

FCC PART 15.249

TEST REPORT

For

Xiamen Ursalink Technology Co., Ltd.

4/F, NO. 63-2 Wanghai Road, 2nd Software Park, Xiamen, China

FCC ID: 2AOSV-UGM1301

Report Type: Original Report	Product Name: LoRaWAN GATEWAY
Report Number: RXM190604050-00	
Report Date: 2019-09-20	
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” .

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
MEASUREMENT UNCERTAINTY.....	3
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	5
JUSTIFICATION	5
EUT EXERCISE SOFTWARE	5
EQUIPMENT MODIFICATIONS	5
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	5
SUPPORT CABLE LIST AND DETAILS	5
BLOCK DIAGRAM OF TEST SETUP	6
SUMMARY OF TEST RESULTS	7
FCC§15.203 - ANTENNA REQUIREMENT.....	8
APPLICABLE STANDARD	8
ANTENNA CONNECTOR CONSTRUCTION	8
FCC §15.207 (A)– AC LINE CONDUCTED EMISSIONS	9
APPLICABLE STANDARD	9
EUT SETUP	9
EMI TEST RECEIVER SETUP.....	9
TEST PROCEDURE	10
CORRECTED AMPLITUDE & MARGIN CALCULATION	10
TEST EQUIPMENT LIST AND DETAILS.....	10
TEST DATA	11
FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS	13
APPLICABLE STANDARD	13
EUT SETUP	13
TEST EQUIPMENT SETUP	14
TEST PROCEDURE	15
CORRECTED AMPLITUDE & MARGIN CALCULATION	15
TEST EQUIPMENT LIST AND DETAILS.....	15
TEST DATA	16
FCC §15.215(C) – 20 DB BANDWIDTH TESTING.....	20
APPLICABLE STANDARD	20
TEST PROCEDURE	20
TEST EQUIPMENT LIST AND DETAILS.....	20
TEST DATA	20

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	LoRaWAN GATEWAY
EUT Model:	UGM1301-915
Rated Input Voltage:	DC5V
External Dimension:	51.5mm(L)*34mm(W)*3.2mm(H)
Serial Number:	190604050
EUT Received Date:	2019/6/14

Objective

This type approval report is prepared on behalf of **Xiamen Ursalink Technology Co., Ltd.** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

N/A

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.

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

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
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
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

Justification

The EUT was configured in operating mode for testing which was provided by the manufacturer.

The device employs total 8 channel as below:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	5	903.1
2	902.5	6	903.3
3	902.7	7	903.5
4	902.9	8	903.7

Channel 1 and channel 8 was selected to test.

EUT Exercise Software

No software was used in test.

Equipment Modifications

No modifications were made to the EUT.

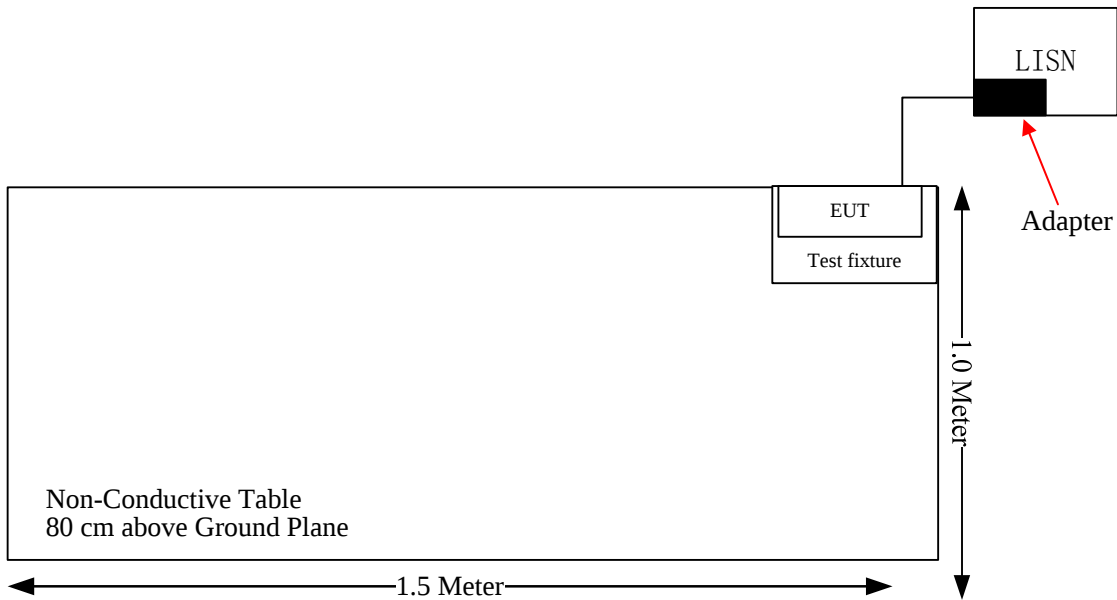
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
ORIENTAL HERO ELE.FTY	adapter	OH-1015A1201000U1-UL	N/A
Ursalink	Fixture	N/A	N/A

