205, §15.247(a) & RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10- SPURIOUS EMISSIONS

Applicable Standard

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

EUT Setup

Below 1GHz:



The radiated emission tests were performed in the 3 meters chamber A , 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..

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 1 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 limit more than 6dB, then it is unnecessary to perform an QP 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.

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
R&S	EMI Test Receiver	ESR3	102453	2018-06-26	2019-06-26
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	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05

* **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**

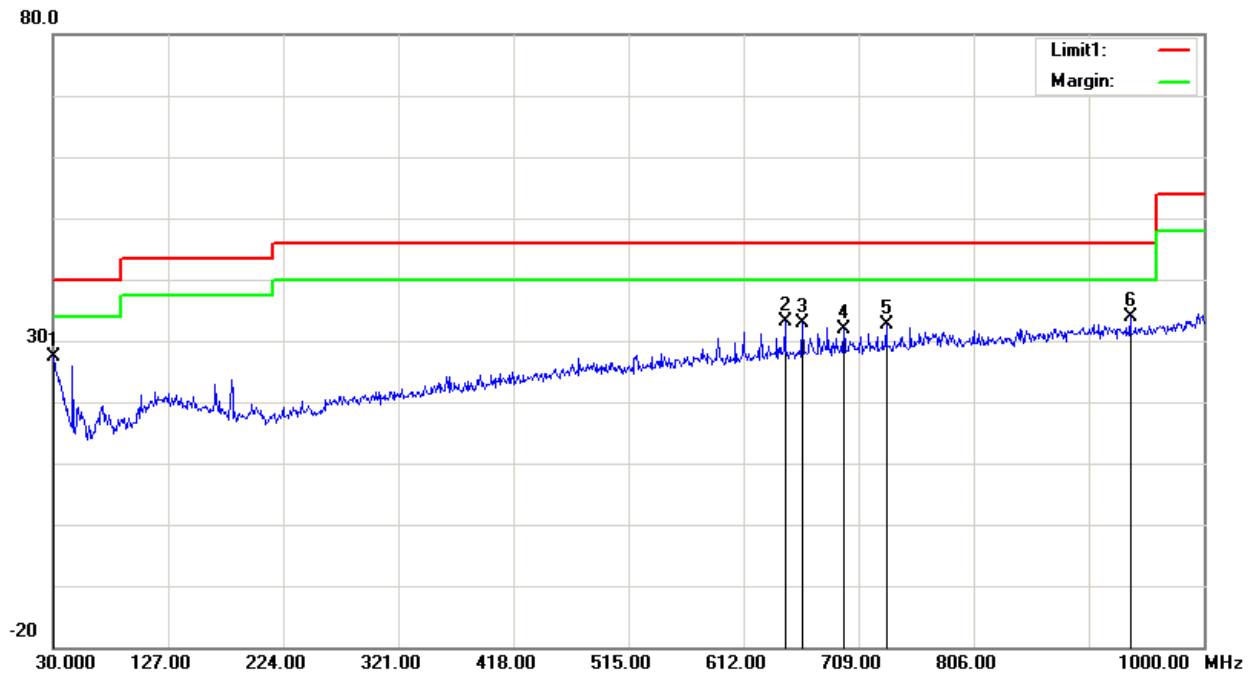
Temperature:	21.7°C
Relative Humidity:	55 %
ATM Pressure:	100.7kPa

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

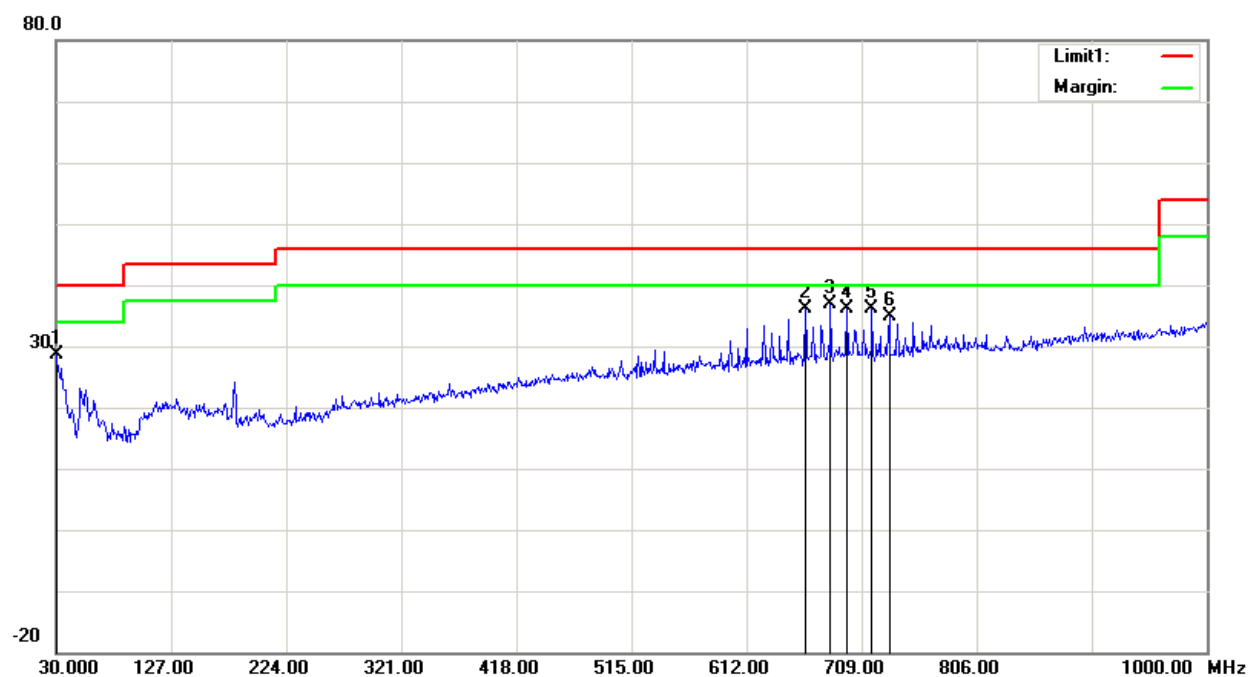
Test Mode: Transmitting (Zigbee Low channel was the worst case)

1) 30MHz-1GHz :

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	26.46	peak	0.91	27.37	40.00	12.63
646.9200	30.85	peak	2.16	33.01	46.00	12.99
661.4700	30.75	peak	2.18	32.93	46.00	13.07
696.3900	29.10	peak	2.89	31.99	46.00	14.01
732.2800	29.37	peak	3.25	32.62	46.00	13.38
937.9200	33.17	peak	0.74	33.91	46.00	12.09

Vertical:

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	27.03	peak	1.72	28.75	40.00	11.25
661.4700	34.05	peak	2.18	36.23	46.00	9.77
682.8100	34.14	peak	2.67	36.81	46.00	9.19
696.3900	33.19	peak	2.89	36.08	46.00	9.92
717.7300	32.78	peak	3.25	36.03	46.00	9.97
732.2800	31.70	peak	3.25	34.95	46.00	11.05

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