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Power Cable	No	Yes	1.5	adapter	Fixture

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, 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.

Antenna Connector Construction

The EUT has one unique antenna arrangement, and the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

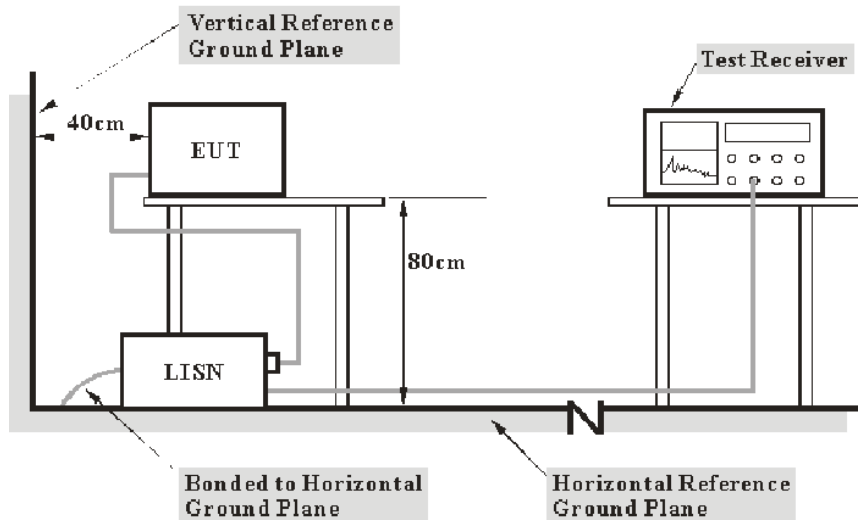
Result: Compliant.

FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

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.

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.

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
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
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09

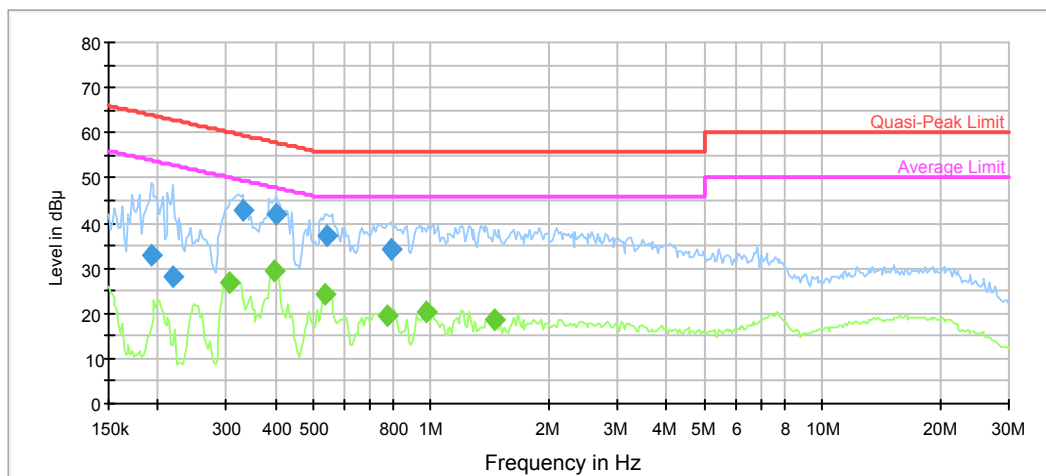
* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data Environmental Conditions

Temperature:	27.2 °C
Relative Humidity:	63 %
ATM Pressure:	100.8 kPa
Tester:	Sky Lu
Test Date:	2019-08-26

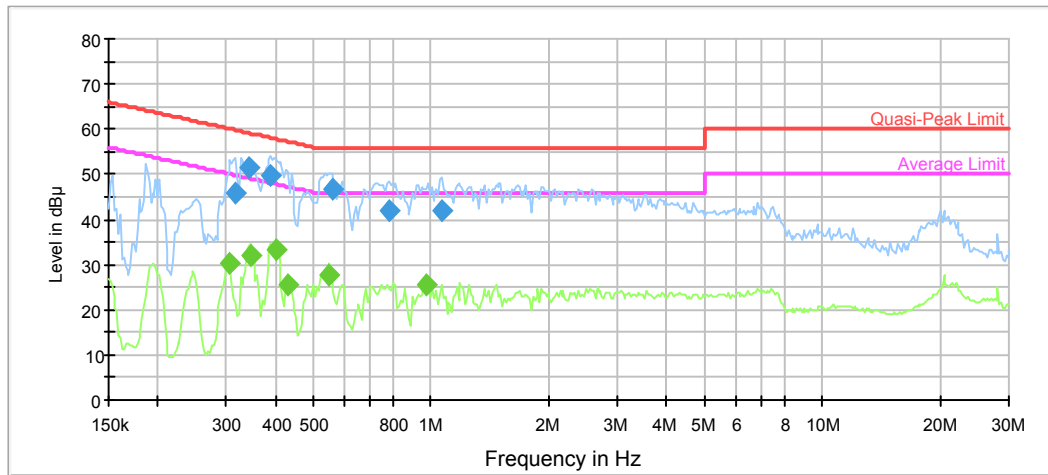
Test Mode: Transmitting

AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.192365	33.1	9.000	L1	10.7	30.8	63.9
0.218929	27.9	9.000	L1	10.5	35.0	62.9
0.329215	42.8	9.000	L1	10.1	16.7	59.5
0.401705	41.8	9.000	L1	10.0	16.0	57.8
0.541438	37.4	9.000	L1	9.9	18.6	56.0
0.790244	34.3	9.000	L1	9.8	21.7	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.304025	26.8	9.000	L1	10.1	23.3	50.1
0.397728	29.6	9.000	L1	10.0	18.3	47.9
0.536077	24.4	9.000	L1	9.9	21.6	46.0
0.774673	19.5	9.000	L1	9.8	26.5	46.0
0.973890	20.2	9.000	L1	9.8	25.8	46.0
1.449989	18.7	9.000	L1	9.8	27.3	46.0

AC120V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.316369	45.8	9.000	N	10.1	14.0	59.8
0.342583	51.6	9.000	N	10.0	7.5	59.1
0.389891	49.8	9.000	N	10.0	8.3	58.1
0.557844	46.8	9.000	N	9.8	9.2	56.0
0.782419	42.0	9.000	N	9.8	14.0	56.0
1.065129	42.1	9.000	N	9.8	13.9	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.307065	30.4	9.000	N	10.1	19.6	50.0
0.346009	32.1	9.000	N	10.0	17.0	49.1
0.401705	33.5	9.000	N	10.0	14.3	47.8
0.430682	25.7	9.000	N	9.9	21.5	47.2
0.546852	27.9	9.000	N	9.8	18.1	46.0
0.973890	25.3	9.000	N	9.8	20.7	46.0

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS**Applicable Standard**

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

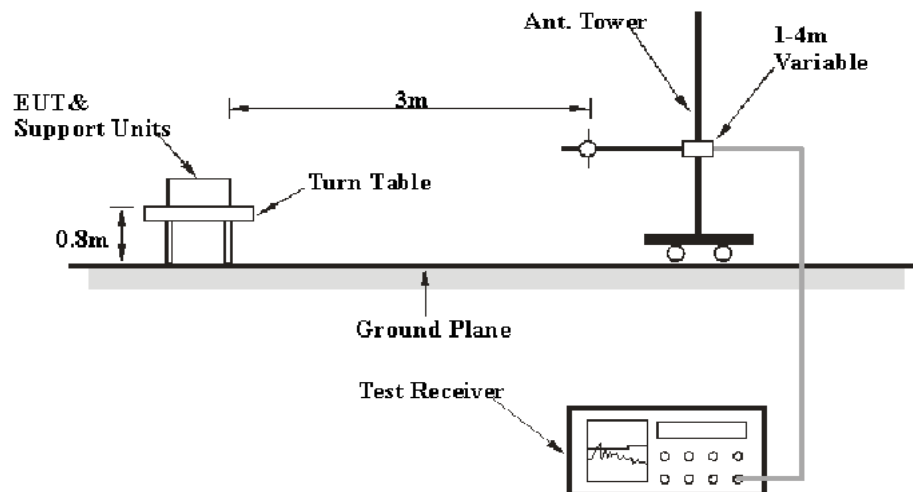
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

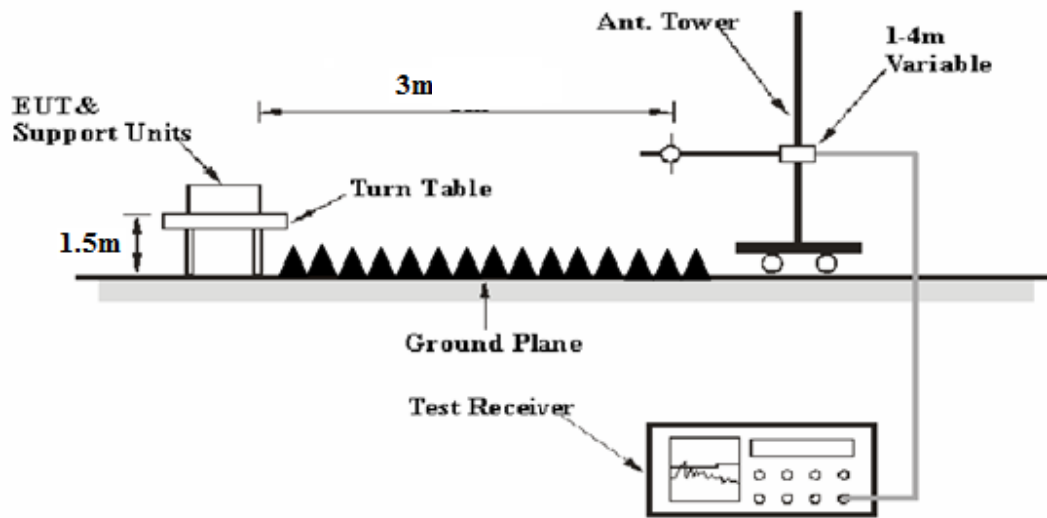
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



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 15.249 limits.

Test Equipment Setup

The system was investigated from 30 MHz to 10 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

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.

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode 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
R&S	EMI Test Receiver	ESCI	100035	2018-08-03	2019-09-03
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2018-09-24	2019-09-24
HP	Amplifier	8447F	2443A01912	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05
Sinoscite	Band-stop filter	BSF880-915MN-0382-003	0382003	2019-06-16	2020-06-16

* **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).

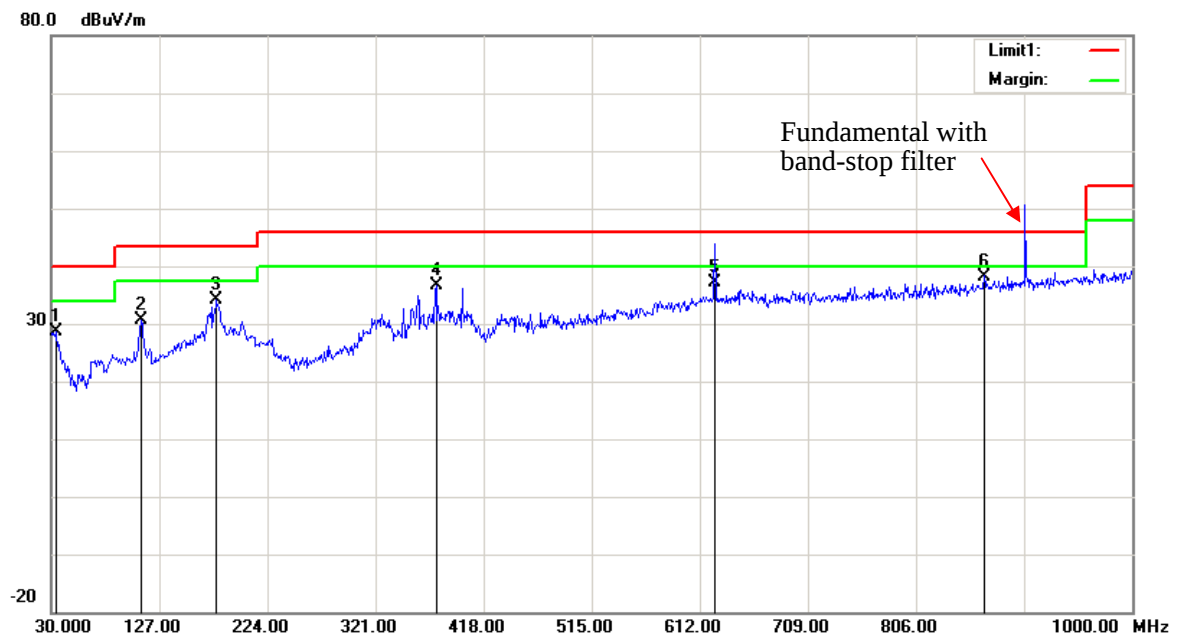
Test Data**Environmental Conditions**

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	26.0 °C	27.8°C
Relative Humidity:	59%	61 %
ATM Pressure:	100.5 kPa	100.3 kPa
Tester:	Ade Xiao	Neil Liao
Test Date:	2019-08-26	2019-07-29

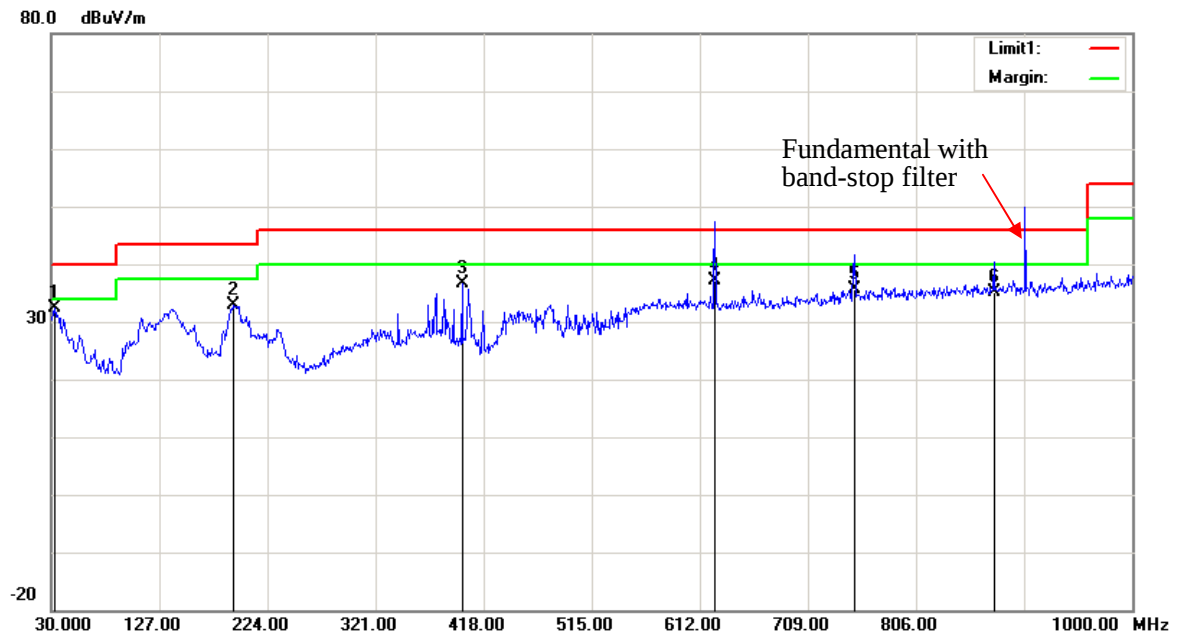
Test Mode: Transmitting

1) 30MHz-1GHz (Low channel is the worst):

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
33.8800	38.41	peak	-9.83	28.58	40.00	11.42
110.5100	47.13	peak	-16.46	30.67	43.50	12.83
178.4100	47.34	peak	-13.27	34.07	43.50	9.43
375.3200	45.35	peak	-8.70	36.65	46.00	9.35
625.5800	40.32	QP	-3.09	37.23	46.00	8.77
867.1100	37.96	peak	0.29	38.25	46.00	7.75

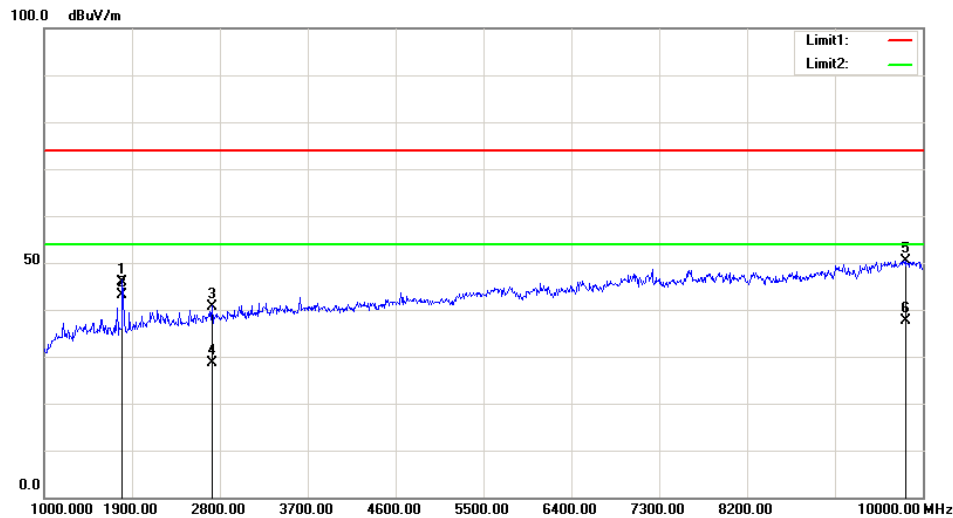
Vertical:

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.9100	41.75	peak	-9.36	32.39	40.00	7.61
192.9600	46.72	peak	-13.84	32.88	43.50	10.62
398.6000	44.86	peak	-8.20	36.66	46.00	9.34
625.5800	40.13	QP	-3.09	37.04	46.00	8.96
750.7100	36.77	QP	-1.17	35.60	46.00	10.40
875.8400	34.51	QP	0.69	35.20	46.00	10.80

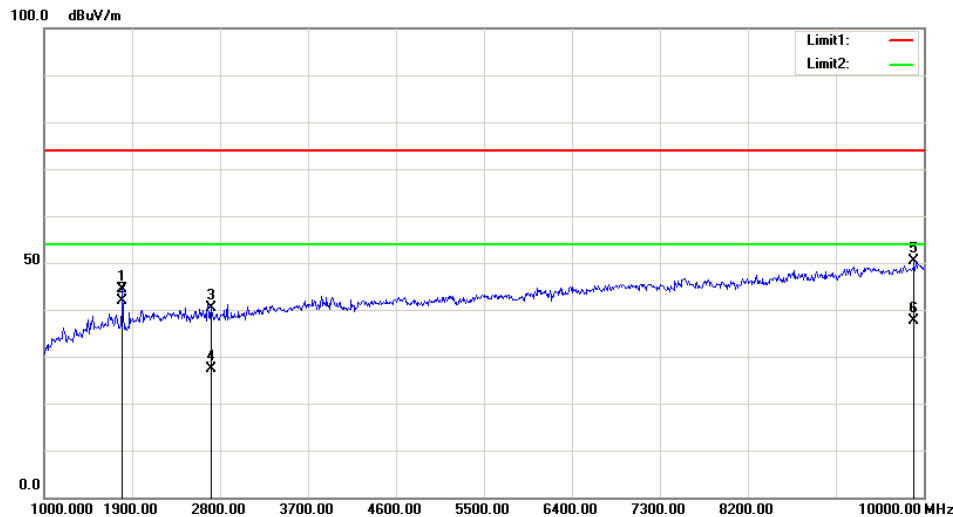
2) 1GHz-10GHz

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: 902.3 MHz									
902.30	58.30	QP	H	22.71	5.27	0.00	86.28	93.98	7.70
902.30	60.60	QP	V	22.71	5.27	0.00	88.58	93.98	5.40
902.00	14.20	QP	V	22.71	5.27	0.00	42.18	46.00	3.82
1804.60	52.50	PK	V	26.48	1.66	35.90	44.74	74.00	29.26
1804.60	49.25	AV	V	26.48	1.66	35.90	41.49	54.00	12.51
2706.90	49.44	PK	V	29.04	1.88	36.47	43.89	74.00	30.11
2706.90	33.88	AV	V	29.04	1.88	36.47	28.33	54.00	25.67
3609.20	45.36	PK	V	31.54	2.41	37.11	42.20	74.00	31.80
3609.20	32.16	AV	V	31.54	2.41	37.11	29.00	54.00	25.00
High Channel: 903.7 MHz									
903.70	58.80	QP	H	22.72	5.26	0.00	86.78	93.98	7.20
903.70	61.20	QP	V	22.72	5.26	0.00	89.18	93.98	4.80
928.00	14.30	QP	V	22.87	5.37	0.00	42.54	46.00	3.46
1807.40	53.55	PK	V	26.49	1.66	35.90	45.80	74.00	28.20
1807.40	50.79	AV	V	26.49	1.66	35.90	43.04	54.00	10.96
2711.10	45.92	PK	V	29.06	1.88	36.47	40.39	74.00	33.61
2711.10	34.12	AV	V	29.06	1.88	36.47	28.59	54.00	25.41
3614.80	45.25	PK	V	31.55	2.42	37.11	42.11	74.00	31.89
3614.80	33.01	AV	V	31.55	2.42	37.11	29.87	54.00	24.13

Test plots
Horizontal



Vertical



FCC §15.215(c) – 20 dB BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-01-04	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:	27.5 °C
Relative Humidity:	60 %
ATM Pressure:	100.8 kPa
Tester:	Neil Liao
Test Date:	2019-08-28-2019-08-29

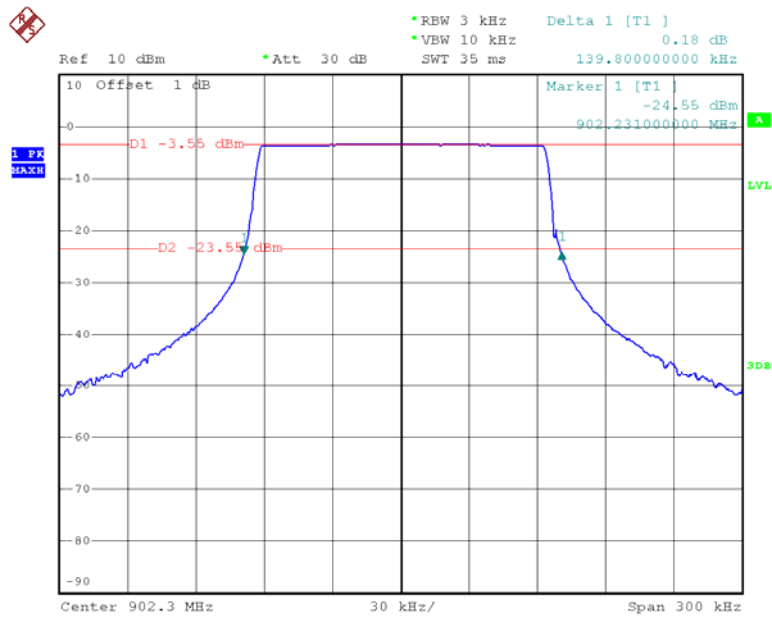
Test Result: Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

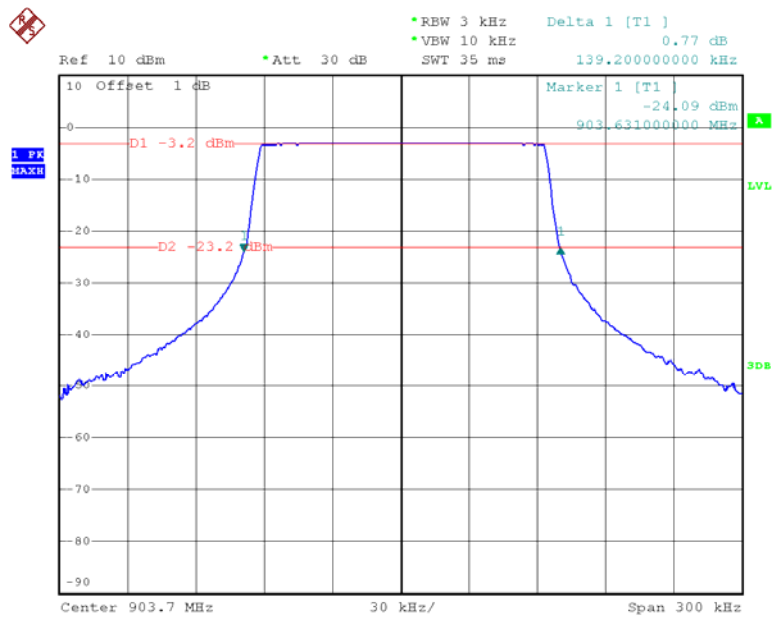
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	902.3	0.1398
High	903.7	0.1392

Low Channel



Date: 28.AUG.2019 23:59:58

High Channel



Date: 29.AUG.2019 00:01:41

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